Schöbel, Sofia

Exploring gamification in digital learning environments. Conceptual and empirical foundations for gamification designs

Kassel : kassel university press 2020, XXVII, 310 S. - (Research on IT / service / innovation / collaboration; 20) - (Dissertation, Universität Kassel, 2020)

Quellenangabe/ Reference:
Schöbel, Sofia: Exploring gamification in digital learning environments. Conceptual and empirical foundations for gamification designs. Kassel : kassel university press 2020, XXVII, 310 S. - (Research on IT / service / innovation / collaboration; 20) - (Dissertation, Universität Kassel, 2020) - URN: urn:nbn:de:0111-pedocs-326168 - DOI: 10.25656/01:32616; 10.17170/kobra-202010051886

https://nbn-resolving.org/urn:nbn:de:0111-pedocs-326168
https://doi.org/10.25656/01:32616

Research on IT / Service / Innovation / Collaboration 20

Sofia Schöbel

Exploring Gamification in Digital Learning Environments

Conceptual and Empirical Foundations for Gamification Designs

Forschungszentrum für Informationstechnik-Gestaltung
ITeG

Fachgebiet Wirtschaftsinformatik
Prof. Dr. Jan Marco Leimeister

kassel university press

Research on IT / Service / Innovation / Collaboration
Band 20 / Vol. 20

Herausgegeben von / Edited by
Univ.-Prof. Dr. Jan Marco Leimeister, Universität Kassel

Sofia Schöbel

Exploring Gamification in Digital Learning Environments

Conceptual and Empirical Foundations for Gamification Designs

kassel university press

This work has been accepted by the faculty of electrical engineering / computer sciences of the University of Kassel as a thesis for acquiring the academic degree of Doktor der Naturwissenschaften (Dr. rer. nat).

Supervisor: Prof. Dr. Jan Marco Leimeister
Co-Supervisor: Prof. Dr. Ulrich Bretschneider

Defense Day: 19. February 2020

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.dnb.de.

Zugl.: Kassel, Univ., Diss. 2020
ISBN: 978-3-7376-0835-0 (print)
ISBN: 978-3-7376-0834-3 (e-book)
DOI: https://doi.org/doi:10.17170/kobra-202010051886

https://kup.uni-kassel.de

Cover design: Jörg Batschi Grafik Design, Tübingen
Printed in Germany

Geleitwort

Das digitale Lernen wird immer wichtiger in unserer digitalisierten Arbeitswelt – und in der Corona Krise hat das Thema noch mehr an Bedeutung gewonnen.

Besondere Gelingensvoraussetzung hierfür ist die Fähigkeit zum selbstgesteuerte. Lernen. Digitales Lernen verlangt von Lernenden insbesondere, dass sie vermehrt ihren eigenen Lernprozess aktiver selbst steuern. Erfolgsförderlich erscheinen dabei Konzepte, die Lernende dabei unterstützen, ihre Lernprozesse selbst aktiv und engagiert zu gestalten. Hier kann der Einsatz von spielerischen Komponenten, bekannt unter dem Stichwort Gamification, besonders effektiv und sinnvoll sein. Die Dissertationsschrift von Sofia Schöbel widmet sich diesem Themenbereich und befasst sich mit aktuellen Herausforderungen rund um das Thema Gamification und dem digitalen Lernen.

Die vorliegende Dissertationsschrift von Sofia Schöbel greift die Bedeutung von Motivation und des Engagements von Lernenden im digitalen Lernen auf und stellt dabei das Konzept des Gamifications vor. Die Arbeit verfolgt das Ziel, eine ganzheitliche Konzeptualisierung und empirische Validierung von Gamification für das Verständnis von Lernerfolg in digitalen Lernumgebungen zu schaffen. Dazu wird in einem ersten Schritt der Gegenstandsbereich von Gamification und der damit zusammenhängenden Elemente mittels einer Taxonomie aufgearbeitet. Weiterhin werden empirische Ergebnisse vorgestellt, die aufzeigen, wie die Gestaltung von Gamification Elementen im digitalen Lernkontext erfolgen kann, damit Lernende durch den Einsatz von Gamification motivierter und engagierter sind, was langfristig zu einem erhöhten Lernerfolg führen kann.

Dabei hat die Dissertationsschrift höchste Relevanz für Wissenschaft und Praxis. Sie zeigt als auf, wie Gamification im digitalen Lernen effektiv und effizient eingesetzt werden kann. Aus praktischer Sicht können Unternehmen von dem Beitrag der Arbeit profitieren, um nachzuvollziehen, wie man digitale Lernumgebungen mit Hilfe von spielerischen Elementen so gestaltet, dass Lernende sich in ihrem Lernprozess aktiver engagieren. Dies gilt nicht nur für Unternehmen, sondern auch für auch für die universitäre Hochschullehre, welche von der Demonstration der Gestaltung und Implementierung von Gamification Elementen in digitale Lernumgebungen profitiert. Die Dissertationsschrift weist ein hohes Anschlusspotential für künftige Forschungsstudien auf und ermöglicht ebenfalls eine Übertragbarkeit auf andere

Bereiche abseits des digitalen Lernens. Die Dissertationsschrift von Sofia Schöbel wünsche ich daher die ihr gebührende Verbreitung.

Prof. Dr. Jan Marco Leimeister

Vorwort

Das digitale Lernen und die Motivation von Lernenden ist gleichermaßen für Wissenschaft und Wirtschaft bedeutsam. Mich hat das Thema „Gamification“ zu schon vor meiner Promotionszeit begeistert und interessiert. Ich hatte nach meinem Studium die Chance, dieses Thema im Rahmen meiner Promotion zu vertiefen. Es hat sich schnell gezeigt, dass besonders die Gestaltung von Gamification Ansätzen oft ungenau beschrieben wird und das sich daraus eine Vielzahl von Fragestellungen ergeben. Die genau Erarbeitung dieses Themenfeldes wäre ohne Unterstützung von verschiedenen Seiten nicht möglich gewesen.

Mein Dank richtet sich an all jene, die mich während meiner Promotionszeit begleitet und unterstützt haben. Besonders möchte ich bei meinem Doktorvater und Erstgutachter Professor Dr. Jan Marco Leimeister bedanken. Ebenfalls möchte ich mit bei Professor Dr. Ulrich Bretschneider bedanken, der das Zweigutachten meiner Dissertation übernommen hat. Mein Dank richtet sich außerdem an Professor Dr. André Hanelt und Professor Dr. Jens Klusmeyer die meine Promotionskommission vervollständigt haben. Ein besonderer Dank richtet sich an meine beiden Post Doktoranden Dr. Andreas Janson und Professor Dr. Matthias Söllner, die mich während meiner Promotionszeit stets unterstützt und gefördert haben. Bedanken möchte ich mich ebenfalls bei Professor Dr. Abhay Mishra und Professorin Dr. Mari Clara Stein für die konstruktive Zusammenarbeit an Forschungsstudien.

Ein besonderer Dank gilt ebenfalls meinen Kollegen und Kolleginnen, mit denen ich während meiner Promotionszeit gemeinsam an Projekten, Papern und in der Lehre arbeiten konnte insbesondere Dr. Sissy Josefina Ernst, Dr. Andreas Janson, Dr. Sarah Oeste-Reiß, Dr. Katja Lehmann und Professor Dr. Matthias Söllner.

Ein Dissertationsprojekt abzuschließen ist nicht ohne den Zuspruch und die Unterstützung von Freunden und Familie möglich. Auf diesem Wege möchte ich mich bei meiner Mutter Sigrid und bei Petra und Mareike bedanken, die mich in jeder Lage unterstützt haben und mir geholfen haben, diese Dissertation abzuschließen.

Sofia Schöbel

Zusammenfassung

Ziel: Gamification im digitalen Lernen verfolgt das Ziel, durch den Einsatz von Spiel-Elementen Lernende so anzuregen, dass diese ihr Nutzungsverhalten verändern und bessere Lernerfolge erzielen. Bei der Entwicklung von Gamification Konzepten spielt die Gestaltung und Kombination der Spiel-Elemente eine maßgebliche Rolle für den Erfolg des Gamification Konzeptes. Trotz des zum Teil erfolgreichen Einsatzes von Gamification, bestehen Herausforderungen in Zusammenhang mit der Gestaltung von Gamification Konzepten, welche eine effektive Gestaltung von Spiel-Elementen im digitalen Lernen erschweren. In diesem Zusammenhang widmet diese Dissertation sich drei Herausforderungen der Gamification Forschung, die mit dem Einsatz von Spiel-Elementen im digitalen Lernen verbunden sind. Die erste Herausforderung wird dadurch adressiert, dass ein Erkenntnisgewinn über die Funktionalität von Spiel-Elementen geschaffen wird. Vielfach herrscht ein unterschiedliches Verständnis bezüglich der Charakteristiken einzelner Spiel-Elemente, die eingesetzt werden, um ein Gamification Konzept zu gestalten. Die Aufarbeitung der Charakteristiken von Spiel-Elementen ist notwendig, um die Entwicklung von Gamification Konzepten im digitalen Lernen gewährleisten zu können. Darauf aufbauend setzt sich die Dissertation mit der Herausforderung fehlender, tiefergehender Erkenntnisse über die Effektivität, den Einsatz und die Gestaltung von Spiel-Elementen im digitalen Lernen auseinander. Hierbei wird erarbeitet, welche Rolle Präferenzen von Lernenden bei der Gestaltung von Gamification Konzepten spielen und wie der Einsatz von Spiel-Elementen die Motivation, das Engagement, die Zufriedenheit mit dem Lernprozess, die emotionale Verbundenheit, die kognitive Belastbarkeit sowie den Lernerfolg beeinflussen können. Schlussendlich dient ein dritter Schwerpunkt der Dissertation dazu, den Prozess der Gamification Konzepterstellung zu analysieren, um Schnittstellen aufzuzeigen, mit denen die oftmals gewählten „one-size-fits-all“ Lösungen umgangen werden können und mit denen eine nutzerzentrierte Gestaltung von Gamification Konzepten möglich ist.

Methode: Die Dissertation folgt einem multimethodischen Ansatz, der das Ziel hat, Herausforderungen der Gamification Forschung zu identifizieren und zu lösen. In einem ersten Schritt dient die Entwicklung einer Taxonomie dazu, neue Erkenntnisse zur Funktionalität und den daraus resultierenden Charakteristiken einzelner Spiel-Elemente zu erlangen. Für die Entwicklung und Validierung der Taxonomie wird in der Dissertation auf Experteninterviews und Fallstudien zurückgegriffen. In einem weiteren

Schritt dienen drei empirische Studien dazu, tiefergehendes Gestaltungwissen zum Einsatz von einzelnen Spiel-Elementen im digitalen Lernen zu erlangen. Dazu werden in einem ersten Schritt die Ergebnisse einer Präferenzanalyse von Spiel-Elementen im digitalen Lernen dazu genutzt, ein erstes Verständnis zu erlangen, welche Elemente Lernende bevorzugen und welche sie im Gegenzug nicht präferieren. Zum anderen dienen zwei experimentelle Studien dazu, die Gestaltung und den Einsatz von Abzeichen und Punkten sowie von mediierenden Avataren im digitalen Lernen besser zu verstehen. Neben der Analyse eines Strukturgleichungsmodelles dient eine qualitative komparative Analyse dazu, die Effektivität des Einsatzes von Punkten, Abzeichen und mediierenden Avataren in Bezug auf Problemlösekompetenzen von Lernenden sowie die deren emotionale Reaktion, deren Zufriedenheit mit dem Lernprozess und deren kognitiven Belastung hin zu analysieren. Schlussendlich dient eine systematische Literaturanalyse dazu, den Prozess der Gamification Konzeptentwicklung aufzuarbeiten, um Schnittstellen für die nutzerzentrierte Gestaltung zu verdeutlichen.

Ergebnisse: Die Dissertation kann, neben anderen Ergebnissen, drei Hauptergebnisse präsentieren. Ein Ergebnis ist eine Gamification Taxonomie, die einzelne Charakteristiken von Spiel-Elementen aufzeigt. Durch die Taxonomie können die Effekte des Einsatzes von Spiel-Elementen besser interpretiert werden und es wird gleichzeitig eine Orientierung gegeben, mit der Anwender von Gamification Konzepten bei der Gestaltung und Interpretation von existierenden Konzepten unterstützt werden. Nachdem durch die Taxonomie die Funktionalität von einzelnen Spiel-Elementen verdeutlicht wurde, können diese für den Kontext des digitalen Lernens angewendet werden. Die Ergebnisse der ersten von drei empirischen Studien im digitalen Lernen zeigen auf, dass Elemente wie Punkte oder Level im digitalen Lernen besonders geeignet erscheinen. Ranglisten, mediierende Avatare oder Abzeichen hingegen werden durch Lernende wenig präferiert. Darüber hinaus präferieren Lernende eine Kombination von vier Spiel-Elementen Eine tiefergehende Analyse von Punkten in Kombination mit Abzeichen zeigt auf, dass bei der richtigen Wahl des Elementdesigns positive Effekte in Bezug auf das Engagement, die intrinsische Motivation, und die Zufriedenheit mit dem Lernprozess hervorrufen werden können. Ebenso zeigt sich, dass der Einsatz von Punkten und Abzeichen den fertigkeitsbasierten Lernerfolg durch Engagement mediiert. Bei dem Einsatz von mediiereden Avataren können Gestaltungfaktoren wie die der Interaktivität präsentiert werden, welche die emotionale Verbundenheit, die Zufriedenheit mit dem Lernprozess und die kognitive Last bestimmen können. Schlussendlich zeigt das dritte Hauptergebnis der Dissertation auf, wie und in welcher Form Nutzer bei der Entwicklung von Gamification Konzepten integriert werden können, um ein an Nutzer angepasstes Gamification Konzept zu entwickeln.

Theoretischer Beitrag: Die Dissertation leistet drei theoretische Kernbeiträge. Durch die Herleitung von Charakteristiken von Spiel-Elementen mittels einer Taxonomie, ist es möglich, den Erfolg von Gamification Konzepten zu messen und nachvollziehen zu können. Der zweite Kernbeitrag der Dissertation und der daraus resultierende theoretische Beitrag beläuft sich auf die Gestaltung von Spiel-Elementen im digitalen Lernen. Eine Präferenzanalyse und zwei experimentelle Untersuchungen bieten die Grundlage für die theoretischen Implikationen. Durch eine Analyse welche Spiel-Elemente Lernende bevorzugen, können Aussagen über die Bedeutung von einzelnen Spiel-Elementen im digitalen Lernen getroffen werden. Durch zwei weitere Studien von Spiel-Elementen können theoretische Beiträge in Bezug auf die folgenden Punkte geliefert werden: 1) ein Ansatz für die Gestaltung und den Einsatz von Punkten und Abzeichen im digitalen Lernen und deren Auswirkungen auf des Engagement und die Problemlösefähigkeiten von Lernenden 2) Verständnis zur Gestaltung von mediierenden Avataren, Punkten und Abzeichen in Bezug auf deren motivierenden Wirkungen, 3) Implikationen für die Gestaltung von mediierenden Avataren im digitalen Lernen und deren Zusammenhang zur emotionalen Verbundenheit, der Zufriedenheit im Lernprozess und der Reduktion von kognitiver Last. Der dritte und letzte theoretische Kernbeitrag leistet einen vorhersagenden theoretischen Beitrag. Genauer gesagt werden durch den Beitrag Implikationen zur nutzerzentrierten Gestaltung gegeben, die eine individuellere Gestaltung von Gamification Konzepten fördern können. Um die hier gewonnenen Beiträge in die Breite tragen zu können werden außerdem Propositionen für die nutzerzentrierte Gestaltung von Gamification Konzepten gegeben.

Praktischer Beitrag: Die Dissertation liefert fünf praktische Beiträge. Erstens präsentiert die Dissertation die praktische Anwendbarkeit einer entwickelten Taxonomie von Spiel-Elementen und deren Charakteristiken. Diesbezüglich wird präsentiert, wie mittels des Einsatzes einer Taxonomie existierende Gamification Konzepte erklärt und verändert werden können. Weiterhin wird vorgestellt, wie die Taxonomie dazu beitragen kann, neue Gamification Konzepte zu entwickeln. Ein weiterer praktischer Beitrag wird durch die Vorstellung einer Rangfolge von Spiel-

Elementen geleistet. Die Rangfolge unterstützt Praktiker dabei, die Rolle von Nutzerpräferenzen im digitalen Lernen zu Spiel-Elementen besser beurteilen zu können. Ein dritter praktischer Beitrag kann durch die Präsentation eines Forschungsmodells gegeben werden, welches die Effekte des Einsatzes von Spiel-Elementen auf die Problemlösekompetenzen von Lernenden misst. Durch das Model wird Praktikern ein Instrument an die Hand gegeben mit Konstrukten die einen maßgeblichen Anteil zur Verbesserung des Lernprozesses mittels des Einsatzes von Spiel-Elementen beitragen. Bezüglich des Einsatzes von mediierenden Avataren können Gestaltungsimplikationen in Bezug auf die Rolle der emotionalen Verbundenheit, der Zufriedenheit mit dem Lernprozess und der kognitiven Last gegeben werden. Abschließend können praktische Implikationen bezüglich des Prozesses der Gamification Konzept Entwicklung unter der Berücksichtigung des Aspektes der Nutzerzentriertheit an Praktiker gegeben werden.

Ausblick: Aufbauend auf den Erkenntnissen der Dissertation zur Gestaltung von Spiel-Elementen im digitalen Lernen sollten künftige Forschungsstudien sich mit artverwandten Konzepten wie dem des Nudgings auseinandersetzen. Weiterhin sollte der Gestaltungsspielraum bei der Entwicklung von Gamification Konzepten ausgebaut werden. Hierbei sollten nähere Betrachtungen bezüglich der Rolle des Wettbewerbes und der Kollaboration getätigt werden. Spiel-Elemente, die den Wettbewerb und die Kollaboration zwischen Lernenden anregen, können in Bezug auf ihre effektive Gestaltung hin näher analysiert werden. Eine weiterer Forschungsschwerpunkt resultiert aus der konkreten Gestaltung und Etablierung von adaptiven Gamification Konzepten in Form eines gestaltungsbasierten Ansatzes, in den die Erstellung eines Informationssystems im digitalen Lernen eingebunden ist. Hier sollten Langzeitstudien umgesetzt werden, um die Effektivität von entwickelten Gamification Konzepten zu analysieren. Schlussendlich sollte ein Schwerpunkt auf der Entwicklung und Erforschung von adaptiven Gamification Konzeptes mittels des Einsatzes von künstlicher Intelligenz und NeuroIS näher betrachtet werden.

Schlüsselbegriffe: Gamification, Digitales Lernen, spielbasiertes Lernen, Spiel-Elemente

Abstract

Purpose: Gamification is about using gamification elements in contexts such as digital learning and aims to motivate and engage users to change their behavior. To design gamification concepts, developers can select between various elements, the design and combination of which can be decisive for the success of a gamification concept. While past research has made various efforts regarding the effectiveness of gamification in learning, research still has to better understand how to design effective and meaningful gamification concepts. Therefore, important challenges remain to better understand the concept of gamification in learning which will be tackled in this dissertation. Because research still discusses the relevance and meaning of individual gamification elements, the first challenge focusses on getting a better understanding about the functionality and characteristics of gamification elements. Another challenge results from misguiding or different insights about the effectiveness of gamification concepts in digital learning. Therefore, the studies connected to the second challenge present empirical insights that demonstrate how gamification elements in learning should be designed to support learners in managing their learning processes. Finally, a third challenges of this dissertation serves to analyze the process of developing gamification concepts to better understand how to avoid the oftentimes selected "one-size-fits-all" solutions by discussing how users can be involved from the beginning of the concept development process.

Methodology: This dissertation follows a multi-method approach. First, a developed taxonomy specifies the functionalities and characteristics of gamification elements. To evaluate and validate the developed taxonomy, expert interviews and case studies are used. Second, the results of three empirical studies provide in-depth knowledge on the use and design of gamification elements in digital learning. A preference analysis is used to get a better understanding about which gamification elements users prefer in digital learning and which one they experience as not supporting in their learning activities. The results of two experimental studies are used to better understand the design and use of badges and points as well as mediating avatars in digital learning. A best-worst scaling is used for the preference analysis. Furthermore, a structural equation model and a qualitative comparative analysis are used to analyze the effectiveness of points, badges, and mediating avatars in relation to learners' problem-solving skills, their emotional reaction, their satisfaction with the learning process, and their cognitive load.

Third, a systematic literature review is used to derive the components of a user-centered gamification concept development process.

Findings: The dissertation has three core findings, among others. First, the developed taxonomy presents a consolidated list of existing gamification elements that can be used to gamify information systems. In addition to this list, the functionalities of each gamification element are documented in more detail by a representation of the characteristics of each gamification element. Second, another finding focusses on the effectiveness of gamification concepts in the context of digital learning with the intention to achieve better learning outcomes. The results of three empirical studies demonstrate the effectiveness of using gamification elements in digital learning. Points and levels are preferred by learners other than badges, mediating avatars, or leaderboards that were not evaluated as supportive for learning activities. Furthermore, the results indicate that learners prefer a combination of around four gamification elements. A more detailed experimental analysis of points and badges highlights that with the right design, learners are engaged, intrinsically motivated, satisfied and are supported in training their problem-solving skills. In addition, designing mediating avatars in digital learning can result in emotional attachment, satisfaction with the learning process, and less cognitive load. The last core finding of this dissertation describes how users can be involved in the development process of gamification concepts with the intention to better guide gamification concept developers in creating individualized and meaningful gamification concepts.

Theoretical contribution: In relation to the core findings, the dissertation has three overall contributions. The first one is a theory of prediction and explanation. The theory explains the characteristics and dimensions of gamification elements. The second theoretical contributions results from the insights of three empirical studies about the usage of gamification elements in digital learning. A theory of explanation results from the preference analysis of gamification elements. By referring to the characteristics of each gamification element in combination with their ranking position of the preference analysis, predictions can be made about the meaning of individual elements in digital learning. The other two experimental studies presented in this dissertation contribute to a theory of explanation and prediction. Therefore, the dissertation presents theoretical contributions on 1) a detailed understanding about the usage of gamification elements in digital learning, their effects on engagement, and a learners problem-solving skills, 2) the relevance and meaning of motivating gamification element designs, and 3) the meaning of mediating avatar design configurations in digital learning and its effects on emotional attachment, satisfaction with the learning process, and cognitive load. The third and last core contribution of this dissertation provides a more detailed understanding on how to develop user-centered gamification concepts. Therefore, the dissertation contributes to a theory of prediction. By analyzing existing gamification methods that can be used to gamify information systems, the dissertation presents possible entry points to involve users when developing gamification concepts. Such a consideration of users allows gamification concept developers to systematically develop individualized gamification concepts. In addition, propositions are presented that allow for a more detailed analysis of gamification concept development.

Practical contribution: Among others, the dissertation has five major practical contributions. First, the dissertation presents a taxonomy and two case studies which highlight how the developed taxonomy can be used to explain and improve existing gamification concepts and how to develop new gamification concepts. Another practical contribution is given by a ranking of gamification element preferences in digital learning. The ranking of gamification elements supports practitioners in evaluating the role and meaning of user preferences in gamification and digital learning. A third practical contribution results from a research model that demonstrates how the effects of gamification elements on problem-solving outcomes can be considered. A fourth practical contribution considers the design of mediating avatars in digital learning and their relationship to emotional attachment, satisfaction with the learning process, and cognitive load. Finally, practical implications about how to consider users in the development process of gamification concepts can be given to practitioners by presenting the results of a systematic literature review on gamification methods.

Outlook: By building up on the result of this dissertations, future research should try to get a deeper understanding about how to broaden the concept of gamification in digital learning. Therefore, concepts such as digital nudging and the usage of nudging elements should be further analyzed. In addition, more research studies should focus on the design of competitive and cooperative gamification concepts. Both competitive as well as cooperative gamification concepts should be analyzed in more detail to better understand their effectiveness in digital learning. Another direction for future research should consider an action design science approach in combination with the development of an information system in digital learning. Therefore, more needs to be learned about the long-term effects of gamification in digital learning. Finally, more research should

focus on analyzing the relevance and design possibilities of adaptive gamification by referring to methods of artificial intelligence and NeuroIS that enable researchers to create individualized gamification concepts.

Key words: Gamification, Digital Learning, Gamified Learning, Gamification Elements

List of Publications

During my time as Ph.D. student at the Department of Information Systems of the University of Kassel, I authored and co-authored the following publications under the supervision of Jan Marco Leimeister (Ph.D. supervisor). Some publications might overlap which is why I provide a brief description at the beginning of each section highlighting publications that significantly influenced the content of each section.

Under Review/ Forthcoming:

Schöbel, S.; Janson A.; Leimeister J.M. (in progress): Gamification of Online Trainings – Understanding the Role and Meaning of Engagement and Problem-solving Outcomes in Learning (*Journal of Management Education (JME))*.

Published/ Accepted for Publication:

2020

Schöbel S.; Barev, T.; Janson A.; Hupfeld, F.; Leimeister, J. M. (2020): Understanding User Preferences of Privacy Nudges – A Best-Worst Scaling Approach. In: *Hawaii International Conference on System Sciences (HICSS).* Maui, Hawaii, USA.[1]

Schöbel, S.; Janson, A.; Söllner M. (2020): Capturing the Complexity of Gamification Elements: A Holistic Approach for Analysing Existing and Deriving Novel Gamification Designs. In: *European Journal of Information Systems (EJIS)*.

Schöbel, S.; Janson, A.; Jahn, K.; Kordyaka, B.; Turetken, O.; Djafarova, N.; Saqr, M.; Wu, D.; Söllner, M.; Adam, M.; Gad Heidberg, P.; Wesseloh, H.; Leimeister, J.M, (2020): The Why, What, and How of Gamification Designs – A Research Agenda for Gamification in Information Systems. In: *Communications of the Association for Information Systems (CAIS)*.

2019

Schöbel S.; Janson A.; Mishra A. N. (2019): The Details make the Design: Towards a Configurational View for Designing Avatars in Digital Learning. In: *International Conference on Information Systems (ICIS)*. Munich, Germany.

[1] Nominated for best paper award

Schmidt-Kreaplin M.; Thiebes, S.; Schöbel, S.; Sunyaev, A. (2019): Users' Game Design Element Preferences in Health Behavior Change Support Systems for Physical Activity: A Best-Worst-Scaling Approach. In: *International Conference on Information Systems (ICIS).* Munich, Germany.

Glavas, M.; Schöbel, S.; Oeste-Reiß, S. (2018): Über die Entwicklung und Bedeutung von Berufsbildern im Lernkontext – Ergebnisse einer Marktstudie des Energieberatungsmarktes. In: Leimeister J. M.; David K. (Eds.), Chancen und Herausforderungen des digitalen Lernens – Methoden und Werkzeuge für innovative Lehr-Lern-Konzepte (pp. 11-31).

Glavas, M.; Schöbel, S.; Oeste-Reiß, S. (2018): Referenzprozess zur Aufarbeitung von implizitem Wissen zu Tätigkeitsfeldern und Arbeitsprozessen –Ergebnisse einer Workshopserie. In: Leimeister J. M.; David K. (Eds.), Chancen und Herausforderungen des digitalen Lernens – Methoden und Werkzeuge für innovative Lehr-Lern-Konzepte (pp. 75-94).

Schöbel, S.; Söllner, S. (2018): Bedeutung von Präferenzen für Spielelemente – Analyse und Empfehlungen für die Anpassung von Spielelementen durch Nutzerpräferenzen. In: Leimeister J. M.; David K. (Eds.), Chancen und Herausforderungen des digitalen Lernens – Methoden und Werkzeuge für innovative Lehr-Lern-Konzepte (pp. 121-139).

Schöbel, S.; Söllner, S. (2018): Leitfaden für die Identifikation, Auswahl und Kombination von Gamification-Elementen am Beispiel des Lernkontextes. In: Leimeister J. M.; David K. (Eds.), Chancen und Herausforderungen des digitalen Lernens – Methoden und Werkzeuge für innovative Lehr-Lern-Konzepte (pp. 143-161).

Imas, C.; Urbon, U.; Kraft, J.; Herbst, I.; Schöbel, S.; Glavas, M.; Oeste-Reiß, S. (2018): Entwicklung von Lernvideos, Lernzielen und Testfragen in kleinen und mittelständischen Unternehmen und in Weiterbildungsinstituten. In: Leimeister J. M.; David K. (Eds.), Chancen und Herausforderungen des digitalen Lernens – Methoden und Werkzeuge für innovative Lehr-Lern-Konzepte (pp. 199-218).

Schöbel, S.; Janson, A.; Hopp, J. C. & Leimeister, J. M. (2019): Gamification of Online Training and its Relation to Engagement and Problem-solving Outcomes. In: *Academy of Management Annual Meeting (AOM).* Boston, Massachusetts, USA.

2018

Schöbel, S. & Janson, A. (2018): Gamifying Information Systems - Improving Motivation and Effective Use Through a Theory-motivated Method. In: *International Conference on Information Systems (ICIS)*. San Francisco, CA, USA.

Janson, A. & Schöbel, S. (2018): Nudging Privacy in Digital Work Systems – Towards the Development of a Design Theory. In: *International Conference on Information Systems (ICIS)*. San Francisco, CA, USA.

Schöbel, S. & Janson, A. (2018): Avatar Designs are in the Eye of the Beholder – About Identifying Preferred Avatar Designs in Digital Learning. In: Annual *Pre-ICIS Workshop on HCI Research in MIS (ICIS).* San Francisco, California, USA.

Leimeister, J. M.; Schöbel, S.; Lehmann, K.; Oeste-Reiß, S. & Söllner, M. (2018): StaySmart-Ansatz zum kollaborativen Kompetenzaufbau, -erhalt und -austausch. In: Ahrens, D. & Molzberger, G. (Eds.), Kompetenzentwicklung in analogen und digitalisierten Arbeitswelten. Gestaltung sozialer, organisationaler und technologischer Innovationen (pp. 89-106).

Schneider, T.; Janson, A. & Schöbel, S. (2018): Understanding the Effects of Gamified Feedback in Mobile Learning – An Experimental Investigation. In: *International Conference on Information Systems (ICIS).* San Francisco, California, USA.

Schöbel, S. & Janson, A. (2018): Is it all about Having Fun? - Developing a Taxonomy to Gamify Information Systems. In: *European Conference on Information Systems (ECIS).* Portsmouth, UK.

2017

Schöbel, S.; Janson, A.; Ernst, S. -J. & Leimeister, J. M. (2017): How to Gamify a Mobile Learning Application – A Modularization Approach. In: *International Conference on Information Systems (ICIS).* Seoul, South Korea.

Schöbel, S.; Söllner, M. & Mishra, A. N. (2017): Does the Winner Take it All? Towards an Understanding of why there might be no One-Size-Fits-All Gamification Design. In: *European Conference on Information Systems (ECIS).* Guimarães, Portugal.

Söllner, M.; Oeste-Reiß, S. & Schöbel, S. (2017): Spielende Kompetenzmessung im Projekt StaySmart. In: Praeview - *Zeitschrift für innovative Arbeitsgestaltung und Prävention*, Ausgabe/Nummer: 1, Erscheinungsjahr/Year: 2017. pp. 18-19.

Schöbel, S.; Ernst, S. -J.; Söllner, M. & Leimeister, J. M. (2017): More than the Sum of its Parts – Towards Identifying Preferred Game Design Element Combinations in Learning Management Systems. *In: International Conference on Information Systems (ICIS).* Seoul, South Korea.

Schöbel, S. (2017): About the Relevance of User Preferences in the Development of Gamification Approaches. In: *European Conference on Information Systems (ECIS),* Doctoral Consortium. Guimarães, Portugal.

2016

Schöbel, S.; Lehmann, K.; Oeste-Reiß, S.; Söllner, M.; Glavas, M.; Hilbert, L. & Kamsties, S. (2016): Kompetenzen und Qualifikationen von Energieberatern - Eine qualitative Analyse des Energieberatungsmarktes. Kassel University Press. Technical Reports des Wissenschaftlichen Zentrums für Informationstechnik-Gestaltung (ITeG) an der Universität Kassel, W. Z., Ed.

Schöbel, S.; Lehmann, K.; Oeste-Reiß, S. & Söllner, M. (2016): StaySmart – Individuelles und kompetenzorientiertes E-Learning im Zeitalter des demografischen Wandels. In: *e-Learning Fachtagung Informatik (DeLFI).* Potsdam, Germany.

Schöbel, S.; Söllner, M. & Leimeister, J. M. (2016): The Agony of Choice – Analyzing User Preferences regarding Gamification Elements in Learning Management Systems. In: *International Conference on Information Systems (ICIS).* Dublin, Ireland.

Schöbel, S. & Söllner, M. (2016): How to Gamify Information Systems - Adapting Gamification to Individual User Preferences. In: *European Conference on Information Systems (ECIS)*. Istanbul, Turkey.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ACD	Active Discovery
ADR	Action Design Research
B	Best
BIBD	Balanced Incomplete Block Design
BWS	Best Worst Scaling
CsQCA	Crisp QCA
CMB	Common Method Bias
DSR	Design Science Research
FsQCA	Fuzzy QCA
IF	Impact Factor
IM	Intrinsic Motivation
IS	Information System
JQ3	JOURQUAL 3
LG	Learning Goals
LMS	Learning Management System
MEA	Meaning
OE	Outcome Expectations
OLE	Ordinary Least Squares
PBL	Points, Badges, Leaderboards
PLS-SEM	Partial Least Squares Structural Equation Model
QCA	Qualitative Comparative Analysis
RQ	Research Question
SEP	Self-Expansion

SDT	Self-determination Theory
SEM	Structural Equation Model
STD	Standard Deviation
TML	Technology-mediated Learning
W	Worst
WI	Wirtschaftsinformatik

1 Introduction

"Our biology designed us for play throughout the life cycle. We play when we're young, and we're still able to play when we're old."
Brown (2009, 405)

1.1 Problem Statement

The citation of the Stuart Brown (2009) describes an inner human need that supports the importance of playing games along all ages. Playing games is an important part of every day's private or even work life. Huizinga (1949) was one of the first researchers, who supported that playing games is and will be an important part of our lifes. Since then, this phenomenon has not changed at all. Instead, the use of games has increased at an astounding pace and has led to inspiring trends as, for example, gamification, one of the most prominent developments in the last years (Hamari et al. 2016). Gamification is defined as "the use of game design elements in non-game contexts" (Deterding et al. 2011b) and involves incorporating elements into monotonous and tedious tasks to make them enjoyable (Thiebes/Lins/Basten 2014), leading in turn to increased user activity (Deterding et al. 2011b). Therefore, gamification is the next stage of game development, finally broadening the concept to areas in which games have not been acceptable until now, for example work.

Gamification has been established in different areas such as health, sustainability, crowdsourcing, or learning (Seaborn/Fels 2015). In today's digital learning environments gamification has become increasingly important. Boredom, being distracted, and fatigue lead to participants just clicking through the online training without focusing on the learning content, thereby resulting in insufficient learning outcomes (Davis/Singh 2015; de-Marcos et al. 2014). In digital learning environments, it has become challenging for learners to keep motivated in learning (Means et al. 2009), and gamification has been proven as effective motivating concept in learning. The global market for gamification solutions will grow from USD 1.65 billion in 2015 to USD 11.10 billion by 2020 (Dobeco 2016). Although gamification has become more popular, practitioners started criticizing the concept of gamification and claimed that several gamification concepts are going to fail and that their effects are often short term in practice (Gartner 2012; Fogel 2015). One cause for criticism is the poor game design:

> *"The challenge facing project managers and sponsors responsible for gamification initiatives is the lack of game design talent to apply to gamification projects (...) poor game design is one of the key failings of many gamified applications today"* (Fogel (2015) referring to the work of Burke (2014)).

This criticism can especially be observed in the context of digital learning, where gamification solutions are oftentimes handled as one-size-fits-all approaches by referring to points, badges, and leaderboards (PBL) concepts or by using elements without adapting them to the needs of learners (Santhanam/Liu/Milton-Shen 2016; Liu/Santhanam/Webster 2017). To this day, many organizations criticize the design of gamification concepts and do not consider gamification in digital learning because they doubt that it results in better learning outcomes (Pandey 2015). In summary, practice shows that the concept effectiveness of gamification is not yet fully understood, and research needs to concentrate on getting a better understanding about what components contribute to designing a meaningful gamification concept. Under this light, this dissertation focuses on answering three research challenges, that are explained in the following.

Research Challenge 1: Limited investigation of gamification element characteristics.

Gamification is about using game-like elements in non-entertainment-based contexts (such as information systems (IS)) (Deterding et al. 2011a). These elements can be adapted and designed by gamification concept developers. Different kinds of elements exist that can be classified in different ways. The most prominent classification used in gamification is the "mechanics, dynamics, aesthetic" (MDA) classification (Hunicke/LeBlanc/Zubek 2004). It describes components or building blocks of a game (mechanics), the run-time behavior of mechanics on user inputs (dynamics), and the desirable emotional response evoked in a user (aesthetics) (Hunicke/LeBlanc/Zubek 2004). Typically, mechanics are elements that can be selected and adapted by designers. In turn, dynamics describe the effects that are caused by mechanics, or in other words they present more details about how to design mechanics. Although classifications of gamification elements exist that help to support designers of gamification concepts, research studies use them incongruently and refer to them by describing different terms of elements. A closer look on studies that observe elements that are used to gamify IS, for example, reveals that there are many different terms to describe one element such as a leaderboard that can be described as ranking, high-score table, score board, badge board, or line chart (Schöbel/Janson 2018). In addition, studies that refer to existing gamification element classifications, do not share the same knowledge about which characteristics these elements share. Faghihi et al. (2014), for example, describe a challenge as a game mechanic and, thus, as a building block to gamify an IS, while Blohm and Leimeister (2013) refer to a challenge as an effect of mechanics on the subjective user experience. Finally, Hunicke (2004) describe a challenge as aesthetics, because a challenge represents the emotional response evoked in users when they interact with a game mechanic such as a level. With a different understanding about elements and their characteristics, and classification, gamification designers do not have an orientation (Deterding 2015) when gamifying digital learning environments, which results in the random selection and combination of gamification elements and in turn to effects that cannot be fully understood because failures in gamification concepts cannot be interpreted and explained (Super et al. 2019; Schlagenhaufer/Amberg 2015; Liu/Santhanam/Webster 2017). The design deficits of gamification concepts that can be observed in research and practice might result from a lack of set of properties that is common to all gamification concepts (Scheiner/Witt 2013). To better understand how to design gamification concepts in learning, a better understanding is necessary about the functionalities of gamification elements and their characteristics. Otherwise, it is impossible to compare and judge about the effects of gamification on learning outcomes.

Research Challenge 2: Limited investigations of gamification element designs and their effectiveness in digital learning.

Gamification has become more important for digital learning to motivate learners to a more regular system use (Cheong/Cheong/Filippou 2013; Aparicio et al. 2019). Although gamification has been successfully used to gamify digital learning concepts, observing results of research studies leads us to conclude that points out that we need to learn more about how to design effective gamification concepts in learning. The success of gamification concepts depends on how a gamification concept is designed (Sailer/Homner 2019). Most often gamification concepts are designed as one-size-fits all solutions. Gamification is not just a matter of combining PBL, rather, it is a design process that should consider that gamification elements make sense to users by connecting them to their activities (Hallifax et al. 2019; Liu/Santhanam/Webster 2017). Using competitive elements in learning, for example, can be risky and difficult because users react differently towards competitive gamification elements (Santhanam/Liu/Milton-Shen 2016; Schöbel/Söllner 2016). Weaknesses in the design of gamified digital learning solutions can also be observed when looking at the results of gamification studies. Replacing a leaderboard with a level in a combination of feedback, points, goals, and time pressure can result in different or even negative behavioral effects in learning (Attali/Areli-Attali 2015; Li/Grossman/Fitzmaurice 2012). On the other hand, using PBL in a digital learning system can result in negative effects on learning behavior (Hew et al. 2016), whereas using points, badges, and levels can have positive effects on learning behavior (Shute et al. 2015). Although research on gamification has further developed, criticism as to what effects are caused by gamification still prevails, making it necessary to empirically explore the effects of gamification in more detail (Seaborn/Fels 2015) in relation to gamification concept designs. By empirically exploring the design of individual elements or element combinations, it is possible to better understand the effectiveness of gamification concepts in learning.

Research Challenge 3: Limited investigation of how to proceed when developing gamification concepts.

The third and last research challenge that is addressed in this dissertation refers to the importance of the process of designing gamification concepts. The process of developing a gamification concept can be addressed by using a method. A method, in turn, can be described as a development project, that is structured in a systematic way by referring to different development activities (Brinkkemper 1996). Such a method can support designers or developers of gamification concepts in selecting the right elements and adapting them to the needs of users and supporting designers in getting away from one-size-fits-all solutions. Therefore, a method can further support developers of gamification concepts in developing the best design for their gamified IS. Although methods on how to gamify IS exist, there is some support that gamification projects fail because of a poor understanding of the gamification design process. Also, designers of gamification concepts probably pay too little attention to the underlying psychological dynamics of a gamification concept (Morschheuser et al. 2018). It can be further observed that designers without training that apply a method to gamify a IS are probably not successful in applying gamification effectively (Sailer/Homner 2019). Such a lack of training might result from missing guiding implications about how to stepwise design gamification concepts. In addition, there are contrary results as to the effectiveness of gamification, which requires an exploration of the process by which gamification is used to improve the behavior of users (Landers 2015). Such an understanding about processes in gamification is not only of relevance for digital learning solutions, because the process of creating gamification concepts can set apart good gamification designs from poor ones, which is of general interest in research, no matter which context we refer to (Liu/Santhanam/Webster 2017). The third and last challenge of this dissertation is necessary to not only support practitioners in guiding their gamification concept development process, it rather supports researchers in getting a better understanding the meaning and process of designing gamification concepts in IS.

1.2 Solution Statement and Research Questions

Based on the research challenges, I focus on three different goals. An overview about all research questions, the study focus, insights from previous studies, and the outcomes is given in Figure 1.

	Study Title	Research Question	Focus	Insights from previous Studies	Outcomes
Research Challenge 1 Theoretical Foundation	**Understanding the Characteristics of Gamification Elements – A Taxonomy to Analyze and Design Gamification Concepts**	**RQ1:** Which gamification elements exist and how can they be categorized to provide guidance in developing and explaining gamification concepts in IS? **RQ1a:** Which gamification elements exist to develop gamification concepts in IS? **RQ1b:** How can gamification elements be categorized? **RQ1c:** How can a categorization of gamification elements support practitioners and researchers in gamifying IS and explaining gamification concepts in IS?	• Identification of gamification elements • Understanding about characteristics of gamification elements • Identification of possibilities to explain existing gamification concepts • Identification of possibilities about how to create gamification concepts	• Insights were gathered from existing research studies but not on the results of own research studies.	1. List of gamification elements 2. Taxonomy about gamification elements and their characteristics 3. Use cases about how to develop gamification concepts with a taxonomy and how to explain existing gamification concepts
Research Challenge 2 Empirical Foundations	**Gamification Element Preferences of Users in Technology-mediated Learning**	**RQ2:** Which and how many gamification elements do learners prefer? **RQ2a:** Which elements do learners prefer? **RQ2b:** How many elements do learners combine to a bundle of elements?	• Analysis of user preferences towards gamification elements in learning • Identification of the most and least preferred gamification elements in learning • Amount of combinable elements	• Description of gamification elements and their characteristics • Explanation of ranking results based on the different characteristics of gamification elements described in the taxonomy	1. Ranking of preferred gamification elements 2. Implications about amount of elements that need to be combined in a bundle
	Exploring the Role and Meaning of Points and Badges in Technology-mediated Learning – An Experimental Analysis of Engagement, Satisfaction, Motivation, and Problem solving Outcomes	**RQ3:** How does the usage of points and badges in TML influence motivation, engagement, satisfaction with the learning process, and problem-solving skills of learners?	• Understanding about how to design badges and points in digital learning • Understanding about the effects of gamification on satisfaction, engagement, and problem-solving skills	• Insights from the BWS and the preferences of users towards specific elements • Taxonomy to understand the characteristics of points and badges	1. Empirical validation about effects of points and badges 2. Empirical validation about the effects of point and badges on satisfaction, engagement, motivation, and problem-solving skills
	A Configurational View on Designing Mediating Avatars in Technology-mediated Learning and how they Support Emotional Attachment, Satisfaction, and Extraneous Cognitive Load	**RQ4:** Which mediating avatar design configurations constitute emotional attachment, satisfaction with the learning process, and extraneous cognitive load in TML?	• Understanding about meaning and relevance of mediating avatars in learning • Insights about how to designs mediating avatars for online learning applications	• Insights from the BWS and the preferences of users towards specific elements • Taxonomy to understand the characteristics of mediating avatars	1. Empirical validation about how mediating avatars in learning affect users 2. Empirical validation about role of emotional attachment, satisfaction, and extraneous cognitive load in relation to mediating avatar designs
Research Challenge 3 Implications	**The Role and Meaning of User-centered Gamification Concepts – A Review and Synthesis of Gamification Methods**	**RQ5:** Which insights can be gained from existing gamification methods about the process of developing more user-centered gamification concepts?	• General implications about what to consider when developing gamification concepts in terms of considering users • Generalization of findings	• Insights from theoretical background • Insights from empirical studies	1. Guidelines about how to create more user-centered gamification concepts for IS 2. Summary of existing methods to gamify IS

Figure 1: Overview about Research Questions of Dissertation
Source: Own Illustration

First, I want to get a deeper understanding of what gamification is in relation to its elements and their characteristics (*research challenge 1*). Such a detailed understanding helps to decide how to adapt gamification concepts to a context such as digital learning. Second, I want to take a closer look on the context of learning to understand the relevance of gamification in learning (*research challenge 2*). Lastly, I want to get a deeper understanding about the gamification development process and its possibility as user-centered concept development (*research challenge 3*). To achieve these goals, I consider five different research questions that are answered by five different research studies I have conducted.

RQ1 is used to get a better understanding about gamification elements and their characteristics. To answer *RQ1*, I use a mixed-method approach. In a first step, I present a developed taxonomy of gamification elements based on the recommendations of Nickerson et al. (2013). This taxonomy provides an overview about existing gamification elements that can be used to gamify IS (*RQ1.1*). In addition, I present identified dimensions and characteristics to categorize gamification elements (*RQ1.2*). To evaluate the developed taxonomy, I present the results of expert interviews. Finally, I present the results of a case study be demonstrating how a taxonomy can be used to explain already gamified IS and to develop new ones (*RQ1.3*). An overview about the *RQ1*, its sub questions, its method, and results is given in Table 1.

RQ1	**Which gamification elements exist and how can they be categorized to provide guidance in developing and explaining gamification concepts in IS?**
RQ1a	Which gamification elements exist to develop gamification concepts in IS?
RQ1b	How can gamification elements be categorized?
RQ1c	How can a categorization of gamification elements support practitioners and researchers in gamifying IS and explaining gamification concepts in IS?
Methods	Mixed method study with taxonomy development, expert interviews, and two case studies.
Results	List of gamification elements, list of characteristics of gamification elements, shared understanding about gamification elements and their characteristics.

Table 1: Overview Research Question 1
Source: Own illustration

To answer *RQ2, RQ3, RQ4* I used three different empirical studies to analyze gamification elements in learning. In a first step, I present the results of a so-called best-worst scaling (BWS). A BWS can be used to identify preferences of users (Louviere et al. 2013) to get a better understanding about which gamification elements users of learning applications prefer the most and which elements they prefer the least. Based on these insights I can better explain the effects that specific elements may cause.

In addition, the results of *RQ2* are useful to better understand which gamification elements need to be further analyzed to make them more attractive to users of learning applications. Table 2 shows the question, its sub questions, the method I used to answer the research questions, and a summary of the most important results.

RQ2	**Which and how many gamification elements do learners prefer?**
RQ2a	Which elements do learners prefer?
RQ2b	How many elements do learners combine to a bundle of elements?
Method	BWS
Results	Ranking about most and least preferred gamification elements in digital learning

Table 2: Overview Research Question 2
Source: Own Illustration

The results of *RQ2* are useful to identify which gamification elements need to be analyzed in more detail in terms of the preferences of users. To answer *RQ3*, I present the results of an experiment that uses points and badges in the context of digital learning. Therefore, I use a structural-equation model (SEM) (Chin 1998) to analyze if gamification can influence satisfaction with the learning process, motivation, engagement, and problem-solving skills. As a result, I present a theoretical model that explains how gamification in learning can influence learning process satisfaction, emotional attachment, and cognitive load. An overview about the question, results, and method is presented in Table 3.

RQ3	**How does the usage of points and badges in TML influence motivation, engagement, satisfaction with the learning process, and problem-solving skills of learners?**
Methods	Model development, survey study and SEM
Results	Theoretical model for explaining and predicting the influence of gamification on satisfaction with the learning process, engagement, motivation, and problem-solving skills.

Table 3: Overview Research Question 3
Source: Own Illustration

A gamification element that was ranked as “least preferred” element in section 5 was a mediating avatar (Schöbel/Söllner/Leimeister 2016). To better understand how a mediating avatar in learning should be designed to be more appealing to learners, I answer *RQ4* and use a so-called qualitative comparative analysis (QCA) (Ragin 2009). The effects of gamification elements on a user’s behavior are difficult to analyze and observe (see section 4 which demonstrates that the effects of gamification on a learner's problem solving-skills) and research still needs to get a deeper understanding about constructs that determine usage when using gamification elements (Hanus/Fox 2015). Thus, *RQ4* demonstrates how mediating avatar designs constitute along emotional attachment, satisfaction with the learning process, and extraneous cognitive load. By using QCA, different kind of avatar configurations result. An overview about *RQ4*, the method I use, and the results is given in Table 4.

RQ 4	**Which mediating avatar design configurations constitute emotional attachment, satisfaction with the learning process, and extraneous cognitive load in TML?**
Methods	Model development, survey study and QCA
Results	Configurations of avatar designs in terms of emotional attachment, satisfaction with the learning process, and extraneous cognitive load.

Table 4: **Overview Research Question 4**
Source: Own Illustration

Finally, *RQ5* is used to analyze the process of developing gamification concepts under the light of user-centeredness to support developers in systematically creating new gamification concepts and to give implications about how to better avoid one-size-fits-all approaches. Therefore, a systematic literature review is used to identify methods that are used to gamify IS. These methods are then analyzed in more detail in terms of user-centeredness. As a result, practical implication can be given to developers of gamification concepts about how to consider users when developing gamification concepts. In addition, propositions help to identify gaps for future research. Table 5 specifies *RQ6*.

RQ 5	**Which insights can be gained from existing gamification methods about the process of developing more user-centered gamification concepts?**
Method	Systematic literature review
Results	Practical implications about the development process of user-centered gamification concepts, Propositions about user-centered designs of gamification concepts.

Table 5: **Overview Research Question 5**
Source: Own Illustration

1.3 Structure of Dissertation

To answer the RQs this dissertation is structured in nine different parts. Figure 2 provides an overview about the nine different parts of this dissertation. After introducing the overall motivation of this dissertation and the related goals, I continue with a theoretical background (section 2). In the theoretical background I outline the role and meaning of gamification, its elements, and the outcomes that are caused by gamification (section 2.1). A second part of the theoretical background focuses on technology-mediated learning (TML) and gamification in the domain of learning (section 2.2). Afterwards, I describe the philosophical and methodological background of this dissertation (section 3). Starting with research epistemologies, I specify different philosophical viewpoints and their relationship to IS research (section 3.1). Afterwards, I explain the relevance and necessity of literature reviews (section 3.2), followed by qualitative research methods (section 3.3) and quantitative ones (section 3.4). Both quantitative and qualitative research methods are of relevance for my dissertation. In a last step I explain the meaning of a QCA (section 3.5), and close with insights on design science research (section 3.6).

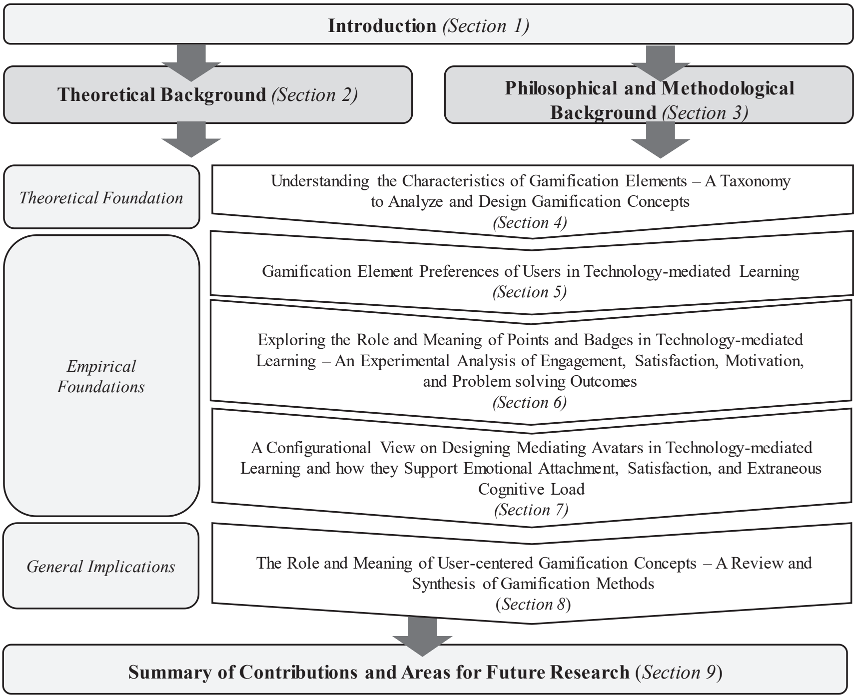


Figure 2: Overview about Structure of Dissertation
Source: Own Illustration

In section 4 to section 8 I present the results of my RQs starting with a theoretical foundation about gamification elements (section 4). In section 5, 6, and 7, I present the results of empirical research studies that were conducted in the domain of learning. I give general recommendations about how to consider users when developing gamification elements in section 8. In a last part of the dissertation (section 9), I outline the practical and theoretical contributions and give implications for future research.

1.4 Overview of Publications in Relation to Research Questions

This dissertation is based on seven different publications. These publications are used to answer the research questions that were presented in the previous section. For each paper I added the available outlet metrics. Four different metrics were added: the impact factor (IF) according to Clarivate Analytics 2018, the Google Scholar h5-index (h5), the VHB JOURQUAL 3 (JQ3) ranking, and the WI-Journal list 2008 of the Wissenschaftliche Kommission für Wirtschaftsinformatik (WKWI) (see Table 6).

No.	Publication	Outlet/ Metrics	RQ	Research Challenge
1	Schöbel, S. & Janson, A. (2018): Is it all about Having Fun? - Developing a Taxonomy to Gamify Information Systems. In: European Conference on Information Systems (ECIS). Portsmouth, UK.	IF:/ h5: 30 JQ3: B WKWI: A	1	1
2	Schöbel, S.; Janson, A.; Söllner M. (2020): Capturing the Complexity of Gamification Elements: A Holistic Approach for Analysing Existing and Deriving Novel Gamification Designs. In: European Journal on Information Systems (EJIS).	IF: 2.892 h5: 96 JQ3: A WKWI: A	1	1
3	Schöbel, S.; Söllner, M. & Leimeister, J. M. (2016): The Agony of Choice – Analyzing User Preferences regarding Gamification Elements in Learning Management Systems. In: International Conference on Information Systems (ICIS). Dublin, Ireland.	IF:/ h5: 25 JQ3: A WKWI: A	2	2
4	Schöbel, S.; Janson, A.; Hopp, J. C. & Leimeister, J. M. (2019): Gamification of Online Training and its Relation to Engagement and Problem-solving Outcomes. In: Academy of Management Annual Meeting (AOM). Boston, Massachusetts, USA.	IF:/ h5: 63 JQ3:/ WKWI: /	3	2
5	Schöbel, S.; Janson A.; Leimeister J.M. (Under Review): Gamification of Online Trainings – Understanding the Role and Meaning of Engagement and Problem-solving Outcomes in Learning (Journal of Management Education (JME)).	IF: 0.83 h5: 41 JQ3: B WKWI:	3	2
6	Schöbel S.; Janson A.; Mishra A. N (2019): The Details make the Design: Towards a Configurational View for Designing Avatars in Digital Learning. In International Conference on Information Systems (ICIS), Munich, Germany.	IF:/ h5: 25 JQ3: A WKWI: A	4	2
7	Schöbel S.; Janson A.; Stein M. C.; Leimeister J. M. (Work in Progress): User-centred Gamification Concepts: A Review and Synthesis of Gamification Methods.	IF:/ h5: 30 JQ3: B WKWI: A	5	3

Table 6: Overview about Publications for this Dissertation
Source: Own Illustration

2 Theoretical Background

"My view is that a theory is an account that is intended to explain or predict some phenomena that we perceive in the world."
(Weber 2003, iv)

Gamification is a key component in this dissertation. Therefore, I discuss the relevant aspects of gamification in the theoretical background section. Another aspect that needs to be further discussed to understand the relevance of the studies I present in this dissertation is the concept of technology-mediated learning (TML). I discuss the concept of TML to get to an understanding and definition of the concept itself.

2.1 Foundations on Gamification

In a first step, I explain the term gamification. In addition, I discuss the role and meaning of gamification elements. Afterwards, I discuss how gamification can change the behavior and specify the terms motivation and engagement.

2.1.1 Conceptualization of Gamification

"It is ancient wisdom, but it is also a little cheap, to call all human activity 'play'. […] we find no reason to abandon the notion of play as a distinct and highly important factor in the world's life and doings. For many years the conviction has grown upon me that civilization arises and unfolds in and as play."
(Huizinga 1949, ix)

Gamification has its origin in playing games. "A game is something that integrates well with our daily life activities but only some of us dedicate a certain amount of time to think of and define it formally" (Yohannis/Prabowo/Waworuntu 2014, 284). This statement reveals that playing games is a voluntary activity that individuals enjoy in their free time. Others describe games as "a system in which players engage in an artificial conflict defined by rules, that results in a quantifiable outcome" (Salen/Zimmerman 2004, 80). Having a quantifiable outcome is probably one important component to separate games from gamification. A quantifiable outcome refers to the goal of a game or can be described as the status a player gains when completing a game (Salen/Zimmerman 2004). However, some researchers also indicate that there is a difference between play and games. Play can be described as a free activity that is not serious but that absorbs the attention and interest of a player (Huizinga 1949).

Furthermore, play is an activity that is not connected to material interests or profits; it has its own rules and boundaries of time and space and supports social groupings (Huizinga 1949). The idea of playing a game and the concept of gaming becomes important to better understand how gamification works. Comparing concepts of gaming with those of playing and contrasting it to having a whole game or parts of a game delivers four different categorizations of game-relevant aspects (Deterding et al. 2011a). Serious games, gamification, toys and playful designs can be differentiated (Figure 3).

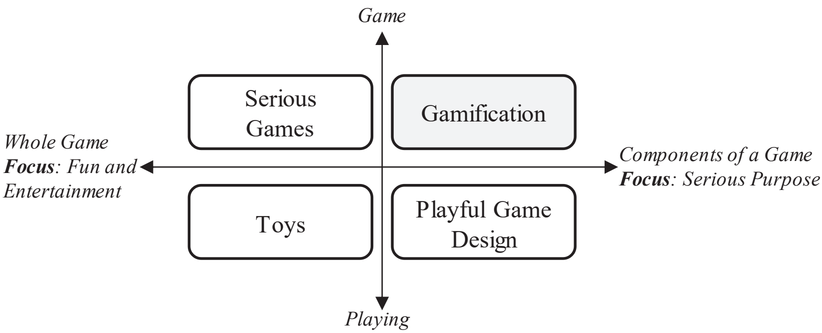


Figure 3: Serious Games, Gamification, Toys, Playful Design
Source: Own Illustration based on Deterding et al. (2011a, 14)

Besides differentiating between a game and components of a game it is useful to consider the focus of a game. A game aims to entertain individuals to have fun (Marczewski 2015). If an application or IS is used with components of a game, it has a more serious purpose than just entertaining individuals (Marczewski 2015). Serious games are played with a computer and focus on a serious context while at the same time creating a gameful and entertaining experience (Zyda 2005). A playful design is about a passive activation of users to play such as the opportunity to propose to Apple's virtual assistant Siri and awaiting her response instead of only asking her to set up meetings (Sicart 2014). Toys do not follow specific rules or have a specific intention; they are just available to create fun. Finally, gamification is about using components of a game for a serious purpose without focusing on playing.

To better understand the concepts of gamification, I now compare different definitions of gamification. There are still inconsistencies about the definition of gamification. The most prominent definition of gamification is given by Deterding et al. (2011a), who describe gamification as "the use of game design elements in non-game contexts"

(Deterding et al. 2011a, 10). Another definition is presented by Hamari et al. (2014), who define gamification as “a process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes” (Hamari/Koivisto/Sarsa 2014, 3026). Comparing these two definitions with the definitions of other research studies reveals that most studies refer to Deterding’s definition (Cheong/Cheong/Filippou 2013; Christy/Fox 2014). Others use a combination of Deterding’s and Hamari’s definition by defining gamification as using elements for a non-entertainment-based context and combine it with the effects and outcomes that can be achieved by gamification such as motivation, engagement, fun, enjoyment, or a different usage behavior (Buckley/Doyle 2017; Faghihi et al. 2014; Fernandes et al. 2012; Gnauk/Dannecker/Hahmann 2012). Besides these definitions, others exist. An overview about different gamification definitions is given in Table 7.

	Definition	Game Components	Outcome	Context
1	“Gamification is the use of game design elements in ***non-game contexts***.”	Game design elements	-	Non-game
2	“Gamification has been defined as a process of enhancing ***services*** with ***(motivational) affordances*** in order to invoke ***gameful experiences*** and further ***behavioral outcomes.***”	Motivational affordances	Experience & behavior	Services
3	“Gamification has been employed to enable attitude change and increase of ***user motivation***. It refers to adding gamefulness to existing systems in ***non-game contexts*** usually aiming to ***increase the value*** of a service or business product beyond its face value, as well as to boost user ***engagement***, ***loyalty***, and ***satisfaction*** or otherwise affect ***usage behavior***.”	-	Engagement, loyalty, satisfaction, behavior	Non-game
4	“Using game-based ***mechanics***, ***aesthetics*** and ***game thinking*** to ***engage*** people, ***motivate*** action, ***promote*** learning, and ***solve problems.”***	Mechanics, aesthetics, game thinking	Learning, problem solving	-
5	“Gamification is a ***design strategy*** attempting to reproduce the ***engagement*** power of games by emulating key ***game mechanics*** without actually designing a full game and implementing them in a ***non-gaming context*** (e.g., industry, education, etc.).”	Game mechanics	Engagement	Non-gaming
6	“In this sense, gamification introduces a new approach which uses ***elements*** and ***dynamics*** of games with no ambition to ***deploy complex narratives or visual settings***.”	Elements, dynamics	-	-
7	“This concept is defined as the intentional use of ***game elements*** for a ***gameful experience*** of ***non-game tasks*** and contexts.”	Game elements	-	Non-game task
8	“Gamification is based on utilizing ***game elements*** in design and ***motivation*** principles in ***non-game situations***.”	Game elements	Motivation	Non-game situation
9	“Referred to as the selective ***incorporation*** of ***game elements*** into an interactive system without a fully-fledged game as the end product.”	Game elements	-	Interactive system

1: (Deterding et al. 2011a, 10); 2: (Hamari/Koivisto/Sarsa 2014, 3026); 3: (Ašeriškis/Damaševičius 2014, 83); 4: (Kapp 2012, 10); 5: (Filsecker/Hickey 2014, 138); 6: (Ibánez/Di-Serio/Delgado-Kloos 2014, 291); 7: (Nebel et al. 2016, 391); 8: (Osipov et al. 2015, 72); 9: (Seaborn/Fels 2015, 14)

Table 7: Comparison of Gamification Definitions
Source: Own Illustration

To define gamification, three components are of relevance. The first one is the "non-game-based" or "non-entertainment-based" context. As I described in the beginning of this section, gamification can be separated from other kind of games by its purpose (see Figure 3). Gamification has a serious purpose and consists of part of a game. This comparison might explain the component of "non-game-based" context of gamification. Second, gamification is about using elements. However, various descriptions for elements exist such as game elements, game design techniques, game mechanics, game design principles, design patterns, or dynamics (Alcivar/Abad 2016; Arai et al. 2014; Bista et al. 2012; Buckley/Doyle 2017; Gnauk et al. 2012). Finally, all definitions refer to outcomes or effects that can be caused by using gamification. Some studies just mention that gamification causes motivation and/or engagement and behavioral outcomes (Fernandes et al. 2012; Pedreira et al. 2015). Others refer to outcomes in relation to the domain in which a gamification concept is used such as achieving organizational goals or enhance learning (Shen et al. 2016). However, I would describe a result of using gamification as a motivational process that can lead to behavioral changes (Toda et al. 2014), because being motivated does not automatically lead to behavioral changes.

Drawing from different definitions to define gamification I refer to the work of Deterding et. al. (2011a), Hamari et al. (2014), and the work of Seaborn and Fels [2015], who specify different contexts in which gamification is used, and refer to the following definition of gamification: *"the use of games, or gamification elements in non-entertainment-based contexts* (Deterding et al. 2011a) - *digital as well as non-digital (according to Deterding et al.* (2011a), *the use of gamification should not be limited to digital technology) - that is intended to achieve desired outcomes* (Hamari/Koivisto/Sarsa 2014)*."* Desired outcomes are typically bound to the domain of the gamification endeavor, and can relate to a variety of different effects, such as an increase in student learning, a more effective use of an organizational IS, or changing user behavior towards a healthier lifestyle (Seaborn/Fels 2015). Looking at how gamification is defined reveals that two constructs need to be explained in more detail: its elements and the effects that are caused by gamification. In the following, I explain both issues, starting with a discussion of the so-called "gamification elements".

2.1.2 Gamification Elements

The previous section outlines that gamification elements are important components when designing a gamification concept. Over 30 different elements exist that can be used to gamify an IS (Thiebes/Lins/Basten 2014). Looking at how gamification is defined (section 2.1.1) points out that there is no shared understanding of the term "gamification elements". Whereas some studies describe elements as mechanics (Hunicke/LeBlanc/Zubek 2004), others describe elements in gamification as components (Werbach/Hunter 2012). Therefore, it seems reasonable to discuss how gamification elements can be described and classified. Further, this overview is important to derive a definition of gamification elements for this dissertation. Classification is about ordering objects or items into groups or classes that share similar characteristics (Bailey 1994).

Name	Definition	Examples
Motivational affordances	A classification of objects that afford motivation (Weiser et al. 2015).	Points, feedback, rewards
General Design Principles	Abstract guidelines for the design process (Weiser et al. 2015).	Offer meaningful stories, support user choices
Mechanics	"Possible means of interaction between user and system"(Weiser et al. 2015, 4).	Feedback, rewards, Competition
Elements	"Mechanics can be implemented using one or several concrete elements"(Weiser et al. 2015, 4).	Achievements, badges, leaderboards
Game mechanics	"Describe the particular components of the game, at the level of data representation and algorithms" (Hunicke/LeBlanc/Zubek 2004, 2).	Points, level, leaderboard
Game dynamics	"Describe the run-time behavior of the mechanics acting on player inputs and each other's outputs" (Hunicke/LeBlanc/Zubek 2004, 2).	Competition, collection, cooperation
Game aesthetics	"Describe the desirable emotional responses evoked in the player, when she interacts with the game system" (Hunicke/LeBlanc/Zubek 2004, 2).	Challenge, fellowship, sensation
Game components	"Components are more-specific forms that mechanics or dynamics can take" (Werbach/Hunter 2012, 80).	Points, achievements, badges
Dynamics	"At the highest level of abstraction are dynamics" (Werbach/Hunter 2012, 78)	Constraints, emotions, narratives
Mechanics	"Mechanics are the basic processes that drive the action forward and generate player engagement" (Werbach/Hunter 2012, 79).	Challenge, competition, cooperation
Gamification Objects	"(…) are the basic building blocks of a gamified system, which typically include items, characters, scripts, visual assets, and so on" (Liu/Santhanam/Webster 2017, 1013)	Virtual coach (narratives), rewards (badges)
Gamification Mechanics	"(….) refer to the rules that govern the interaction between users and game objects" (Liu/Santhanam/Webster 2017, 1014)	Conferring rewards (goals), giving kudos, social networking
Game interface design pattern	"Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations" (Deterding et al. 2011a, 12)	Badge, leaderboard, level
Game design patterns and mechanics	"Commonly reoccurring parts of the design of a game that concern gameplay" (Deterding et al. 2011a, 12)	Time constraint, limited resources, turns
Game design principles and heuristics	"Evaluative guidelines to approach a design problem or analyze a given design solution" (Deterding et al. 2011a, 12)	Enduring play, clear goals, variety of game styles

Table 8: Classification of Gamification Elements
Source: Own Illustration

Table 8 presents different possibilities of gamification element classifications with examples. These element classifications are not loosely coupled. Some belong to an overall framework. The most prominent classification of gamification elements is called the "*Mechanics, Dynamics, and Aesthetics (MDA)*" classification developed by Hunicke et al. (2004). Deterding et al. (2011a) describe such a classification as conceptual models of the components of a game or game experiences. Werbach and Hunter (2012) not only define components. They also define mechanics and dynamics in their MDC classification where mechanics do have the same meaning as in the MDA classification. Weiser et al. (2015) define a classification named *–"motivational affordances"* classification, which includes design principles, mechanics, and elements and Liu et al. (2017) present two categories in their framework: mechanics, and objects whereby objects describe the building blocks of a gamification concept. All these classifications or categorizations of elements have something in common that is important for the definition of gamification elements for this dissertation. In each framework there is a group of elements that are basic components of a gamification concepts. These are the elements that can be selected, combined, and designed by someone aiming to gamify an IS. This group of elements can somehow be seen as initial classification of elements that can be adapted and changed in their design to be more competitive, or cooperative or that can be designed so that they trigger a specific motive.

For this dissertation, I use the term "gamification elements" to describe the components of a game such as points, or badges that are analyzed in this dissertation. Thus, I define gamification elements based on Liu et al. (2017), and Hunicke's (2004) as *"building blocks (or components) of a gamified system that include all elements that can be selected and adapted by designers to create a gamification concept*."

Table 8 highlights that there are some barriers about which elements are assigned to which kind of element category. To better understand how gamification concepts can be adapted to digital learning (section 1), a meaningful categorization of gamification elements in line with definitions of each gamification element are useful. This aspect is going to be answered in the *RQ1* of the dissertation.[2] In relation to the relevance and meaning of motives in gamification, it is important to better understand how motivation, engagement, and usage constitutes around gamification elements.

[2] Therefore, I do not present a list and definitions of all existing elements in the theoretical background section. A detailed description of all elements and their definition is an essential part of section 4.

2.1.3 Effects and Outcomes of Gamification

Gamification and the usage of gamification elements is connected to motives and a user's behavior. The *Motive-Incentive-Activation-Behavior Model* can be used to describe this relationship (Leimeister et al. 2009). Figure 4 visualizes the relationship and the entry point of gamification elements.

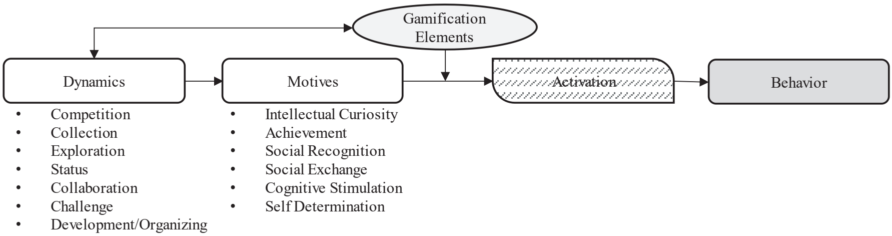


Figure 4: Gamification Elements, Motives, and Behavior
Source: Own Illustration based on Leimeister et al. (2009, 203), and Blohm and Leimeister (2013, 276)

A motive is a reason that causes someone to act and is an individual's inherent striving for a specific goal (Petri 2010; LeDoux 2003). In gamification, elements are used to strengthen the activation of motives. This activation in turn can lead to a behavioral change (Leimeister et al. 2009). Motives are related to so-called dynamics (section 2.1.2), and dynamics can be addressed by gamification elements based on their individual design. In gamification, six motives are important (Blohm/Leimeister 2013). Intellectual curiosity is an individual's willingness to focus on new and even complicated tasks or situations whereby curiosity has its origins in motivation (Euler/Mandl 1983; McDougall 1923). Achievements describe the success someone has when he or she completes a goal (Thiebes/Lins/Basten 2014). Achievements can be connected to the dynamic collection and, for example, points or badges are elements that can be collected (Blohm/Leimeister 2013). Social recognition and social exchange both constitute by recognition through others, interaction, and communication with others (Frischmann 2009). Social recognition can for example be triggered by competition and competition is instantiated by a leaderboard. Cognitive stimulation is about the stimulation of the way individuals think, act and process information (Hayes 1995). They are closely connected to challenges that can, for example, be addressed by time pressure (Blohm/Leimeister 2013).

Finally, self-determination is about making own decisions about gamification elements by for example developing an own avatar design. Self-determination can be explained by self-determination theory (SDT) that is important to understand the overall meaning of motives and motivation (Deci et al. 2001). More precisely, SDT posits that every human has inner needs (or motives) in terms of autonomy, competence, and relatedness (Deci et al. 1991). "Competence involves understanding how to attain various external and internal outcomes and being efficacious in performing the requisite actions; relatedness involves developing secure and satisfying connections with others in one's social milieu; and autonomy refers to being self-initiating and self-regulating of one's own actions" (Deci et al. 1991, 327). This classification can be found in the motive classification for gamification elements. Self-determination itself is used to support individuals in organizing their work. This is reflected by autonomy. Social exchange on the other hand is about working with others and, thus, addresses the need of relatedness. Finally, social recognition is reflected by the need for competence. Motives such as achievements depend on the design of a gamification elements and can be gained by collecting a badge (Blohm/Leimeister 2013). A badge can be given for being better than others (so being more competent) or for working with others (so being related to others). SDT is also related to intrinsic and extrinsic motives and on intrinsic and extrinsic motivation.

Motivation is one central construct in gamification. Most definitions of gamification indicate that gamification is used to motivate users (section 2.1.1). Intrinsic motivation can be described as "doing something because it is inherently interesting or someone enjoys it" (Ryan/Deci 2000, 55) while extrinsic motivation is about "doing something because it leads to a separable outcome" (Ryan/Deci 2000, 55). In other words, extrinsic motivation is about the desire to perform an activity with the intention to attain positive consequences or to avoid negative ones (Deci/Ryan 2000; Kuvaas et al. 2017). Some researchers posit that extrinsic motivation is about getting money or tangible assets which is not necessarily true because it is not sufficient to assume they induce extrinsic motivation (Kuvaas et al. 2017). The same effect could arise when someone is told about rewards, they can collect such as badges or points that can be collected. The success of a user can be easily measured when collecting points and they are also connected to positive consequences such as being rewarded for completing a goal. Extrinsic motivation and intrinsic motivation should not be handled as contrasts. Extrinsic motivation can under some circumstances be self-determined and thus can also trigger intrinsic motivation (Deci/Ryan 1993).

If motives are activated by specific gamification elements, a behavior can result. Depending on the context and the goal of a gamification concept, usage can be explained in different ways. Usage behavior in learning can result in having better learning performance (or test results). In better usage behavior in health might be the result doing sports more regularly. All these outcomes have in common that they can be activated through gamification elements that strengthen inner motives of individuals. However, individuals can differ in their motives and about what they like or dislike because some individuals might not focus on a specific goal that is connected to a gamification element (Schlagenhaufer/Amberg 2015).

2.2 Foundations on Technology-mediated Learning

"(...) if you look at what produces learning and memory and well-being, play is as fundamental as any other aspect of life, including sleep and dreams."

(Stuart L. Brown M. D., president of the national institute for play - the New York Times magazine, "The importance of play" – written by Robin Marantz Henig (2008))

One important component of this dissertation is learning. In this dissertation, I refer to the area of learning and empirically explore and demonstrate how gamification concepts can be adapted to learning applications. I first explain the role and meaning of TML. This includes a discussion of the term itself and an overview about the central components of TML. In a second step I describe the connection between learning and gamification.

2.2.1 Conceptualization of Technology-mediated Learning

Learning has become more important in the last decades because of the rapid growing of information and knowledge (Alavi 1999, Bock 1986). Although both references are older, this statement still holds true. Learning and trainings are one of the most often used methods for companies to improve the productivity of individuals and to communicate new insights to new staff (Gupta/Bostrom 2009). IS can be used to support digital learning processes and to make learning more effective (Alavi/Leidner 1999). One instantiation of IS and learning can be found in TML.

TML is an overarching term to describe different kinds of learning modes such as web- or computer-based learning, asynchronous or synchronous learning, instructor-led or self-paced learning, individual-based or team-based learning (Gupta/Bostrom 2009). Learning itself can be described as "an enduring change in behavior, or in the capacity to behave in given fashion, which results from practice or other forms of experience" (Schunk 2012, 3). Learning is about motivating learners by providing correctional feedback to them to change their behavior to get better learning performance (Kettanurak/Ramamurthy/Haseman 2001). Technology in learning can be defined as "the collection of tools used to deliver learning material and to facilitate communication among participants" (Piccoli/Rami/Blake 2001, 404). Such tools or computer programs are for example computer-mediated communication, internet-guided learning, mobile learning, or microcomputer-assisted learning (Lou/Abrami/d'Apollonia 2001). Learning with technologies can happen in two ways by learning "from" a technology or learning "with" a technology (Reeves 1998).

In summary, I refer to the work of Alavi and Leidner (2001, 2) and define TML as "*an environment in which the learner's interaction with learning materials, peers, and/or instructors are mediated through advanced information technology.*" To specify this definition, one can say that using technologies in learning offers the possibility to connect individual from multiple time zones, and enables companies as well as individuals to share their information and ideas with a crowd of other interested learners (Desanctis et al. 2003). This statement highlights that learning is not only related to individuals anymore; it can also be used as more active and team-oriented learning (Alavi/Wheeler/Valacich 1995; Gupta/Bostrom 2009).

With this view in mind, Leidner (1995) developes five different learning models. Having an objectivism learning model is about the "uncritical absorption of objective knowledge" (Leidner/Jarvenpaa 1995, 270). In this mode, knowledge is transferred from a teacher (or instructor) to a learner. Having a constructivism model is about a process of constructing knowledge by a learner. Objectivism and constructivism involve one individual learner, whereby the third model involves more than one learner and is named collaborativism (Leidner/Jarvenpaa 1995). This kind of learning promotes group skills as well as socialization. The fourth model is about processing and transferring new knowledge into long-term memory and is called cognitive information processing (Leidner/Jarvenpaa 1995). Finally, socioculturism is about subjective and individualistic learning and empowers learners to transfer knowledge to their own situations and ideas. These different modes clarify that a technology alone does not support learning; rather, the different kinds of interactions and collaborations between a technology and learner(s) cause learning (Leidner/Jarvenpaa 1995; Piccoli/Rami/Blake 2001).

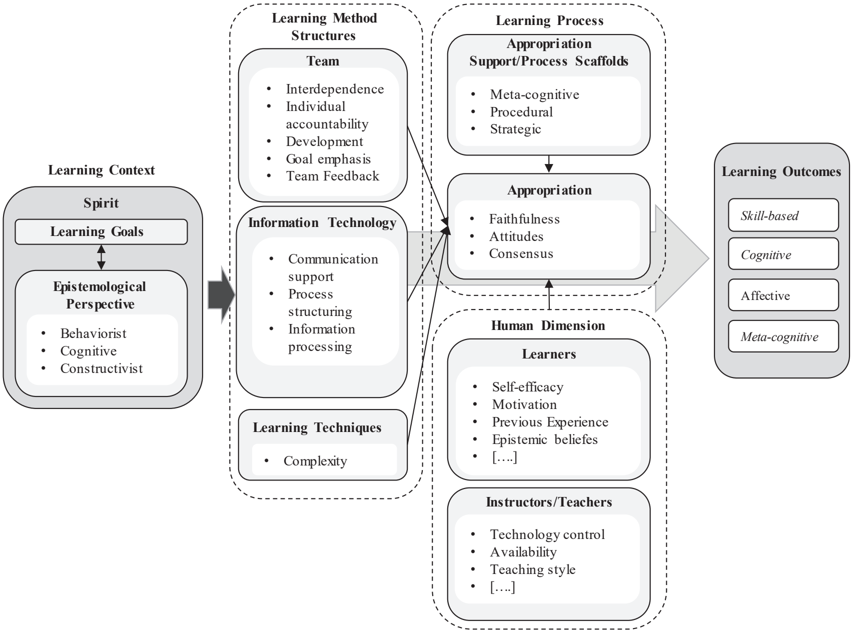


Figure 5: **Conceptual Model of Technology-mediated Learning**
Source: Own Illustration based on Gupta and Bostrom (2009, 690) and Piccoli et al. (2001, 406)

Furthermore, learning with technology cannot happen by letting learners use a technology. It involves a learning context, learning method structures, a learning process, and in the end learning outcomes (Gupta/Bostrom 2009). Figure 5 gives an overview about the different aspects with examples and a demonstration of their relationship. Gupta and Bostrom (2009) outline that five different aspects are of relevance when describing TML. The learning context, learning outcomes, and human dimensions are of relevance for this dissertation and are going to be described in more detail afterwards. Different possibilities to learn from and with a technology exist. What can be found in this section are the recommendations given by Leidner and Jarvenpaa (1995) as collaborativism.

Referring to Gupta and Bostrom (2009), learning methods conceptualize by the team or its social set ups, the information technology, and the learning techniques an individual learner has. All these issues result in the appropriation (or scaffolding) of a learning process. An appropriation process describes where learners learn and adapt the structures based on their interpretation of learning goals and the epistemological perspective (Poole/Desanctis 1992). This learning process is affected by humans (or learners) (Gupta/Bostrom 2009). In their model, Gupta and Bostrom (2009) refer to learners as the human dimension. However, it should be considered that not only learners are of relevance when designing or understanding a TML process. In addition, teachers (or instructors) are of relevance (Piccoli/Rami/Blake 2001). As described in section 2.1.3, motivation is a key component of gamification. Motivation can be found in relation to the human dimensions. Thus, gamification and the usage of gamification elements can support learners in their learning process. They can be helpful to keep learners motivated to continue with their learning process. If gamification supports a learner's motivation, one result can be observed in better learning outcomes (Santhanam/Liu/Milton-Shen 2016).

Learning goals are important to construct online trainings. Learning goals comprise the knowledge that a learner gains by a learning process (Kang/Santhanam 2003). Gupta and Bostrom (2009) suggest to classify them as skill-based, cognitive, affective, and meta-cognitive learning goals. Skill-based goals support in gathering procedural knowledge, whereby cognitive ones support developing boarder domain knowledge in a subject (Gupta/Bostrom 2009). Affective goals enhance the level to which someone is immersed with an object, and meta-cognitive support learners in getting a better understanding of their own learning (Gupta/Bostrom 2009). If learner have achieved a learning goal, their success or failure in learning, can be analyzed by referring to learning outcomes (Gupta/Bostrom 2009). Whereas affective and meta-cognitive goals can be measured by instruments such as satisfaction, it is more difficult to measure cognitive and skill-based goals (Gupta/Bostrom 2009). This problem might be addressed by referring to Blooms taxonomy of learning goals (1956) that was further refined by Anderson (2001) and Krathwohl (2002). They make a suggestion to match different cognitive process dimensions with different kinds of knowledge (Krathwohl 2002). This idea is further supported by the presentation of different verbs that describe the cognitive dimensions and that support in describing the learning goals and making them more precise.

An overview about the dimensions, the verbs, and knowledge dimensions is given in Figure 6.

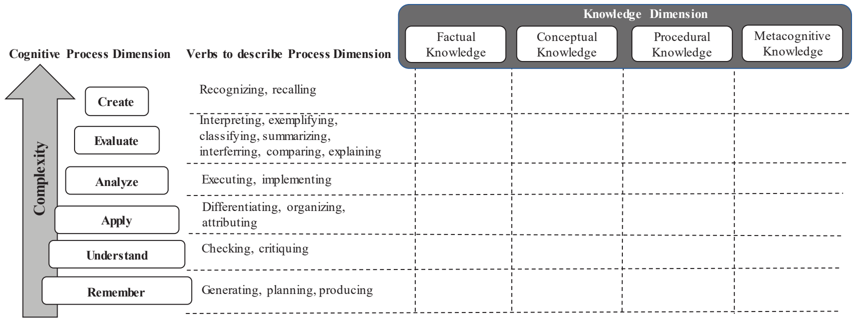


Figure 6: **Cognitive Dimensions Learning Goals and Knowledge Dimensions**
Source: Own Illustration based on Krathwohl (2002, 216)

Blooms taxonomy is a common language, presenting learning goals to better describe the congruence of educational objectives (Krathwohl 2002; Anderson et al. 2001). Krathwohl (2002) describes factual knowledge as basic information that learners must know to understand a discipline in general. Krathwohl (2002) describes conceptual knowledge as getting a better understanding of the interrelationships of a basic element that a learner needs to focus on. Procedural knowledge and metacognitive knowledge are described similar to the suggestion by Gupta and Bostrom (2009). Krathwohl (2002) describes procedural knowledge as getting an understanding of how to do something such as algorithms, techniques, or gaining knowledge about how to determine when using an appropriate procedure. On the other hand, metacognitive knowledge is about the awareness and knowledge of one's own cognition (Krathwohl 2002). These knowledge dimensions can be matched with different cognitive process dimensions. A definition of each dimension is given in Table 9.

Cognitive Process Dimension	**Description**
Remember	"Retrieving relevant knowledge from long-term memory"(Krathwohl 2002, 215)
Understand	Support learners in understanding the meaning of a topic including written, oral and graphical communication.
Apply	Using a well-known procedure to solve a problem of another given situation.
Analyze	Breaking learning materials into its parts and getting a better understanding about how these components contribute to the overall structure or purpose.
Evaluate	"Making judgements based on criteria or standards"(Krathwohl 2002, 215)
Create	Different elements are put together to create a new idea, problem-solution or simply a new product.

Table 9: **Cognitive Process Dimensions**
Source: Own Illustration based on Krathwohl (2002, 215)

To develop factual knowledge a task can be used that asks a learner to repeat a definition of a dimension.

As indicated earlier, learning goals are closely connected to learning outcomes. Different ways of measuring learning outcomes exist. Bostrom et al. (1990) describe the so-called training outcomes cover two different constructs: understanding, which is reflected by measuring the learning performance, and motivation to use, which can be measured by attitudes towards a system. They suggest to measure learning performance for example by the number of types and errors a learner makes (Bostrom/Olfman/Sein 1990). Similar to this, different ways of measure learning outcomes exist, classifying them into cognitive, process related or affective outcomes (Lou/Abrami/d'Apollonia 2001). Process-related measures (Lou/Abrami/d'Apollonia 2001) or skill-based ones (Gupta/Bostrom 2009) should discovered which constructs are measured and in which way they are measured. Another suggestion is given by Gupta and Bostrom (2009) that use skill-based outcomes that are represented by analyzing the learners performance, cognitive outcomes that are reflected by the ability to use a system, and meta-cognitive outcomes that can be measured by self-efficacy and that represent a learners judgment of their capability in using an IS (Gupta/Bostrom 2013).

Another aspect needs to be discussed in more detail to better understand TML for the theoretical background of this dissertation: the epistemological perspective (see Figure 5 for more details). Research epistemologies are going to be part of section 3.1. However, at this point they are necessary to understand their relevance in terms of TML. The term “epistemology” describes the nature of knowledge and the meaning of knowing something (Hannafin/Kim/Kim 2004). There are three classifications in IS that are also relevant for learning and that provide a template to create and design content structures embedded in a learning method: behaviorism, cognitivism, and constructivism (Leidner/Jarvenpaa 1995; Mowrer/Klein 2001; Gupta/Bostrom 2009). Behaviorists focus on what learners do and assume that the behavior of learners is predictable (Kettanurak/Ramamurthy/Haseman 2001; Gupta/Bostrom 2009). Thus, learning happens when a learner changes his (or her) behavior which can be triggered by immediate or delayed feedback or by controlling learners (Gupta/Bostrom 2009; Kettanurak/Ramamurthy/Haseman 2001). The cognitive perspective claims that learning determines in a process that represents reality (Jonassen 1991; Kettanurak/Ramamurthy/Haseman 2001). It describes what and how learning happens in terms of knowledge effectiveness and efficiency that can be addressed by questions

(Kettanurak/Ramamurthy/Haseman 2001). Such questions have a predefined learning goal but the process of information cognition is up to the learner (Winn/Snyder 2001). Finally, constructivists assume that learning happens when learners solve a realistic problem and they focus on how to make learning more productive by for example working with personal experiences or discovery-based learning (Kettanurak/Ramamurthy/Haseman 2001; Gupta/Bostrom 2009). Constructivist approaches do not only need cognitive tools but also constructive ones and a cognitive perspective (Jonassen 1991). With this perspective learners are provided with all necessary information, but they have to find their own way to solve a problem (Duffy/Cunningham 2001).

2.2.2 Gamification in Technology-mediated Learning

Learning happens everywhere, every time, in groups, or alone. Learning is of relevance for private as well as work-life. For some areas it might be more relevant (universities) than for other. However, learning happens all around. The increasing number of interdisciplinary learning programs leads to different kinds of learning situations that can be handled more effectively by using gamification (Urh/Vukovic/Jereb 2015). In addition, it is still challenging to keep learners motivated in continuing with learning and to construct meaningful learning material (Christy/Fox 2014). One solution might be the consideration of gamification, the relevance of which can be observed in the immense market growth of gamification. It is expected that the global gamification market will grow up to USD 11.10 billion by 2020 (it was 1.65 billion in 2015) (Dobeco 2016). In addition, companies argue that changing learning experiences is about improving the experience of learners (Dobeco 2016).

At this point, it should be discussed how gamification can influence or even change learning behavior. Gamifying learning has two purposes (Ibánez/Di-Serio/Delgado-Kloos 2014). The first is to encourage desired learning behavior. The second is to engage the users in learning by the use of learning materials such as tutorials or digital documents. Therefore, engagement has been proven to be positively correlated with the outcomes of user success, such as user satisfaction and academic achievements (Ibánez/Di-Serio/Delgado-Kloos 2014). Accordingly, gamification increases the motivation of users by providing different gamification elements, by making an activity or task more fun and engaging, and by encouraging exchange between users. Motivation is also relevant for learning. Motivation is a part of the human dimension and is bound to individuals (see section 2.1.1 for more details). Motivation of individuals on the other hand is important to influence the learning process and to make a learning process more appealing to learners proving them with a good learning experience (Gupta/Bostrom 2009). Being motivated leads to a better learning process which can result in better learning outcomes. Thus, gamification can support learners in experiencing a learning process to be more fun and entertaining so that they keep learning and, thus, perform better. With this view in mind, gamification should be connected to the learning process and gamification elements should be adapted to a learning process to make it more meaningful.

Although gamification has been proven as effective concept to support learners in achieving better learning outcomes, some challenges remain that need to be further addressed by research (see section 1.1 about research challenges). In gamified learning, literature is lacking research that connects gamification elements to types of learning and less is known about which elements can lead to which kind of learning outcomes (Wilson et al. 2009). Research in the context of gamification and learning highlights that we need to get a better understanding about single gamification elements and their combinations (Wilson et al. 2009). However, such a detailed analysis of gamification elements requires a shared understanding about gamification element characteristics and a set of terms that is common to all gamification concepts. In addition, there are contrary results about the effectiveness of gamified learning which requires an exploration of the process by which gamification improves learning (Landers 2015). It needs to be learned more about what sets apart good gamification designs from poor ones is of general interest in research (Liu/Santhanam/Webster 2017). More precisely, the effects of gamification elements on motivational and behavioral outcomes still need to be analyzed in more detail, because the success of gamification concepts depends on how a gamification concept is designed (Sailer/Homner 2019). Using competitive elements in learning can be risky and difficult because users react different towards competitive gamification elements (Santhanam/Liu/Milton-Shen 2016; Schöbel/Söllner 2016). Studies about gamification and learning explain that we do not know the relationship between gamification elements and learning and we must understand what the mediating variables are (Wilson et al. 2009). The study from Wilson was conducted in 2009. Although research about gamification has further developed there is still criticism about the concept of gamification in relation to the effects that are caused by gamification which makes it necessary to empirically explore the effects of gamification in more detail (Seaborn/Fels 2015). All these aspects are part of this dissertation and are answered in section 4, 5, 6, 7, and 8.

3 Philosophical and Methodological Background

"Knowledge is produced by people, for people, and is about people and their social and physical environment."
(Chua 1986, 603)

IS research is not based on an overarching theoretical perspective, rather, there are two different beliefs about knowledge (Orlikowski/Baroudi 1991). One is the philosophical belief that is represented by epistemology (Chua 1986). The other is a methodological viewpoint on science. Both, methodological and philosophical beliefs, lead researchers and readers in a general direction of where instances about a particular kind of inquiry can be located (Schwandt 1998, 221). They are used to understand the world we live in and the people that constitute, build, and interpret this world (Chua 1986). To ground this dissertation, I present different epistemologies as well as methodological perspectives. For the methodological background, I derive the overall idea of different kinds of research streams and explain some existing methods in more detail. There are many different methods in IS research that are not all be part of this dissertation. However, this dissertation is grounded on a mixed-methods approach that makes it necessary to explain the used methods and their philosophical grounding in more detail.

3.1 Research Epistemologies and Philosophical Consideration

Epistemologies can be defined as "criteria for constructing and evaluating knowledge" (Orlikowski/Baroudi 1991, 8). In other words, it can be stated that "Epistemological assumptions decide what is to count as acceptable truth by specifying the criteria and process of assessing truth claims" (Chua 1986, 604). There are three prominent and often used epistemologies in IS research: positivism, interpretivism, and critical perspectives (Orlikowski/Baroudi 1991). Especially positivism seems to be very prominent in IS research (Orlikowski/Baroudi 1991). However, in the last decades interpretivism has also become important and relevant for IS research (Walsham 2006). These three epistemologies are not the only existing epistemologies. Another one that I want to outline in this dissertation is pragmatism which has become more important for research that aims to create knowledge by explanation and prediction (Goldkuhl 2012). To get a better understanding about each of the four epistemologies I now start by defining each of them and continue to compare them to get a better understanding about their differences and similarities. In addition, this section is important to better understand the relevance of each study of this dissertation later on.

3.1.1 Conceptualization of Research Epistemologies

Positivistic researchers assume that a priori fixed relationships exist in a phenomenon of interest (Orlikowski/Baroudi 1991). Positivists focus on getting knowledge out of hypotheses testing or quantifiable measures because they allow for an amount of control over the collection and analysis of data (Orlikowski/Baroudi 1991). They further aim to explain the external reality and other than pragmatists and interpretivists they assume that people – the ones that normally produce knowledge – are not part of actively creating reality (Lincoln/Guba 1985). They assume that reality is separate from individuals and that subject and object are two different things, whereby the object is independent of researchers (Weber 2004). Positivists belief that a statement is only true if there is a one-to-one relationship to the reality (Weber 2004).

Having an interpretative view on phenomena is about the understanding that knowledge is created by individuals and their subjective and intersubjective meaning (Orlikowski/Baroudi 1991). Interpretative researchers try to better understand the meaning that individuals assign to a phenomenon and assume that reality and knowledge are kind of social products (Orlikowski/Baroudi 1991). In this light it is not possible to separate reality and individuals because an individual's knowledge reflects their goals, history, culture etc. (Weber 2004). This epistemology is oftentimes used in combination with qualitative research methods and aims to interpret and understand a phenomenon of interest (Goldkuhl 2012). Whereas positivists have a fixed set of variables, interpretivist create a holistic understanding about a research area (Goldkuhl 2012).

Pragmatism seems to be closely related to interpretivism. Pragmatism is concerned with action and change and tries to understand the relationship between knowledge and action (Goldkuhl 2012). Action is about changing existing conditions is guided by purpose and knowledge (Goldkuhl 2012). Pragmatism is not only interested in what might be but also in what is, so it tries to create a new, not yet realized world to support individuals and acts as a kind of problem-solving philosophy (Goldkuhl 2012; Farjoun/Ansell/Boin 2015). Focused on the individual's actions, pragmatists try to explain how their actions form new environments and tries to understand how a phenomenon at one level can affect a phenomenon at another level (Farjoun/Ansell/Boin 2015). Pragmatists see a world that comprise several processes rather than seeing things as final products (Farjoun/Ansell/Boin 2015). Also pragmatist researchers think of empirical evidences and explanations as being inseparable (Behfar/Okhuysen 2018). To better understand pragmatism (and also interpretivism and positivism), it is useful to look on the kind of reasoning that is used for pragmatism. Pragmatism is closely connected to the reasoning of abduction (Behfar/Okhuysen 2018). Besides abduction, there is also the mode of deduction and induction. Table 10 specifies all three kinds of reasoning.

Abduction	**Deduction**	**Induction**
Moves from observations in specific situations to an explanation	*Moves from premises to a conclusion by following the premises and rules of logic*	*Moves from specific observations to a general theory*
1. Result: This bird has yellow feathers	1. Rule: All feathers in this box are yellow	1. Case: The bird in this box is yellow
2. Rule: All feathers in this box are yellow	2. Case: The bird in this box is yellow	2. Result: The bird has yellow feathers
3. Case: The bird is in a box	3. Result: The bird has yellow feathers	3. Rule: All feathers in this box are yellow
Positivism, pragmatism	Positivism, pragmatism	Interpretivism

Table 10: Comparing Abduction, Deduction, Induction
Source: Own Illustration

Whereas abductive reasoning elaborates different degrees of novelty in reasoning and different motivating sensory, deductive reasoning moves from a general assumption to a specific prediction and inductive reasoning from specific cases to general assumptions (Behfar/Okhuysen 2018). One can say that abductive reasoning starts with having a result, then deriving a rule out of it and finally modulating the case. This is different to deduction, that starts with a rule, and induction, that begins with a case (see Table 10). Pragmatism is based on abductive reasoning and making the world better by action and change (Behfar/Okhuysen 2018). The same can be said about positivism (Behfar/Okhuysen 2018). Positivist research also relies on deduction as reasoning (Orlikowski/Baroudi 1991). The last belief about knowledge left is the critical philosophy, which might be covered in all three kinds of reasoning. A critical researcher exposes hidden contradictions and attempts to reframe a phenomenon, that oftentimes tends to be covered by longitudinal studies (Orlikowski/Baroudi 1991). As critical researchers assume that a phenomenon has a historic component, they want to explain what it is becoming (or what not) as well as to analyze was it has been (Chua 1986). Critical research does not treat elements as isolated components; it tries to create awareness and an understanding of social domination (Orlikowski/Baroudi 1991).

Researchers that compare these different epistemologies against each other often concentrate on comparing positivism with interpretivism (Weber 2004) or pragmatism with interpretivism (Goldkuhl 2012). Although critical researchers believe that interpretation of a phenomenon is not enough, the roots of critical argumentations can be located in interpretivism and it can be seen as a viable separate tradition in IS (Orlikowski/Baroudi 1991; Goldkuhl 2012). There are four different forms of interpretivism: conservative, constructivist, critical, and deconstructionist. As indicated critical epistemologies are grounded in longitudinal studies. This dissertation, however, does not focus on any longitudinal studies which is why I will not outline the critical approach in more detail. Positivism, pragmatism, and interpretivism are part of this dissertation which is why I now compare these three epistemologies.

Differentiation Criteria	Positivism	Interpretivism	Pragmatism
Empirical focus	Data and constructs	Beliefs	Action and change
Ontology	Object – Researcher and reality are separated	Subject – Researcher and real world are inseparable	Object and subject – Researcher, reality, and real world are inseparable
Method	Typically, quantitative such as surveys or experiments	Typically, qualitative such as interviews or case studies	Field study which can be qualitative and/or quantitative
Truth of theory	One to one mapping between research statement and reality	Interpretation matched lived experience	Action and change constitute new or even better reality
Type of knowledge	Explaining and predicting	Understanding	Constructing
Role of researcher	Engaged in explaining	Engaged in understanding	Engaged in change
Validity	Data means reality	Defensible knowledge	Improve knowledge by data and defensible knowledge
Reliability	Research results can be reproduced	Implications for subjectivity	Research results can be reproduced and deliver implications
Reasoning	Abductive and deductive	Inductive	Abductive, deductive, inductive

Table 11: Comparing Pragmatism, Positivism, and Interpretivism
Source: Goldkuhl (2012, 142), Weber (2004, IV)

An observation that can be made when comparing positivism, pragmatism, and interpretivism is that pragmativism as well as positivism are oftentimes compared to interpretivism (Goldkuhl 2012). The connection obviously seems to be grounded in interpretivism. To compare positivism, interpretivism, and pragmatism, I refer to the work of Weber (2004) and Goldkuhl (2012), the results of which can be seen in Table 11. Some of the aspects presented in Table 11 were already part of the general discussion about positivism, pragmatism, and interpretivism. Some further characteristics help to better understand the differences between them. First, pragmatism is embedded in action and change (Farjoun/Ansell/Boin 2015). It differs from positivism as it does not only analyze given data but changes something if it is an artifact or if it is developing new guidelines. Compared to interpretivism, it tries to understand why something needs to change and in addition acts to really change it. Second, pragmatism combines object and subject, whereas positivism and interpretivism address just one of them. Third, pragmatism can be identified in both qualitative and quantitative data and is about constructing and not about understanding (interpretivism) or explaining and predicting (positivism). Fourth, validity as well as reliability are both needed to assure adequate measurements of a phenomenon of interest (Bhattacherjee 2012). Both aspects that are relevant for positivism and interpretivism are relevant for pragmatism because it is based on both quantitative and qualitative measurements. Finally, positivism, interpretivism and pragmatism can be separated by looking at different ways of reasoning that were already introduced earlier in this section.

3.1.2 Concluding Thoughts

Comparing positivism, pragmatism, and interpretivism reveals that they cannot be separated per se and that there are some overlaps such as the fact that pragmatists works with qualitative as well as quantitative data. In addition, some studies may be grounded on a mixed method approach and thus combine a positivistic with a pragmatic view. Having interpretative data is not per se bound to qualitative approaches (Bhattacherjee 2012). Positivism, interpretivism, and pragmatism are somehow philosophical concepts that support researchers in finding the right language and argumentation for the data they have collected. They can guide them in better grounding their thoughts, results, and clues. They are connected to the method that is used for a study and deliver directions about how to work with the collected data and to better understand "what is," "what might be," "what might not be," and "what could be." On the other hand, they can serve as a starting point to verify why a study is necessary and relevant and can determine the underlying method that supports a pragmatic, positivistic, and interpretative logic. All directions are embedded in my dissertation. The methods I decided for were selected because of the underlying problem statement which is somehow bound to some positivistic, pragmatic, or interpretative argumentation.

With a pragmatic view I present the results of a literature review in section 4 that is used to derive a taxonomy of gamification elements. I also use a qualitative expert interview study and a case study validation for this study to evaluate the developed taxonomy and to demonstrate its usefulness for practice and theory. This indicates that at some point there are some overlaps between pragmatism and interpretivism. Especially the interviews reflect an interpretative viewpoint. Section 5 is used to get a better understanding about the elements of gamification. This section is grounded in a quantitative and positivistic measurement to analyze user preferences towards gamification elements in learning. These insights are then used for section 6 and 7 that work with specific elements and their designs having a positivistic and interpretative viewpoint to understand and explain how gamification in learning is related to specific constructs such as engagement. Finally, in section 8, I use the results from a systematic literature review to derive general implications about how to act more user-centered when developing gamification concepts. This section has an interpretative undertone because I try to find a better way to support researchers and practitioners in creating more user-centered gamification concepts for ISs. With the different philosophical understanding I now continue by describing the methodological viewpoints that are important for this dissertation.

3.2 Literature Reviews

"An effective review creates a firm foundation for advancing knowledge. It facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed."
(Webster/Watson 2002, xiii)

The goal of literature reviews is to summarize prior research, examine contributions of past research with a critical lens, explain the results of found research results, and make room for alterative views on a phenomenon (Schwarz et al. 2007). Literature reviews support researchers in finding a research purpose, they guide the development of hypotheses and relationship between constructs and can be used for the analysis and understanding of data (Leavy 2017). Therefore, theories and literature reviews are essential for every type of research study (Vom Brocke et al. 2015). To define literature reviews, I refer to Rowe (2014, 243) who defines them as follows: "a literature review synthesizes past knowledge on a topic or domain of interest, identifies important biases and knowledge gaps in the literature and purposes corresponding future research directions." There are certain criteria to judge about the quality of a literature review. A literature review of a good quality is complete and focusses on concepts (Webster/Watson 2002). A complete review does not only focus on one set of journals or on one research methodology; instead, it covers a brought set of publications (journals and conferences) and also considers various viewpoints of different topics of interests such as a method (Webster/Watson 2002). To guarantee that all relevant literature is covered, it is useful to use guidelines as orientation that support a researcher in finding all existing studies that he or she needs for their research study.

A literature review can have two different purposes and can be conducted in two different ways. A background paper has the purpose to support empirical papers such as surveys that need an explanation of their used variables (Vom Brocke et al. 2015). A standalone review is about processing existing literature under the light of a different purpose (Vom Brocke et al. 2015). Literature reviews can be conducted either as narrative reviews or as systematic ones (Collins/Fauser 2005). A narrative review is used to describe the experiences of reviewers in a specific field or about a phenomenon whereas a systematic one is a structured process of identifying, evaluating, and synthesizing research (Kitchenham et al. 2009; Vom Brocke et al. 2015). The systematic literature review can be defined as "a systemic, explicit, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by research scholars, and practitioners" (Fink 2010, 3).

The *first step* of a literature review is to determine the goal of the literature review that can be in some part found in the RQ and that clarifies the search process (Cooper 1988; Fink 2010; Vom Brocke et al. 2015). From my point of view, the goal in connection to the research question depends on the kind of review one conducts. A narrative review is used for a survey or the derivation of hypotheses, parts of the goal can be identified in a research question. In section 6, I present the results of an experiment. I used the insights from existing literature to learn more about the constructs of engagement, motivation, satisfaction with the learning process, and engagement, which are also reflected in the research question. Having a standalone review puts the literature review and the research question in the centre of the literature search and analysis (like, for example, in section 8 of this dissertation, where I used a systematic literature review to identify methods that are used to gamify ISs). In summary, the goal is an important first step of the literature review. The goal is also important to decide about the process of the literature review which is either sequential (such a literature review is a step at the beginning of the overall process of reviewing) or iterative (searching for relevant literature in a continuous process) (Vom Brocke et al. 2015).

The *second* and *third step* is about the identification of relevant studies. Again, the choice of the sources depends on the goal of the literature review (Vom Brocke et al. 2015). However, to cover the full range of relevant publications, it is important to not only focus on journals but also on conference publications (Webster and Watson 2002). For some studies, like a meta-analysis that can be grounded on literature, it is even important to cover unpublished work to avoid publication bias (Peters et al. 2006).

Sources can be either citation indexes, publications, or bibliographic databases (Vom Brocke et al. 2015). This dissertation focusses on the IS community and literature reviews in IS should typically involve databases such as JSTOR, IEEE, ScienceDirect, ACM, or GoogleScholar that provide an overview on not only IS related work. But not only the sources determine where to search and how to search for literature. The coverage of a literature review can be considered by having a comprehensive review (covering all relevant studies), a representative review, or seminal works that narrow down the number to a limited amount of studies. Finally, the keywords that are relevant for the third step should be selected as technique as well as the possibility of a forward and a backward search (Vom Brocke et al. 2015). Going backward is about reviewing the citations of a paper and going forward is about making a "web of science" search (Robey/Boudreau/Rose 2000). Looking at techniques, so-called "landmark studies" that typically are well-known studies in an area of interest should be considered as well (Leavy 2017). In gamification, the authors Juho Hamari and Sebastian Deterding are well-known and oftentimes cited in studies about gamification. Their work should be considered when conducting a literature review about gamification.

For the keyword search, it is important to identify the correct research term and fields (Vom Brocke et al. 2015). For the terms, Boolean operators such as "AND" or "OR" should be used in combination with the most important keywords that match the predefined goal of the literature review (Vom Brocke et al. 2015). If I would like to have a list of papers that work with gamification elements, the most obvious combination of keywords would be "gamification elements," which would probably deliver too many relevant papers. Therefore, the keywords should be narrowed down to a suitable and logical combination of the most relevant terms which can be quite difficult (Vom Brocke et al. 2015). For the search field, a typical tile, keywords, abstracts of the full text is considered (Vom Brocke et al. 2015).

The *fourth step* is about the decision to include or exclude identified studies for the final analysis. Criteria for the inclusion or exclusion of studies could be the type of source, discipline, or even the period (Rowe 2014). Typical practical criteria could be the language or the setting of the study (Rowe 2014). Methodological aspects could be the adequacy of the study coverage and scientific quality (Rowe 2014).

The *last two steps* are about the analysis of the relevant papers. This is also covered by synthesizing the studies. Synthesizing is probably the most important part of the review and is about describing the global perspective that is covered along all studies (Okoli 2015). This again is important when we look at the goal of a literature review and, in line with this, at the contribution to theory that is going to be made by a literature review.

3.3 Qualitative Research

"Qualitative methods are strategies of empirical inquiry that investigate phenomena within a real-life context. They are helpful especially when the boundaries between phenomena and context are not apparent, or when you want to study a particular phenomenon in depth."

(Recker 2013, 88)

Qualitative research often is referred to as the contrast to quantitative research. The latter is concerned with gathering data that can be put in numbers to predict and establish laws of human behavior. It follows the perspective of an objective, a priori reality (Yilmaz 2013). Qualitative research has become more and more important and accepted in the discipline of IS research (Sarker et al. 2018). In this section I first discuss the term of qualitative research and then present different kinds of qualitative research methods.

3.3.1 Conceptualization of Qualitative Research

Qualitative Research has a long history. Starting from over a century ago in the fields of anthropology and sociology, it keeps evolving continuously as more methods get developed and its scope gets expanded. While still mostly used in the social sciences, we can see a trend of using qualitative research more and more in digital and social media research (Flick 2018). It can be defined as "an emergent, inductive, interpretive, and naturalistic approach to the study of people, cases, phenomena, social situations and processes in their natural settings in order to reveal in descriptive terms the meaning that people attach to their experiences in the world" (Yilmaz 2013, 312). Qualitative research tries to explore the motivation behind human behavior and the context through which this behavior emerges. In this scope, variables are plentiful and interwoven and, consequently too complex to measure them on their own. Qualitative research is based on an interpretive or constructivist perspective (Merriam/Grenier 2019, 4). This point of view follows the idea that the objective reality, while existing, is incomprehensible by science and the human mind, since it can only be grasped through the lens and bias of the human perspective. Qualitative research can have six different claims (Sarker et al. 2018). The first one is about searching for the truth or original cause of something (Hirsch 1967). The second one is about developing a better understanding about a phenomenon that has not been fully understood in the past (Walsham/Sahay 1999). The third claim is about generating new and novel ideas by abstracting them (Walsham 1995). Fourth, qualitative research can claim to develop a universal understanding about a phenomena (Miles et al. 1994). Lastly, it can claim to seek to represent the view of a group of people or can try to capture the experiences of individuals (Gubrium/Holstein 1997; Schweizer 2014).

There are three different sources of qualitative data: researcher-provoked data, user-generated data, and naturally occurring data (Sarker et al. 2018). Researcher-provoked data exists because of the researcher's initiation (such as conducting an interview), user-generated data is for example available through digital data, and naturally occurring data is, for example, formed by two individuals that talk to each other (Sarker et al. 2018). Qualitative research studies can have a deductive (abductive) and/or inductive reasoning. As described in section 3.1.1., deductive reasoning moves from premises to a conclusion, and inductive moves from observations to general theories. Sarker et al. (2018) add polyphonic strategies to this list, that consider different subjects with different perspectives and interpretation. Mapping deductive with inductive reasoning and comparing it with data-centric versus interpretation-centric data delivers different sources of qualitative research that can be seen in Figure 7.

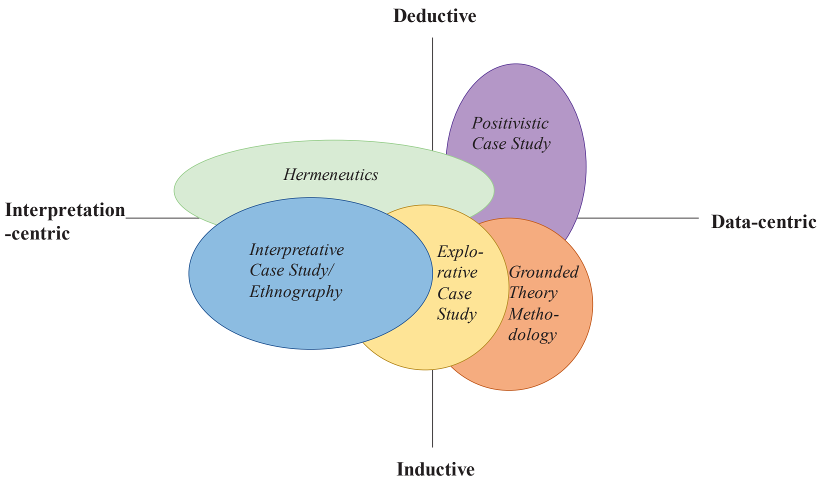


Figure 7: **Genres of Qualitative Research**
Source: Sarker et al. (2018, 762)

Sarker et al. (2018) demonstrate that case studies are an important genre of qualitative research. This dissertation uses a positivistic case study in section 4 to demonstrate the usefulness of a taxonomy that I have developed. The other genres are not a part of this dissertation, but I briefly discuss them and focus on case studies. Hermeneutics are about interpreting texts and text analogues by using epistemological insights and an interpretative approach by which an individual can comprehend parts of a text in terms of the whole and vice versa (Sarker et al. 2018). Grounded theory is about using mostly coded data to construct a conceptually dense theory (Sarker et al. 2018).

All other genres reflect different kinds of a case study. In general, a case study is about using intensive research on a case in its natural surroundings in a specific time frame (Recker 2013). They are used for theory testing as well as theory building (Recker 2013). Case studies follow a linear and iterative logic considering a plan, design, preparation, collection, analysis, and sharing as components of a case study (Recker 2013). Preparing a case study involves the formulation of an adequate research questions that guides the collection phase that can consist of multiple sources (Recker 2013). The data analysis is then about examining, coding, categorizing, or testing collected data and sharing is about spreading the results with an interested audience (Recker 2013). There are three different genres of case studies (Sarker et al. 2018). In a positivist case study, the argumentation is closely related to positivism and treating case study data as representative facts (Sarker et al. 2018). An exploratory case study is about treating data as representative facts that support in reconstructing events (Yin 2003). An interpretive case study or ethnography has a wide range of data and analysis (Sarker et al. 2018). Having an interpretative case study includes data and an analysis varies from the representation of reality to a more impressionist strand (Sarker et al. 2018). There are many different philosophical views on what qualitative research should be. This can be better understood when comparing those of qualitative to quantitative method (Lincoln/Guba 1985). Qualitative and quantitative terms are compared in Table 12.

Aspect	Qualitative terms	Quantitative terms
Truth value	Internal validity	Credibility
Applicability	External validity or generatability	Transferability
Consistency	Reliability	Dependability
Neutrality	Objectivity	Confirmability

Table 12: Criteria for Qualitative and Quantitative Research
Source: Yilmaz (2013, 314)

In qualitative research, it is very hard to pinpoint an exact standard that can be followed point by point in order to construct a sound, scientific study, although many can agree upon four criteria proposed by Lincoln and Guba: *credibility, transferability, dependability and confirmability* (Lincoln 2007). *Credibility* (or sometimes referred to as internal validity) refers to “How congruent are one´s findings with reality?” (Merriam/Grenier 2019, 25). It is achieved if the results of a study are found to be correlating with the actual findings of the study. Therefore, data and information gathered is processed and interpreted correctly. Literature lists numerous methods of achieving credibility. A very common technique is called triangulation, which lists up to four methods that can be applied to validate findings. These can be multiple investigators, multiple theories, multiple sets of data or multiple methods of conforming emerging findings (Merriam/Grenier 2019). Other methods of establishing credibility include peer reviews, member checks, random sampling and many more. To judge the quality in terms of credibility, different questions can be considered such as “How context-rich and detailed are the basic descriptions?” (Miles et al. 1994, 278,279).

Transferability means the degree to which results collected from one study can be translated to a different setting with different participants. How much of this can be achieved is a debated topic since the aim of qualitative research is exactly not to generalize and to see every information gathered as context dependent. In order to make transferability possible, albeit to a limited degree, researchers should provide enough content and context to their research findings. Of course, this can create the problem that which information the researcher deems important might differ from what the audience perceives as necessary information (Shenton 2004). Shenton (2004) summarized a list of information that should be given in order to achieve a general transferability (Shenton 2004, 70):

a. number of organizations taking part in the study and where they are located;

b. restrictions in the type of people who contributed data;

c. number of participants involved in the study;

d. data collection methods that were used;

e. number and length of the data collection sessions;

f. time period of data collection.

Dependability or reliability describes to which extend a researcher's findings can be replicated in another setting (Merriam/Grenier 2019). Thus, if the experiment would be replicated step by step, similar results should be obtained. Again, this can be hard to achieve due to the context-based nature of qualitative research. Some of the same methods that can be used for gaining credibility can enhance reliability, including triangulation, peer reviews, investigators position, and audit trail (Merriam/Grenier 2019). It helps to include data about the research design and its implementation, the operational detail of data gathering, and an evaluation of the effectiveness of the process taken (Shenton, 2004). Lincoln and Guba (2007) describe this process as dependability audit. Similar to credibility, a bunch of different questions can be used to better judge about the quality such as "Are research questions clearly defined and the features of the study design congruent with them?" (Miles et al. 1994, 278,279).

Confirmability mainly deals with the issue of objectivity; researchers bias and its effect on the outcomes of a study. Ideally a researcher should be objective and factual but since this is, especially under the constructivist view, impossible, a researcher should at least know about his biases and lay those open as much as possible in his report. A lot of publications also deal with this issue under the name of "the researcher as instrument" as cited by Chenail (2011, 256): "The researcher as instrument can be the greatest threat to trustworthiness in qualitative research if time is not spend on preparation of the field, reflexivity of the researcher, the researcher staying humble and preferring to work in teams so that triangulation and peer evaluation can take place." (Chenail 2011 after Poggenpoel/Myburgh 2003).

3.3.2 Data Collection in Qualitative Research

Qualitative research covers a wide range of methods and approaches in line with many different genres that exist (Yilmaz 2013; Sarker et al. 2018). To collect qualitative data, different techniques can be used. A typical way of data collection in qualitative research is to conduct interviews. In this dissertation, interviews are used in section 4 for the evaluation of a taxonomy that I developed. Therefore, I focus on interviews in this section and briefly describe the other options of collecting data in qualitative research. Using interviews for the collection of data has become an accepted way in IS research (Schultze/Avital 2011). Interviews engage individuals in an active conversation with a researcher (interviewer) (Schultze/Avital 2011). With an interview, a researcher typically tries to better understand the life around individuals and how they feel, live, and make sense of things going on in their life (Schwandt 2001). More precisely, interviews are about exchanging the views between a researcher and an interviewee as they talk about a topic of common interest which differentiates qualitative research from other research disciplines (Schultze/Avital 2011). Interviews are based on a socially and linguistically complex human interaction considering not only active listening but also engagement of the researcher (Schultze/Avital 2011). Interviews can happen in different settings such as face-to-face (interviewer with interviewee) or one-to-many (interviewer with a group of interviewees), which can be conducted in person or via phone (Recker 2013). Having involved more than two interviewees is described as a focus group (Recker 2013). Interviews can be either explorative, descriptive, or explanatory (Recker 2013). With descriptive interviews, researchers get a rich understanding about a phenomenon and how it is perceived by individuals (Recker 2013). Exploratory interviews are typically used to derive propositions or hypotheses in relation to an observed relationship (Recker 2013). Finally, explanatory interviews are often used in causal studies to detect relationships between constructs (Recker 2013). Most interviews have a so-called semi-structured nature that is based on an interview protocol that is in turn based on different questions ranging from more general ones to more specific questions (Recker 2013). No matter which kind of interview technique is used, interviews result in having an oftentimes long list of transcripts that can be analyzed in different ways such as the qualitative content analysis of Mayring (2014). Another qualitative data collection technique is an observation (direct or participant observation) where researcher typically observe individuals in a situation and document their observations (Recker 2013). Another way is the documentation were all kinds of documents such as emails, documents or even music are analyzed (Recker 2013). Finally, all these kinds of data collection techniques can be combined under the light of so-called triangulation (Recker 2013) which is just about doing more than one kind of qualitative data collection.

This dissertation is based on a mixed methods approach that does not only involve quantitative research but also qualitative research. Qualitative research is a rather small component of this dissertation that can be found in section 4 where I use interviews to evaluate the gamification taxonomy that I have developed. However, I think that qualitative research is important to understand the role of interviews that were conducted in section 4. This dissertation uses some quantitative methods that are presented in the next section. I think the results of the quantitative studies, and even more the results from the literature analysis (presented in section 8), offer room for future qualitative analyses for example to better explain the results in the quantitative studies (section

5,6,7) or to develop a new gamification method based on the analysis of existing methods (section 8). In addition, I have conducted an analysis that also involves part of a qualitative understanding about data (described in section 3.5). In the following, I describe the role of quantitative research as counterpart to qualitative research.

3.4 Quantitative Methods

"In the everyday sense of the term, humans have been experimenting with different ways of doing things from the earliest moments of their history. Such experimenting is as natural a part of our life as trying a new recipe or a different way of starting campfires."

(Shadish/Cook/Campbell 2002, 1)

Quantitative research oftentimes is handled as the counterpart of qualitative research. Their differences can be explained by their epistemological focus.

	Quantitative	Qualitative
Assumptions	• Reality is single, tangible, and fragmentable • Social facts have an objective reality • Knower and known are independent, a dualism • Primacy of method • Variables can be identified and relationships measured • Inquiry is objective, value free	• Realities are multiple, constructed, and holistic • Reality is socially constructed • Knower and known are interactive, inseparable • Primacy of subject matter • Variables are complex, interwoven, and difficult to measure • Inquiry is subjective, value-bound
Purposes	• Generalizability • Predication • Causal explanations	• Contextualization • Interpretation • Understanding actors perspective
Approach	• Begins with hypotheses and theories • Manipulation and control • Uses formal, structured instruments • Experimentation and intervention • Deductive • Component analysis • Seeks consensus, the norm • Reduces data to numerical indices • Abstract language in write-up	• Ends with hypotheses or grounded theory • Emergence and portrayal • Researcher as the instrument • Naturalistic or nonintervention • Inductive • Search for patterns • Seeks pluralism, complexity • Makes minor use of numerical indices • Descriptive write-up
Researcher Role	• Detachment and impartiality • Objective portrayal • Etic (outsider's point of view)	• Personal involvement and partiality • Empathic understanding • Emic (insider's point of view)

Figure 8: Comparing Qualitative and Quantitative Research
Source: Yilmaz (2013, 314)

In section 3.1., I described that quantitative research has a positivistic view whereas qualitative research typically has an interpretative view on research. Getting a better understanding about how qualitative and quantitative research differ (besides their epistemological orientation) can be achieved by looking at how they differ in their assumptions, purposes, research approaches, and the researcher's role. This work has been done by Yilmaz (2013) under consideration of Glesne and Peshkins (1991) and Lincoln and Guba's (1985) work and can be seen in Figure 8. With these differences in mind, I now take a deeper look on quantitative research and ways of how to conduct quantitative research.

3.4.1 Conceptualization of Quantitative Research

As presented in the previous section, quantitative research differs from qualitative research. Quantitative research methods focus on quantities and thus on values that represent values a researcher uses to generalize data (Recker 2013). One important aspect of quantitative research is to focus on measurements which can be derived from empirical observations and mathematical expressions gathered from quantitative and observed relationships (Recker 2013). With a broader view quantitative research can be classified as empirical research of a social phenomenon that is used to test variables of a theory (for example by derived hypotheses) that are analyzed with statistics to better explain a construct or an observed phenomenon (Creswell/Creswell 2017; Yilmaz 2013). Quantitative research measures and analyzes the relationship between different variables a researcher wants to observe (Yilmaz 2013). It is based on a priori theories, whereby researcher and the observed phenomenon are independent and, thus, reflects a positivistic view on data (Yilmaz 2013). With quantitative data, a researcher is able to generalize collected data and to transfer it to other areas (Yilmaz 2013).

Similar to qualitative research, validity and reliability of collected data are important to judge about quantitative data. However, they have a different role and meaning in quantitative research. In quantitative research, reliability and validity are used to avoid problems of shared meaning and accuracy (Recker 2013). Reliability is about the extent to which measured variables are consistent and intend to measure what they should measure (Recker 2013). If a researcher would repeat the same measurement again, it should deliver the same results as in the previous study (Yilmaz 2013). Reliability is about data, not measurement instruments (Yilmaz 2013). There are many different reliability tests for quantitative data such as Cronbach's alpha that measures the internal consistency of a construct (Straub/Boudreau/Gefen 2004) or inter-rater reliability that clarifies if and how similar the coding results of two or more coders are. Validity is about judging if collected data measures what a researcher wants to measure (Recker 2013). Validity is about the question whether the study measurement process is accurate or not (Yilmaz 2013). Different kinds of validity exist. Face validity is about whether an indicator is a reasonable measure of a construct (Recker 2013). Content validity describes whether a set of items of a construct matches with a domain for a construct (Recker 2013). Construct validity covers convergent validity and discriminant validity and describes the operationalization between constructs (Recker 2013). Discriminant validity" indicates the extent to which the measurement items posited to reflect of make up a construct differ from those that are not believed to make up the construct" (Recker 2013, 71). On the other hand, convergent validity indicates how well items reflect a construct (Recker 2013). Other kinds of validity such as the external validity that explains to what extend results can be generalized, exist (Recker 2013).

There are five different steps that are typically used to work with quantitative data:

1. generation of models, theories and hypotheses;
2. the development of instruments and methods for measurement;
3. collection of empirical data, sometimes through experimental control and manipulations of variables;
4. statistical modeling and/or other analysis of data;
5. evaluation of results (Recker 2013, 73).

Different ways of collecting quantitative data exist. For this dissertation experimental studies and surveys are of relevance. Experimental studies can be conducted in a lab or in the field, so they differ about where data is collected and what is and can be controlled in an experiment (Recker 2013). Another quantitative method is a survey that can, for example, be represented done by collecting data over a longer time period in what can be described as longitudinal surveys (Recker 2013). Because surveys as well as experiments are important for this dissertation, I describe them in the following.

3.4.2 Survey Study

For both surveys as well as experiments, two terms are important: dependent and independent variables. “Variables that explain other variables are called independent variables, those that are explained by other variables are dependent variables” (Bhattacherjee 2012, 12). In addition, moderating and mediating variables are of relevance. “Those that influence the relationship between independent and dependent variables are called moderating variables” (Bhattacherjee 2012, 12). A mediating variable also explains a dependent variable (Bhattacherjee 2012) (see section 3.4.4 about moderators, mediators, dependent, and independent variables and their relationships).

Other than experimental research, survey research does not need a manipulating independent variable(s) (Recker 2013). With a survey information about attitudes, characteristics, and options of a unit of analysis are observed by collecting a large number of data by using questionnaires (either online or offline), telephone interviews, or other published statistics (Bhattacherjee 2012; Recker 2013). In section 5, I use a survey to analyze user preferences of learners towards gamification elements. Therefore, an online survey is used to collect data from learners. The results of a survey are typically analyzed by statistical techniques or other quantitative approaches (Recker 2013); some of them that are relevant for this dissertation are going to be explained in more detail in the next sections. Survey methods are typically used to better understand what is happening and/or how and why something is happening (Recker 2013). Recker (2013) suggests seven different aspects to assure for a good quality of a survey. First, he suggests to present all relevant details about a survey to assist a reader of a publication to better understand how and why a survey was used. Second, the sample frame should be supported. In a third step, the characteristics of respondents should be reported. Fourth, the questionnaire should append and in a fifth step the validity and reliability of a survey should be considered. Finally, a pre-test should be made to refine the used instrument and the response rate should be reported.

Collected survey data can be analyzed in different ways by conducting a univariate analysis, a bivariate analysis or a multivariate analysis. A univariate analysis is about analyzing one single variable by referring to a frequency distribution, a central tendency, or dispersion whereas a bivariate analysis focusses on two variables (Bhattacherjee 2012). A multivariate analysis focusses on more than two variables (such as a structural equation model which is explained in section 3.4.4.2). In this dissertation, I used a survey for section 5. It contains a so-called Best-Worst scaling, whose data is collected with a survey. The method is described in more detail at the end of this section.

3.4.3 Experimental Study

Experiments can either be conducted in a laboratory (where a researcher can control every variable he wants to analyze) or in the field, for example, by conducting an online experiment where a researcher does not necessarily have control over what participants are doing in the experiment (Bhattacherjee 2012). Experiments are an important instrument to make a detailed analysis of different kinds of variables. The purpose of an experiment is to get a better understanding of how to change an independent variable causes a change in a dependent variable (Saunders/Lewis/Thornhill 2016). Experiments examine the cause and effect of relationships (Recker 2013).

When conducting experiments two groups are of relevance: control groups and treatment groups. The experimental group is used to test different manipulations whereas the control group remains with no interventions (or manipulations) (Saunders/Lewis/Thornhill 2016). Providing for a control and treatment group, a researcher is able to judge about the effectiveness of his manipulations (Recker 2013). An experiment is based on a theoretical construct that is developed by deriving hypotheses. By studying the literature and different theories in detail, a research is able to make predictions (hypotheses) and a researchers thus posits different relationships between variables that he is going to test in an experiment (Saunders/Lewis/Thornhill 2016). Different kinds of experiments exist that are demonstrated in Table 13 (Shadish/Cook/Campbell 2002, 12). For some experiments it is important to guarantee that participants are randomly assigned to different groups that are used in the experiment (Recker 2013). Having a quasi-experimental design, a random assignment of participants is not followed (Recker 2013).

Kind of Experiment	Description
Experiment	A study in which an intervention is deliberately introduced to observe its effects.
Randomized Experiment	An experiment in which units are assigned to receive the treatment or an alternative condition by a random process such as the toss of a coin or a table of random numbers.
Quasi Experiment	An experiment in which units are not assigned to conditions randomly.
Natural Experiment	Not really an experiment because the cause usually cannot be manipulated; a study that contrasts a naturally occurring event such as an earthquake with a comparison condition.
Correlation Study	Usually synonymous with nonexperimental or observational study; a study that simply observes the size and direction of a relationship among variables.

Table 13: Vocabulary of Experiments
Source: Shadish/Cook/Campbell (2002, 12)

In general, randomization is about drawing a sample of a population to guarantee that each individual of a population is likely to be randomly assigned to either the experimental or the control group (Bhattacherjee 2012). For some experiments, it is challenging to guarantee that a researcher can generalize its collected data. As indicated before, when using online experiments researchers have to make many precautions that start with a detailed analysis of literature to derive hypotheses (see section 3.2 about the relevance of literature reviews and literature in general). In addition, a researcher must decide how about to measure his different variables (or constructs). Therefore, controls that are used to ensure that the responses that were observed by a researcher are caused by the treatments manipulations and not some other confounding factors are very important (Recker 2013).

Data can be collected before the experiment (pretest) and/or afterwards (posttest) (Bhattacherjee 2012). Once an experiment is ready for data collection, it is useful to make a pretest where researchers can test their constructed experiment (Bhattacherjee 2012). Once all data have been collected, it is important to judge about internal and external validity (see Figure 8 about the comparison of qualitative and quantitative research). Internal validity, indicates to what extent findings of an experiment can be attributed to the interventions and not to any failures or mistakes that were made in the research design (Saunders/Lewis/Thornhill 2016). With a high external validity, results that can be generalized to other settings (Bhattacherjee 2012). In a laboratory experiment, external validity might be low because the experiment is not conducted in a real-world setting. In addition, reliability is important as well. To judge about the reliability of data in experiments, values such as Cronbach's Alpha can be used that analyzes internal reliability by indicating how well the items of a construct describe the construct and what was measured (Bhattacherjee 2012; Recker 2013). I talk in more detail about constructs and items in section 3.4.4.2.

The easiest form of conducting an experiment is using two groups: one treatment and one control group where a pre and/or post-test is also possible (Recker 2013). With a covariance experimental design, a dependent variable can be influenced by covariates (also called extraneous variables). Covariates are variables that "are not of central interest to an experimental study, but should nevertheless be controlled in an experimental design in order to eliminate their potential effect on the dependent variable and therefore allow for a more accurate detection of the effects of the independent variables of interest" (Bhattacherjee 2012, 86). In this kind of experiment, it is important to analyze their possible effects on a dependent variable to identify the true effect of a treatment that is manipulated in an experiment (Recker 2013). Finally, a factorial experimental design considers manipulating two independent variables (or treatments). The amount of variations is bound to the number of collected datasets. The higher the factorial design, the more data is needed to get valid and reliable data. Thus, factorial designs have a higher sample size requirement (Recker 2013). An overview about different experimental designs is presented in Figure 9.

True Experimental Designs

Two-group Posttest-only Design

R	T	O_{post} (Treatment group)
R		O_{post} (Control group)

Two-group Pretest-Posttest-only Design

R	O_{pre}	T	O_{post} (Treatment group)
R	O_{pre}		O_{post} (Control group)

Two-group Covariance Design

R	C	T	O_{post} (Treatment group)
R	C		O_{post} (Control group)

2x2 Mixed Factorial Design

R	T11	O_{post} (Group 1)
R	T12	O_{post} (Group 2)
R	T13	O_{post} (Group 3)
R	T14	O_{post} (Group 4)

Legend

R	Random Assigment
C	Covariate Measurement
T	Treatment Administration
O_{pre}	Pre-test Observation Measurements
O_{post}	Post-test Observation Measurements

Figure 9: **Experimental Designs**
Source: Recker (2013, 84)

In this dissertation I present the result of two experiments in section 6 and section 7. For the first experiment, I present the results of a two-group pre-post design experiment and the results of a 2x2x2 factorial design is selected for the second experiment. To analyze data of the two-group pre-post experiment, I use a structural equitation model (SEM). For the 2x2x2 experiment data I use a qualitative comparative analysis. Both are explained in more detail in the following sections.

3.4.4 Quantitative Data Analysis Methods

There are different ways to analyze quantitative data. Some of them, which I present in more detail in the following section are part of this dissertation. The first data analysis that is relevant for this dissertation is the so-called best-worst scaling (BWS), which is part of section 5. I also refer to a regression analysis which I also explain in the following. In section 6, I demonstrate the results of an experiment. This experiment was analyzed with a structural equitation model (SEM).

3.4.4.1 Best-Worst Scaling and Regression Analysis

One goal of this dissertation is to better understand the role of user preferences in gamification and learning (*RQ2*). With a positivistic view, different kinds of quantitative methods exist that can be used to explain user preferences.

A popular technique is conjoint analysis, which concentrates on combining a limited number of attributes (Green/Srinivasan 1990) and is often used in marketing, for example to evaluate the price or design of a product (Green/Srinivasan 1990). However, a conjoint analysis does not work well for a large number of attributes (seven or more) (Matzner et al. 2015). Another possibility of identifying user preferences for a large number of attributes is the self-explicated approach, which contains several methods such as ranking, rating, maximum difference scaling, or O-methodology (Matzner et al. 2015). In regular ranking mechanisms, respondents are asked to rank attributes from most attractive to least attractive (Cohen 2003). Hence, the resulting data is ranked ordinally. By using a rating measurement, respondents rate each item on a scale from, for example, 1 (least attractive) to 10 (most attractive) (Bacon 2003). Maximum difference scaling (MaxDiff) is a method for paired comparisons where participants have to choose a preferred attribute from a pair of attributes (Thurstone 1927). Finally, Q-methodology enables individual rankings for a factor analysis in order to reveal correlations between different kinds of profiles (Stephenson 1935).

Because there is a greater amount of methods that can be used to understand user preferences, I try to compare existing methods to find out which method is most suitable to compare different gamification elements in terms of user preferences. As indicated in section 1.2, I do not want to compare a bundle of elements but each gamification element individually, which is why conjoint analysis seems to be inappropriate as method. In addition, using simple ranking mechanisms seems not to be suitable because they suffer from potential order effects and a lack of ties and absolute scores (Cohen 2003). Simple rating mechanisms allow participants to rate every choice option equally high, which would not lead to usable results for analyzing user preferences of individual gamification elements because no preference differences are indeed reflected by their ratings (Matzner et al. 2015). Q-methodology, a method that is used in psychology and social sciences to rate how people think about a topic, is not suitable to analyze gamification elements either (Stephenson 1935). Thus, I decided to use a MaxDiff scaling and conducted a so-called discrete choice task. More precisely, a so-called BWS can be used to gain insights into users' preferences.

BWS was developed by Louviere and Woodworth (Louviere et al. 2013), and is an extension of the MaxDiff scaling by Thurstone (1927). BWS describes a cognitive process by which survey participants repeatedly choose two objects in varying sets of three or more objects that they feel exhibit the largest perceptual difference on a described continuum of interests (Finn/Louviere 1992). In comparison to other methods, BWS has several advantages. First, it provides a high level of ranking information because each decision for a pair of attributes provides implications for the attribute not chosen (Marley/Louviere 2005; Thiebes/Lins/Basten 2014). Furthermore, it is scale free, which prevents response styles and therefore does not affect the mean value and the variance obtained. Finally, other response biases can be avoided by using BWS (Lee/Soutar/Louviere 2007).

Overall, comparisons with other rating methods shows that BWS provides better results regarding the discrimination between different attributes (Lee/Soutar/Louviere 2007). BWS relies on a classic random utility choice model that is enhanced by two contrary choices options (Louviere et al. 2013). Overall, there are three different BWS cases. In the first case, respondents have to choose between attributes. In the second case, they have to choose between different attribute levels. And in the third, they have to choose between profiles of attributes that differ by attribute levels. As indicated by the name "best worst", a respondent has to choose the most and the least preferred attribute out of one choice set. By using observations obtained from all choices of every participant, preferences for each attribute (and/or level) can be calculated by using a scoring mechanism and a conditional logistic regression analysis.

A quantitative method that is closely related to a BWS and that is well-known in IS research is a regression analysis. The data provided by BWS is based on a so-called counting analysis, which can be further enriched by adding the results of a regression analysis (Lansing/Schneider/Sunyaev 2013). Marley and Louviere (2005) as well as Orme (2005) in their research studies argue that a regression analysis should lead to the same results as the counting approach. Thus, the BWS counting analysis provides results that are a close approximation of the results of a regression analysis (Lansing/Schneider/Sunyaev 2013). Thus, they can be used to verify the ranking results of the counting analysis.

In general, a regression analysis is used to collect information about the relationship between independent variables and a dependent (or sometimes called predictor) variable (Saunders/Lewis/Thornhill 2016; Mertens/Pugliese/Recker 2017). A regression analysis can be used for different purposes (Mertens/Pugliese/Recker 2017):

1. it can predict a dependent variable;
2. it can demonstrate if a set of independent variables has an impact on a dependent variable;
3. it can identify which independent variables are of relevance for a research mode;
4. it can determine how important different independent variables are for a dependent variable.

A regression analysis can be used to judge about the ranking positions of a BWS (Marley/Louviere 2005; Orme 2005). However, this depends on the kind of regression analysis that is used in a research study. Each kind of regression analysis has the same structure: (Bhattacherjee 2012):

$$y = \beta 0 + \beta 1x1 + \beta 2x2 + \beta 3x3 + \cdots + \beta nxn + e$$

ß0 and ß1 (and all following Beta values) describe the regression coefficients and the xi values describe the independent variables (or also control variables) (Mertens/Pugliese/Recker 2017; Bhattacherjee 2012). Regression analyses have different characteristics that are presented in Table 14.

Regression Model	Main Characteristic
"Normal" regression – *A "normal" regression is also referred to as just "regression" or as "Ordinary Least Squares" regression.*	One or more dependent variables that are continuous/scale variables. – *Single regression have one dependent variable, and multiple regressions describe cases that have multiple dependent variables*
Hierarchical regression	• One dependent variable that is a continuous/scale variable. • Multiple blocks with multiple independent variables that are continuous/scale variables.
Logistic regression	• One dependent variable that is a binary variable. • One or more independent variables that are continuous/scale variables.
Other complex regressions	• Multiple dependent variables that are continuous/scale variables. • One or more independent variables that are continuous/scale variables.

Table 14: Regression Models
Source: Mertens (2017, 25)

For this dissertation, a logistic regression is relevant. Because of this, I explain the meaning of a logistic regression more detail. Logistic regressions are also linear models, but they work with binary not with metric data (that are typically generated from Likert scale generated data) (Mertens/Pugliese/Recker 2017). In contrast to a normal regression, a logistic regression converts a binary coded variable that creates a logit function that on the other hand creates a criterion for the transformed version of the dependent variable (Mertens/Pugliese/Recker 2017). For the purpose of the verification of my BWS, two regression outputs are important: coefficients and standard deviation. The role of coefficients was already discussed in relation to a regression model. A standard deviation describes how close or far a value is from the distribution mean (Bhattacherjee 2012). The BWS and regression analysis are a part of section 5.

For this kind of method, I have a positivistic view, because with a given set of gamification elements and data gathered from participants, I can demonstrate which elements in TML are working better than others in relation to user preferences. This further helps to identify which elements need to be further improved to make them more meaningful to users.

3.4.4.2 Structural Equation Models

As described in section 3.4.4.1, a regression can be described as ordinary least squares approach. In contrast, there is also a partial least squares (PLS) approach that is relevant for this dissertation and described in the following. If a researcher develops hypotheses and wants to analyze the relationship of variables, he can refer to a structural equitation model (SEM) which is displayed in a path model – a diagram that presents relationships between constructs (Bollen 2002). Constructs or in other words latent variables are "elements in statistical models that represent conceptual variables that researchers define in their theoretical model" (Sarstedt/Ringle/Hair 2017, 3). Unlike regression models, SEM can have several dependent measures or variables as intermediaries (Mertens/Pugliese/Recker 2017). Thus, SEM can measure latent variables and at the same time can test their relationships (Babin/Hair/Boles 2008).

SEMs are oftentimes analyzed by referring to them as variance-based partial least squares techniques (PLS-SEM) (Hair et al. 2014b). PLS-SEM has become more popular in recent years and is gaining acceptance throughout many different disciplines (Hair et al. 2014b). In other words, PLS is usable for research contexts that are data-rich and theory-skeletal, and the construction of a research model is a kind of dialogue between a researcher and a computer (Lohmöller/Wold 1980). The most often used justifications for PLS-SEM is nonnormal data, small sample sizes, and formatively measured constructs (Hair et al. 2014). Regarding nonnormal data, PLS-SEM is less stringent when working with such data. Sample size of a PLS-SEM can determine parameter estimates, statistical power, and also model fit (Shah/Goldstein 2006).

Although PLS-SEM is running with a smaller sample, it is important to care about the number of relationships that are analyzed in a research model in terms of sample size (Hair et al. 2014a). More precisely, for a model with 10 arrows pointing at a construct, a sample size of at least 256 (with a significance level of 1%) is necessary to have a chance to get reliable and valid results (Hair et al. 2014a). The third aspect of formative constructs might be better to understand in relation to the general logic of PLS-SEM. Figure 10 provides an example of a simple path model and all relevant aspects. In a first step, a model must be specified (Hair et al. 2014). This is typically done by reviewing the literature to identify relevant constructs and to identify the relationship between constructs (Recker 2013). An inner model is more or less the structural model which represents the constructs (Y_1 to Y_5) (Hair et al. 2014a). The measurement model that is also called outer model describes the relationship of items and constructs (Hair et al. 2014a).

A model has endogenous and exogenous constructs. An endogenous latent variable is used when "a latent variable only serves as dependent variable, or as both and independent and a dependent variable" (Sarstedt/Ringle/Hair 2017, 4). On the other hand, exogenous variables are only used as independent variable (Sarstedt/Ringle/Hair 2017). Each construct is measured with items (also named indicators or manifest variables) that are described as "x" in Figure 10 (Hair et al. 2014a).

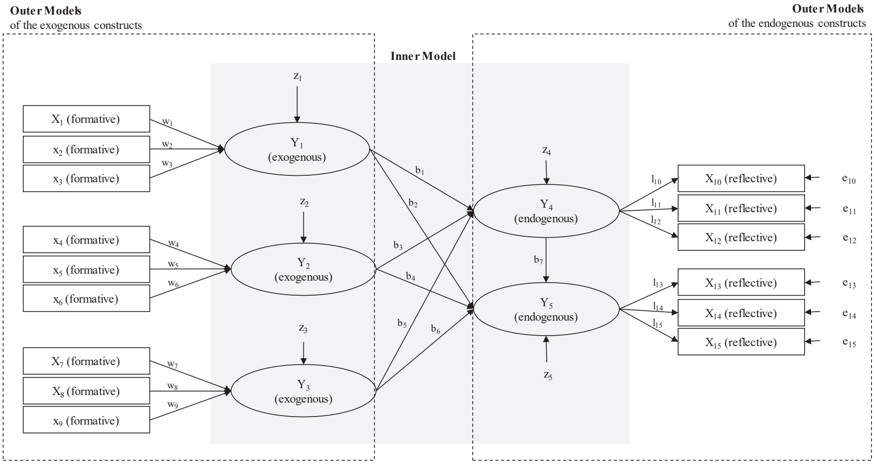


Figure 10: **An Example of a Path Model**
Source: Based on Hair et al. (2014b, 110) and Sarstedt et al. (2017, 4)

These items can be either reflective or formative (Hair et al. 2014b). A reflective item is "a measure that "reflects" an underlying construct" (Bhattacherjee 2012, 45) and a formative item "is a measure that "forms" or contributes to an underlying construct" (Bhattacherjee 2012, 45). The relationship between constructs of a measurement model (in Figure 10, they are indicated by a "b") is represented by a so-called path coefficient (Sarstedt/Ringle/Hair 2017). This path coefficient allows to reject or accept hypotheses that are formulated prior to the model analysis. Each construct (no matter if exogen or endogen) has an error term ("z" in Figure 10), just as formative constructs that have a random measurement error ("e" in Figure 10).

In general, an error term describes the deviation of actual observations from their expected value (Bhattacherjee 2012). For reflective items, "l" represent the loadings that describes the relationship between an item and a construct (Sarstedt/Ringle/Hair 2017). Finally, "w" is used to describe the contribution of a formative item to an outcome variable "Y" (Sarstedt/Ringle/Hair 2017). When constructing a research model, two additional terms are relevant that describe a different kind of relationship between constructs of a model. First, moderators can be used when the effects of either an endogenous or an exogenous construct depend on the values of another variable (Hair et al. 2014b). If we have a mediating variable, we have a situation in which a mediator variable absorbs the effects of an endogenous or exogenous construct in a research model (Hair et al. 2014b). Figure 11 visualizes such a relationship.

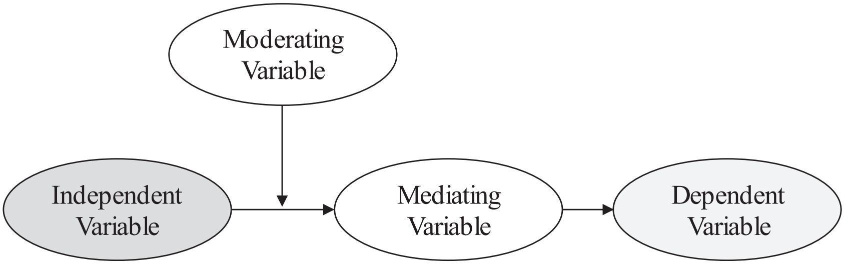


Figure 11: Moderating and Mediating Variables
Source: Based on Bhattacherjee (2012, 12)

As presented in Figure 10, the inner model and outer model are relevant when evaluating PLS-SEM data. In addition, it matters if a research model works with formative and/or reflective constructs. An overview about stages that are necessary to evaluate a PLS-SEM model is given in Figure 12.

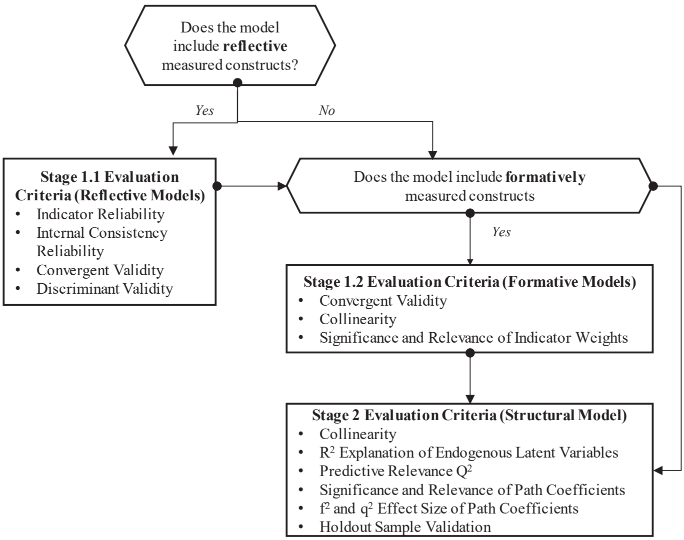


Figure 12: PLS-SEM Model Evaluation
Source: Sarstedt et al. (2017, 15)

In summary, the evaluation of a SEM depends on how the different items are measured in a measurement model. For reflective models, four aspects matter: indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Similar to this, convergent validity, collinearity, and significance and relevance of indicator weights are important for formative models. Finally, for both reflective and formative model's collinearity, R^2, Q^2, significance of path coefficients, f^2, q^2 and holdout sample validation are evaluated. The general meaning of validity and reliability were already discussed in section 3.4. However, because SEM differ from other research methods, I describe the different criteria in more detail in Table 15 that presents a short definition of each criteria.

Criteria	**Description**
Indicator reliability	"It represents how much of the variation in an item is explained by the construct and it referred to as the variance-extracted form the items" (Hair et al. 2014a, 115–116). Indicator reliability is relevant for reflective models.
Internal consistency reliability	"It determines whether the items measuring a construct are similar to their scores (…)" (Hair et al. 2014a, 116). This is relevant for reflective models.
Convergent validity	Describes if a measure "positively correlates with another measure of the same construct" (Hair et al. 2014a, 115). It is relevant for both formative and reflective models.
Discriminant validity	"(..) refers to the degree to which the items that measure different constructs are mutually exclusive"(Mertens/Pugliese/Recker 2017, 50). Discriminant validity is relevant for formative models.
Collinearity	Can arise when two items are highly correlated, if we have more than two items involved it is called multicollinearity– this is only relevant for formative models (Hair et al. 2014a). This is typically checked by a "variance inflation factor" (VIF) (Mertens/Pugliese/Recker 2017).
Significance and relevance of path coefficients	Describes if the relationship between different constructs is significant (typically evaluated by referring to t-values) (Sarstedt/Ringle/Hair 2017). They can decide about rejecting or accepting a hypothesis.
R^2 (explanation of endogenous latent variables)	"Are the amount of explained variance of endogenous latent variables in the structural model. The higher the R^2 values, the better the construct is explained by the latent variables (…)" (Hair et al. 2014a, 93).
Q^2 (predictive relevance)	"Is a measure of predictive relevance based on blindfolding techniques" (Hair et al. 2014a, 203).
f^2 and q^2 (effect sizes of path coefficient)	"f^2 is a measure used to assess the relative impact of a predicator construct on an endogenous construct" (Hair et al. 2014a, 201). "q^2 Is a measure used to assess the relative predictive relevance of a predictor construct on an endogenous construct" (Hair et al. 2014a, 203).

Table 15: Explanation of Evaluation Criteria
Source: Own Illustration

A SEM is going to be discussed in section 6 of this dissertation where I use it to analyze the data of an experiment. For each evaluation criteria presented in Figure 12, different values exist that indicate whether a value is supporting the results of a research model or not. Because these values are important in relation to collected data, I will not outline them in this section but rather describe them in relation to the results of the data in section 6. Similar to methods such as a regression analysis, a BWS or a PLS-SEM typically support positivistic viewpoints on research, especially because they constitute along hypotheses that are constructed a priori before collecting data. These hypotheses can be either accepted or rejected based on a SEM path coefficient (and of course the other evaluation criteria that inform a researcher about the overall quality of his research model).

In the following section, I present the method of a qualitative comparative analysis (QCA).

3.5 Qualitative Comparative Analysis

A qualitative comparative analysis (QCA) can be used for large-scale as well as small-scale data (Greckhamer/Misangyi/Fiss 2013), with survey data or other data such as interview data. One of the first researchers to work with and who initiated QCA, was Charles Ragin (2000). QCA is normally used to "solve a fundamental problem presented by cross-case analyses: preserving the integrity of cases as complex configurations of causal factors while concurrently allowing for the systematic examination of similarities and differences in causal factors across many cases" (Greckhamer et al. 2008, 697).

In real life, outcomes that researchers want to analyze typically do not have a single cause and are not isolated from each other or they even cause opposite effects than expected which can be understood as the premise of QCA (Greckhamer et al. 2008). QCA uses Boolean algebra that is characterized by binary data, a combinatory logic, and Boolean algebra operators (Greckhamer et al. 2008; Ragin 2000; Kogut/Ragin 2006). As described in section 3.4.4.1, linear algebra such as a regression analysis works with independent and dependent variables to better understand causality effects. However, QCA is different because it analyzes which cases share the same outcome a researcher wants to analyze (Greckhamer et al. 2008). These cases are compared with different conditions along all cases which can be a single causal factor or even a combination of different causal factors (Greckhamer et al. 2008).

In QCA, two different kinds of analyses exist to analyze data, a fuzzy-set (FsQCA) and a crisp-set QCA (CsQCA) (Ragin 2009). A crisp set "is dichotomous and evaluates set membership on the two mutually exclusive states of membership or nonmembership" (Greckhammer 2008, p. 700).

In general, QCA emphasizes the effects of the overall analysis rather that its pieces. Thus, QCA evaluates the predictive power of different configurations of conditions based on their measurements, consistency, and coverage (Fiss 2011). So-called consistency values can be interpreted such as correlations. Consistencies outline to which degree specific cases share a certain combination of conditions in relation to an outcome (Ragin 2009). Coverage values can be interpreted such as R-square values and indicate to which degree a configuration explains an outcome. For QCA, two different coverage values exist: the raw coverage, and a unique coverage. Raw coverage values indicate in what percentage a case in a data set can be observed and a unique coverage value estimates the percentage of cases that show a membership in the configuration but not in any other configuration (Ragin 2009).

Ragin (2009) suggests three steps to conduct a QCA:

1. calibration,
2. construction of truth tables,
3. truth table analysis.

First, a data calibration is necessary. QCA works with sets that indicate a membership or a none-membership. To identify which value is a member and which not, each variable has to be calibrated (Schneider/Wagemann 2012). For example, Likert scales can be used for the latent variables that have to be transferred into a fuzzy membership score, ranging from 0 indicating a none-membership, 0,5 indicating a crossover point, and 1 indicating a full membership (Schneider/Wagemann 2012).

But not only can data from a survey be used; it is the same for any other data which need to be transferred into a membership score. For the analysis in section 7, the results of an experiment with Likert scales were used. For a 7-er Likert scales 1 can be used as minimum value, 4 as crossover value, and 7 as maximum value. For CsQCa the membership values differ. CsQCA refers to 1/0 data. A 1 indicates that a phenomenon is present, a 0 indicates that it is absent (Ragin 2009). A simple example for this would be the separation of females and males for which one group is scored with a 1 and the other one with a 0 or classifying different cities by indicating if they are part of the European union. Athens would be coded with 1 because it is a city in the European Union whereas New York would be coded with a 0.

For both kinds of QCA, these values are then used for the calibration procedure that is provided in the QCA software program and that transfers them into a so-called truth table is calculated. A truth table provides an overview about all possible configurations of conditions. In general, 2^k configurations are possible where k stands for the number of conditions observed. This can end up in a high number of different configurations. Therefore, it is necessary to refine the configurations. In this refinement process each possible combination is assessed based on the frequency and consistency of each condition. Regarding the frequency criteria, it is covered how many of the cases have a membership score higher than 0.5 in a configuration to evaluate if this configuration is considered in the further analysis. In a third and last step, the truth table is analyzed.

The approach that is used for the analysis of a truth table is based on the Quine-McCluskey algorithm that calculates combinations of different factors which lead to an outcome by removing factors that are inconsistently present or absent regarding a specific outcome (Fiss 2011). Thus, the algorithm excludes conditions that are not part of a configuration of an outcome. The analysis delivers different values that can be interpreted. First, a parsimonious solution is calculated which includes all assumptions derived from counterfactuals in contrast to the intermediate solution which only includes assumptions based on the easy counterfactuals. Second, an intermediate solution is calculated which represents a subset of parsimonious solutions.

Originally, QCA was handled only with a smaller data sample. However, new trends ended in large-N QCA studies. To better understand its differences, the following Figure 13 explains how small and large-N QCA differ. In summary, QCA can not only be used to analyze quantitative generated data but also data from a qualitative study. It helps researchers to get a better understanding about necessary and sufficient conditions of conditions in relation to a dependent variable. This in turn can support other researchers in making further analyses with a dependent variable.

In this dissertation I refer to a large-N QCA analysis in section 7 that presents which kind of avatar configurations are best in terms of emotional attachment, cognitive load, and learning process satisfaction.

	Small-N QCA	Large-N QCA
Objectives		
Reasoning	Mostly inductive	Inductive or deductive
Primary Goal	Theory building	Theory building and testing
Sample and causal model		
Number of cases	12-50	50+
Relationship to cases	Relatively close, based on knowledge of each case	Relatively distant, based on knowledge of conceptual relationships
Sample/case selection	Theoretical sampling based on theoretical relevance or significance of the case	Theoretical or random sampling; random sample may be inappropriate for large-N research primarily interested in diversity
Number of causal conditions	Typically 4-8	Typically 6-12
Analyses processes		
Consistency	Consistency=1 (i.e., ‘‘Always sufficient’’) is plausible (though minimum threshold consistency of .80 can be used)	Consistency≥80 (i.e., ‘‘Almost always sufficient’’) is convention
Resolving contradicting observations	Various strategies; intimacy with cases may benefit some while small-N may limit others	Various strategies; large-N may benefit some while distance from cases may limit others
Coverage	Typically high – all cases accounted for after iterations of building the model based on in-depth case knowledge	Relatively lower – large coverage desirable but not necessary
Frequency Treshold	Minimum typically one or two cases	Minimum typically higher (3+); tradeoff between potential for deductive analysis and inclusion of rare configurations
Interpretation of findings	Results of necessity and sufficiency are interpreted by returning back to cases; case knowledge is used to build theory	Results of sufficiency and necessity are interpreted primarily as patterns across many cases without returning back to cases; statistical inferences are possible
		Part of this dissertation

Figure 13: Small-N QCA and Large-N QCA
Source: Greckhammer (2013, 54)

3.6 Design Science Research

“The creation of knowledge results from the interdependence from both design and science.”

(Baskerville/Kaul/Storey 2015, 542)

The ultimate goal of this dissertation is to get a better understanding about how to design productive and meaningful gamification concepts in learning. Because of this, I now describe the role and meaning of design science. Design science has become more important in IS related studies (Baskerville et al. 2018) and has its roots in engineering and other applied science (Venable 2006). Design science is “a body of intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process" (Simon 1988, 68–69). "Design" is oftentimes used to describe something that is created for a specific purpose or even understood as the product of a design process (Baskerville/Kaul/Storey 2015). Somehow, design has a pragmatic view on research as it uses knowledge to create a new world, whereas science focusses on analyzing (Simon 1996). "Science" describes a systematic investigation and validation of an artifact with the result of new knowledge (Baskerville/Kaul/Storey 2015). Design Science Research (DSR) utilizes knowledge and applies knowledge to create new artifacts that assist researchers in changing an existing situation and at the same time supports knowledge creation (Baskerville/Kaul/Storey 2015). Artifacts can take different forms such as models, methods, constructs, design pattern, design principles, or design propositions, or even technical, informational and/or social resources (Baskerville/Kaul/Storey 2015). In this dissertation, I present the results of five different studies. All of them contribute to design theory at different levels. In a next step, I describe the role of theory in DSR and continue by describing different approaches of DSR and the relevance of evaluation design science projects.

3.6.1 The Role of Theory in Design Science Research

Theorizing is an important aspect for DSR projects (Venable/Pries-Heje/Baskerville 2012). A design theory in IS integrates not only normative theories but rather descriptive ones and transfers them into design paths with the intention to create more effective IS (Walls/Widmeyer/El Sawy 1992). This can also be observed when looking at the characteristics of a design theory. More precisely, a design theory must deal with goals as contingencies, never involves pure explanations or predictions, is predictive, encompasses kernel theories, tells how to do something, and underlines the practical usefulness (Walls/Widmeyer/El Sawy 1992). Further, such design theories have four different components: meta-requirements, meta-design, kernel theories, testable hypotheses (Walls/Widmeyer/El Sawy 1992). The different components imply that DSR can work with a variety of different methods such as experiments that are typically grounded in hypotheses and a research model (see section 3.4.3 for more details about experiments). According to Gregor (2006), theories for design and action say how to do something and give explicit prescriptions (such as methods or principles of form and function) for constructing an artifact. An artifact is not limited to a physical object rather, it can also be a method, a concept or a construct (Baskerville/Kaul/Storey 2015). A design theory can be further described by eight different components. Table 16 provides an overview of the different components.

Component	Description
Core components	
1) Purpose and scope	“What the system is for,” the set of meta-requirements or goals that specifies the type of artifact to which the theory applies and in conjunction also defines the scope, or boundaries, of the theory.
2) Constructs	Representation of the entities of interest in the theory.
3) Principles of form and function	The abstract “blueprint” or architecture that describes an IS artifact, either product or method/intervention.
4) Artificial mutability	The changes in state of the artifact anticipated in the theory, that is, what degree of artifact change is encompassed by the theory.
5) Testable propositions	Truth statements about the design theory.
6) Justification knowledge	The underlying knowledge or theory form the natural or social or design sciences that give a basis and explanation for the design (kernel theories).
Additional components	
7) Principles of implementation	A description of processes for implementing the theory (either product or method) in specific context.
8) Expository instantiation	A physical implementation of the artifact that can assist in representing the theory both as an expository device for purposes of testing.

Table 16: Information System Design Theory
Source: Gregor (2007, 322)

In all eight components, both analysis and design are important and further depend on the method that is used in combination with a DSR approach. Constructs, for example, can be part of a research model, which demonstrates the relationship between different constructs and thus, reflect the analysis of a theory motivated research model. To test such a research model, a designed artifact such as an online training which I present and design in section 6 can be used. Design knowledge can be represented in descriptions of form and functions or in a nascent design theory or even a well-developed design theory (Baskerville et al. 2018). Gregor and Jones (2007) further explain that an artifact’s implementation and instantiation can be additional components which focus on the implementation of a developed theory. The initial step of a design theory is theorizing, and it should be understood how a developed artifact can support researchers in creating new insights and new knowledge (Baskerville et al. 2018). DSR can be used in combination with different qualitative and quantitative approaches. No matter which methods are used, two of the most prominent methods have been developed by Hevner et al. (2004) and Peffers et al. (2007), who support researchers in systematically developing DSR projects. I explain both approaches in the following and describe the relevance of an artifact’s evaluation in relation to used methods.

3.6.2 Design Science Research Approaches and Evaluation

One DSR approach is presented by Hevner et al. (2004). Hevner's 3-cycle view provides a general overview about the relationship between an artifact's environment and the knowledge base. The 3-cycle view can be seen in Figure 14.

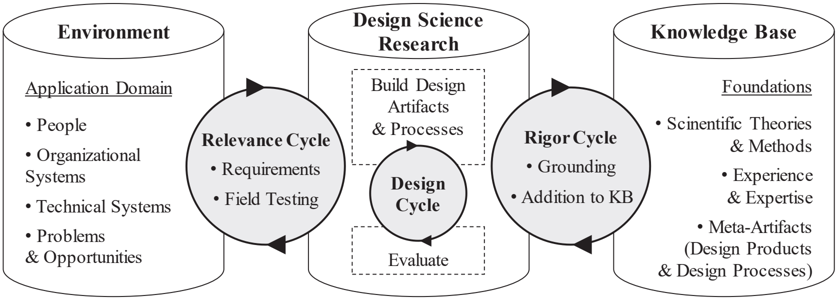


Figure 14: Design Science Research Cycle
Source: Adapted from Hevner et al. (2004, 80)

The environment focusses on the problem space (Simon 1996), which supports a researcher in getting a better understanding about the domain he tries to solve a problem or business need for (Hevner et al. 2004). Whether or not something is relevant for an artifact can be observed by field testing or requirements (relevance cycle). The knowledge base offers foundations from different sources such as methods, constructs, experiences, or products which, for example, can be gathered from literature or existing IS theories (Hevner et al. 2004). "Rigor is achieved by appropriately applying existing foundations and methodologies" (Hevner et al. 2004, 80). Both environment and knowledge base contribute to the development of a design artifact or a design theory, which is further supported or refined by different qualitative or quantitative methods such as a field study, an experiment, or a case study (explained in section 3.3 and 3.4).

Another approach is given by Peffers (2007), who refers to a kind of process that systematically guides researchers in developing and testing a DSR artifact. An overview about the different steps of Peffers' et al. (2007) process is given in Figure 15. The *first step* in Peffers' et al. (2007) process is the identification of a research problem, which will be used to develop an artifact that can be used to solve the identified problem (Peffers et al. 2007). Besides supporting a researcher in developing his artifact, the problem statement also informs the audience in getting a better understanding about the researchers reasoning. The *second step* is about defining the objectives of solution, which can be quantitative as well as qualitative (Peffers et al. 2007).

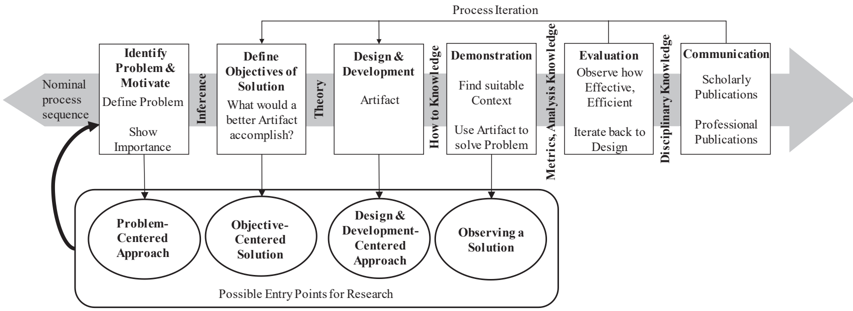


Figure 15: Design Science Research Methodology Process Model
Source: Peffers (2007, 48)

In a *third step*, an artifact is designed and developed. Such an artifact can be a construct, a model, a method, an instantiation or a property of a technical social, and/or informal resource (Peffers et al. 2007). The *fourth step* is about the demonstration of the developed artifact and the *fifth step* focusses on the evaluation of the developed artifact. In a last step, communication is used to present the approaches' utility, novelty, and effectiveness to other researchers (Peffers et al. 2007). Although a method can support researchers in the stepwise development of an artifact, DSR can happen without referring to a method such as the one presented by Peffers' et al. (2007) or the cycle that is introduced by Hevner et al. (2004). However, this ultimate goal of this dissertation is to design productive gamification concepts and to get a better understanding about factors that determine such an effective concept such as a more detailed explanation of gamification elements (section 4).

With different knowledge about gamification elements, it becomes challenging to design productive gamification concepts, because we are not informed about the characteristics of each individual element and, thus, cannot guess if and how effective gamification elements can be. Gamification research highlights that such design knowledge is important for each individual gamification element to better understand its individual logic and effects (Seaborn/Fels 2015).[3]

[3] Although I will not use Peffers' et al. (2007) process in the five different studies I present, I refer to it for future research projects (section 9.3).

For both approaches an evaluation is needed and can be represented by different methods, which can be either used ex ante or ex post. Relevant methods can be seen in Table 17.

DSR Evaluation Method Selection Framework	*Ex Ante*	*Ex Post*
Naturalistic	• Action Research • Focus Group	• Action Research • **Case Study** • Focus Group • Participant Observation • Ethnography • Phenomenology • Survey (Qualitative or Quantitative)
Artificial	• Mathematical or Logical Proof • Criteria-Based Evaluation • Lab Experiment • Computer Simulation	• Mathematical or Logical Proof • Lab Experiment • Role Playing Experiment • Computer Simulation • **Field Experiment**

In **bold**: methods used in dissertation

Table 17: DSR Evaluation Method Selection Framework
Source: Venable (2006, 11)

“Naturalistic evaluation explores the performance of a solution technology in its real environment (…) instead respectively called artificial evaluation and naturalistic evaluation, explicitly recognizing the evaluative nature of the observation activity (Venable 2006, 6).” In my dissertation, I work with different kind of methods. I use a case study in section 4 and contribute to a design theory by presenting how a taxonomy can be used to design gamification concepts.

I also work with field experiments in section 6 and 7 and use research models and hypotheses to develop and evaluate gamification concepts. For both studies, I work with an experiment. According to Purao et al. (2008, 529), “if designs are (implicit) hypotheses about relationships between structure and function in the real world, then creating a design generates a set of embedded hypotheses and constructing the design (building the artifact) constitutes a test of those hypotheses”. In conclusion, although experiments have been applied only rarely in DSR, they can be used to evaluate the quality of a design process (such as a developed gamified IS) (Mettler/Eurich/Winter 2014). In addition, I use a systematic literature review in section 8 and, in a next step, provide propositions that can assist researchers in developing a design theory with a method to gamify IS as an artifact

Next, having the theoretical and methodological background in mind, I start presenting the results of the five research studies I conduced to achieve the dissertations goal of getting a deeper understanding about gamification, its elements, and about analyzing the effectiveness of gamification concepts in TML.

4 Understanding the Characteristics of Gamification Elements – A Taxonomy to Analyze and Design Gamification Concepts[4]

4.1 Introduction

The first section of this dissertation focusses on *RQ1* and its three sub questions:

RQ1: Which gamification elements exist and how can they be categorized to provide guidance in developing and explaining gamification concepts in IS?

> *RQ1a: Which gamification elements exist to develop gamification concepts in IS?*
>
> *RQ1b: How can gamification elements be categorized?*
>
> *RQ1c: How can a categorization of gamification elements support practitioners and researchers in gamifying IS and explaining gamification concepts in IS?*

Although the concept of gamification has gained popularity, some challenges have arisen concerning its classification and the meaning of its elements (section 1.1). Existing classifications of gamification elements lack rigor and require further development (Bui/Veit 2015). In general, the classification of objects extends beyond the mere ordering of elements; it also involves reducing complexity, identifying similarities among objects, and understanding object relationships. Such classifications can support researchers and practitioners in generalizing, communicating, and applying research findings (Glass/Vessey 1995). Under some circumstances, classifications support theory building because they better describe a phenomenon of interest and its relationships towards other objects (Doty/Glick 1994). Existing gamification research reveals that that we need to reconsider our understanding about gamification elements and their characteristics (section 2.1.2). Gamification concepts are often intended to reward users for their behavior. Some studies classify rewards as the building blocks for a gamification concept. However, rewards summarize a certain group of other elements—including points, badges, or virtual goods—which are also classified as building blocks for the concept of gamification (Hunicke/LeBlanc/Zubek 2004; Thiebes/Lins/Basten 2014). In addition, an element that is classified as reward is not necessarily perceived as such, and some support exists regarding the negative effects of

[4] The insights presented in this section are based on Schöbel and Janson (2018). This paper is accepted at EJIS. I thank the associate editor, senior editors and reviewers from EJIS. Their ideas and recommendations helped to improve this study.

badges that are typically classified as such (McKernan et al. 2015). Different understandings of gamification element classifications are not only of a theoretical nature, and any meaningful classification of objects must also support practical utility (Corley/Gioia 2011). Classifications supporting theory development can be directly applied to problems facing practitioners (Corley/Gioia 2011). If we asses gamification elements as the most crucial design components of a gamification concept, a meaningful categorization and a shared understanding of their characteristics is needed because it is not automatically clear what existing elements represent (Liu/Santhanam/Webster 2017). Other observations can be made about outcomes caused by specific combinations of elements (section 2.1.2). Gamification is intended to change user behavior (Deterding et al. 2011a; Hamari/Koivisto/Sarsa 2014). However, each element has different characteristics that decide gamification concept's success in terms of the addressed outcomes. Replacing a level with a leaderboard in a bundle of elements may result in negative or no effects on user motivation (Hamari/Koivisto 2015; Hew et al. 2016; Shute et al. 2015). Leaderboards are typically classified competitive elements, and effects remain controversial and may not be fully understood (Santhanam/Liu/Milton-Shen 2016). Classifications of these elements might therefore be imprecise regarding their outcomes. All such observations result from different understandings about characteristics and classifications of gamification elements. The characteristics of gamification elements will be crucial for achieving a better understanding about the overall concept of gamification. A better understanding of elements and their origins, relationships, and characteristics will help to enrich research and practice (Farjoun/Ansell/Boin 2015).

In conclusion, this study is used to get a better understanding about what gamification is, which elements exist and to demonstrate how a taxonomic classification can support researchers and practitioners in understanding gamification concepts and developing them. A shared understanding about gamification elements is necessary to understand their functionalities to better adapted them to digital learning concepts and to interpret how learners react to specific elements. The insights gained in this study will be used for the empirical analyses presented in section 5, 6, and 7 to better explain the effects and outcomes that are achieved in each of the three studies.

4.2 Theoretical Background

The term "gamification" and the related elements were described in section 2.1. This section is based on getting a better understanding about elements and their classifications to develop a gamification taxonomy. To better understand the relevance of a gamification taxonomy, it is important to first understand what a classification is and what it is used for. The classification of objects is a fundamental cognitive aid (Hambrick 1984), without a classification scheme, researchers and practitioners must deal with individuality and many variables of interest (Hambrick 1984). Classifications help us better understand complex domains (Nickerson/Varshney/Muntermann 2013). There are different ways to classify objects, one of which concerns the development of a typology or taxonomy. Typologies are normally characterized by two or more dimensions, which are used to characterize names in individual cells (Bailey 1994). A taxonomy is a theoretical study of classification, and taxonomies include bases, principles, procedure, and rules (Bailey 1994; Usman et al. 2017). In simple terms, typologies are often developed according to a conceptual base, and taxonomies according to an empirical basis (Bailey 1994). However, research specifies that taxonomies can be both empirical and conceptual (Doty/Glick 1994). Taxonomies go beyond classifying objects, they ease knowledge sharing, provide a better understanding of interrelationships among objects, and support decision making (Bailey 1994; Usman et al. 2017).

Bearing in mind the uses of classifications and taxonomies allows us to better judge state-of-the-art of classifications of gamification elements. Assuming an abductive reasoning approach seems to provide a very different understanding about those elements used in gamification and, from a pragmatic perspective, about how these elements might support researchers and practitioners in gamifying IS. A useful taxonomy of gamification elements can change the way we think about gamification elements. Doty and Glick (1994), maintain that this is because taxonomy goes beyond the mere classification of objects, and might serve as a way to predict outcomes. Thus, the taxonomy theory development approach used herein belongs to theory of explanation and prediction type (specifically, a type-IV theory, when accounting for Gregor's (2006) view on theories within IS research, instead of a type-I theory of analysis) since it does not purely analyze existing gamification elements and through its instantiations makes causal explanations and testable propositions possible. This is also indicated by Gregor (2006), who explicitly classifies the Doty and Glick (1994) approach as a Type-III/IV theory approach. Therefore, and very much in line with "typical" theory development (Grover et al. 2008), the constructs of a taxonomic theory must be well defined, as must the relationships among constructs, a taxonomic theory must also be falsifiable. More precisely, having a falsifiable theory it necessary to validate the utility of a taxonomy, as is the case with any other theory (Corley/Gioia 2011; Doty/Glick 1994). Additionally, a taxonomy can also be judged by its attributes (Nickerson/Varshney/Muntermann 2013). First, a taxonomy should comprise parsimonious dimensions and characteristics, which should be easy to comprehend or apply. Second, a taxonomy should have a robust meaning, and enough dimensions and characteristics should be included so that it is possible to differentiate among those objects presented in the taxonomy itself. Third, a taxonomy should be comprehensive, and should both cover and provide a complete description of all known objects. Fourth, a taxonomy should be extendible and should allow for the inclusion of additional dimensions and characteristics. Finally, a taxonomy should be explanatory, meaning that the taxonomy should explain its objects rather than merely describing them. Additionally, explanatory taxonomies enable the identification of objects based on certain characteristics and vice versa.

Attributes of a Taxonomy*		**Challenges of Gamification Taxonomies**							
		Incomplete list of elements	Encapsulation of elements	Generic classify-cation of elements	Different catego-rizations of elements	Missing presentation of characteristics	Descriptive focus	Different understandings about relationships	Missing validation
Concise	• Limited number of dimensions and characteristics • Not difficult to comprehend and apply		x	x	x	x	x	x	x
Robust	• Enough dimensions and characteristics to clearly differentiate between objects of a taxonmy		x	x	x	x			
Comprehensive	• Classify and identifies all relevant objects • Complete description of each ideal type	x							
Extendible	• Allows for inclusion of additional dimensions and characteristics		x	x		x			
Explanatory	• Should be explanatory not descriptive • Characteristic supports finding an object, and an object can be described by a characteristic • Specified the relationship between objects	x	x			x	x	x	x
Applicable	• Is validated to demonstrate practical usefulness • Is evaluated					x	x	x	x

* Derived and adapted from Nickerson et al. (2013), Doty and Glink (1994), Corley and Gioia (2011), Bailey (1994)

Figure 16: Attributes of a Taxonomy & Challenges of Gamification Taxonomies
Source: Own Illustration

Bearing general taxonomic attributes in mind along and contributions these attributes have made to theory development, I can now judge those challenges facing existing gamification taxonomies (Hunicke/LeBlanc/Zubek 2004; Liu/Santhanam/Webster

2017; Weiser et al. 2015; Werbach/Hunter 2012) (see Figure 16). Identification of these challenges is based on observations of how existing studies use gamification taxonomies. These studies are included in the literature review, as explained in the methodology section. The development of each gamification taxonomy is assessed so that certain aspects, such as missing evaluations, can be observed. These observations were made by reading the original papers that present the various taxonomies. A description of the components of each taxonomy and how these are used in existing research is provided in Appendix A.5.

First, it can be observed that the list of elements varies among taxonomies. Some lists of elements that are presented in existing taxonomies do not cover the full range of their elements. Werbach and Hunter (2012) classify avatars as components of a game, and as a visual representation of a player's character. However, an avatar is not necessarily only the visual representation of a user, and avatars can also be used as tutors or teachers, or as someone who guides a user during the use of an IS (Clark/Choi 2005). Accordingly, existing taxonomies need to be improved in terms their comprehensive and explanatory objects.

Second, in referring to the encapsulation of elements, some taxonomies classify elements such as "rewards" as game mechanics. Bearing the definition of the category of mechanics in mind these rewards are described as particular components, or as building blocks of a game (Blohm/Leimeister 2013; Hunicke/LeBlanc/Zubek 2004) (see section 2.1.2 about description of gamification elements and their components). However, elements such as rewards are encapsulated when considering how rewards are used in research and practice. By definition, a reward does not necessarily become a component of a game merely because it has been categorized as such; instead, elements such as badges, points, or virtual goods reward users for certain behaviors (Thiebes/Lins/Basten 2014). This makes it difficult to further include other elements (extendible) to a taxonomy. Additionally, conciseness suffers because it becomes more challenging to apply a taxonomy to other contexts. Finally, the dimensions seem to be insufficiently precise (robust).

Another challenge is the generic classification of gamification elements and the missing representation of characteristics. Among extant gamification taxonomies, elements are simply classified to inform practitioners and researchers about existing gamification elements. However, each element can be characterized in more detail. The element “reward” is commonly used to describe elements that reward users, though rewards can also be a characteristic of elements such as points, badges, and virtual goods (Thiebes/Lins/Basten 2014). The classification of mechanics, dynamics, components, and aesthetic may offer a general way of categorizing elements. To make taxonomies more robust and extendible more detailed characteristics are necessary so that elements can be described in greater detail. Thus, existing taxonomies are descriptive and not explanatory because they focus on clustering a group of elements without providing detailed information about the characteristics of those elements. Such descriptive taxonomies might help to give an overview about those elements that exist within the taxonomy concerned (Nickerson/Varshney/Muntermann 2013), however, they must be developed further to provide an improved understanding about each individual element.

It is difficult to apply a descriptive taxonomy to a context or phenomenon (applicable, robust), and this difficulty can also be observed regarding how elements are categorized. In considering the mechanics dynamics aesthetics (MDA) framework from Hunicke (2004), Bista (2014) classifies points and badges as dynamics (which are, by definition, the run-time behavior of game mechanics), while Toda et al. (2014) classify them as mechanics. This different ways of categorizing elements might also result from different understandings about their definitions. Ibánez et al. (2014) define dynamics, and claim that they drive users into a state of flow. Comparatively, Bista’s (2014) definition of dynamics suggests that they are used for fun. Toda et al. (2014) explain that mechanics are utilized mechanisms within a system. While Suh et al. (2015) define mechanics as tools, techniques, and widgets. These description seems to be insufficiently detailed (robust) and therefore a more detailed (concise) descriptions is needed. The MDA taxonomy characterizes three objects: mechanics (components of a game), dynamics (run-time behavior of mechanics), and aesthetics (motives of users) (Hunicke/LeBlanc/Zubek 2004).

Obviously, if a relationship exists among objects that seems yet to be fully understood, this becomes clear when investigating how the taxonomy is applied. Ibánez et al. (2014) state that MDA does not outline connections between assigned gamification elements. It is not clear which mechanic leads to which dynamic, nor which emotions are addressed. Accordingly, such taxonomies are lacking terms of conciseness, applicability, and explanation. Finally, validation should be considered for a taxonomy that contributes to theory (Corley/Gioia 2011; Doty/Glick 1994) (concise, applicable, explanatory). All the taxonomies I identified have a descriptive character and require additional validation when demonstrating their usefulness to research and practice. This requirement might explain the different ways and inconsistencies of how taxonomies are used.

Despite these challenges, each taxonomy has its own goal. Existing taxonomies provide useful insights into gamification and elements, and facilitate a better understanding of the constitution of gamification elements and how gamification itself can be described. Insights from existing taxonomies have helped us derive a more useful taxonomy to support researchers and practitioners constructing gamification concepts. This also supports decision making, making it easier to adapt gamification concepts to a target group or a context (such as digital learning), and helps to specify the relationships of gamification elements to better predict user behavior.

4.3 Methodology

To develop a novel gamification taxonomy, I proceeded according to four different steps (see Figure 17 for an overview). First, I conducted a literature review; second, I iteratively designed the taxonomy; third, I evaluated and revised the taxonomy using expert interviews; fourth, I conducted a validation of my taxonomy using two cases, thereby completing its development.

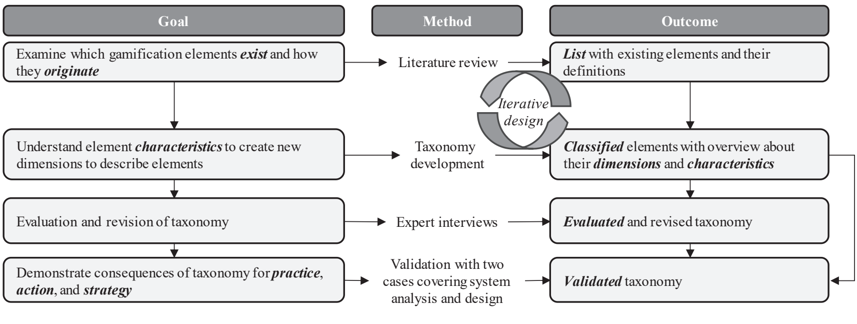


Figure 17: Overview Methodology
Source: Own Illustration

First, I conducted a literature review to identify existing gamification elements and better understand the origins of each element. To cover a broad set of publications, I used the keywords "gamification" and "gamification elements" or "game design elements" when undertaking a search using six databases: ACM, EBSCO, Emerald, IEEE, AIS, and JSTOR. The results of the literature review are important to identify existing elements and were employed in the taxonomy's iterative development. The literature review was used to answer *RQ1a*. Developing a taxonomy involves classifying different kinds of objects to better describe elements and generally improve understanding about their meaning (Nickerson/Varshney/Muntermann 2013). From a pragmatic viewpoint, classifications of objects can support researchers and practitioners in examining how categories (or elements) originate, improving understanding of these across multiple levels and showing how they relate to one another (Farjoun/Ansell/Boin 2015). Taxonomies provide structure and an organization to a field of knowledge, enabling researchers and designers to study the relationships among different objects (Glass/Vessey 1995; Nickerson/Varshney/Muntermann 2013). I reviewed several taxonomy development approaches to inform the development of my own taxonomy (including those of Bradley et al. (2007), Hambrick (1984), Nickerson et al. (2013), and Usman et al. (2017)). I decided to use Nickerson et al.'s (2013) approach because it is the most prominent and widely used approach in the field, and because it offers the most systematic and step-by-step method for developing taxonomies while guaranteeing a complete identification of dimensions and characteristics of objects (an overview of Nickerson et al.'s (2013) development is provided in Figure 18). The taxonomy addresses *RQ1b*.

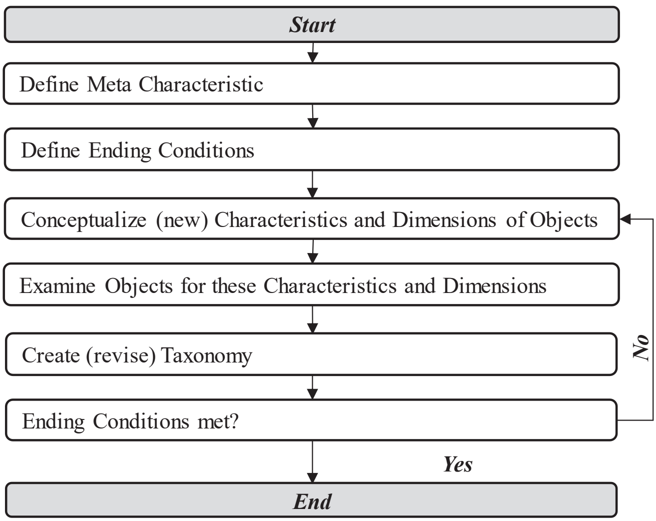


Figure 18: **Steps Taxonomy Development**
Source: Nickerson et al. (2013)

First, a meta characteristic must be defined, which must summarize the identification of different characteristics within each iteration and provide information about characteristics that need to be defined. This helps researchers eliminate irrelevant characteristics from the taxonomy and should be based on the target group for which the taxonomy is being designed (Nickerson/Varshney/Muntermann 2013).

The next part is about the conduction of iterations beginning with either an empirical-to-conceptual or a conceptual-to-empirical approach and any exchanges among them. A conceptual-to-empirical approach involves the examination of empirical cases to see how they fit with the conceptualization, while an empirical-to-conceptual approach involves starting with empirical data clusters before conceptualizing the nature of each cluster (Nickerson/Varshney/Muntermann 2013).

Finally, due to the iterative development process, ending conditions need to be defined (step 2 in Figure 18). Four ending conditions assisted us in deciding when a taxonomy is complete and whether all characteristics and dimensions had been identified within the iterative process (Nickerson/Varshney/Muntermann 2013)(Nickerson et al. 2013). *First*, all identified objects of a taxonomy must have been examined. *Second*, at least one object must be classified under every characteristic of every dimension. *Third*, no dimensions or characteristics can be added in the final iteration. Fourth, dimensions, characteristics, and cell combinations are unique and should not repeat. After the iterative design step has been completed, an evaluation was conducted to analyze the usefulness of the taxonomy. Determining the usefulness of a taxonomy is difficult and may be determined by the effectiveness of its use among practitioners and researchers (Nickerson/Varshney/Muntermann 2013). Accordingly, expert interviews were used to analyze the developed taxonomy and determine its usefulness in developing and understanding gamification concepts among practitioners and researchers. Interview results were then used to revise the taxonomy (see section 3.3.2 about interviews).

In the final step, and to demonstrate the taxonomy's usefulness, I conducted a validation test using two cases covering both system analysis and design (see section 3.3.2 about case studies). The validation is used to answer *RQ1c*. Judging the usefulness of a taxonomy is difficult using quantitative measures alone, and so I considered a usefulness demonstration (Nickerson/Varshney/Muntermann 2013). Such cases can help researchers and practitioners better understand why, how, and with what result certain decisions were made (Yin 2003). Accordingly, two cases are presented for the final step of my taxonomy's development: one to test the analysis and the other to test the design of gamification concepts

4.4 Findings

In this section I present the results for *RQ1*, starting with the results of the literature review (*RQ1a*) and continuing with results pertaining to my taxonomy (*RQ1b*) and its evaluation, before demonstrating the taxonomy's use and validation (*RQ1c*).

4.4.1 Identification of Elements

In the literature review I selected papers focusing on gamification in terms of definition, elements, game design. Since a huge number of papers fit the criteria presented above, I excluded those papers that did not list the elements they used as these are irrelevant to the analysis. I also included additional papers found through cross referencing. A total of 104 papers were used in the analysis.

First, I identified existing elements before classifying them according to their characteristics. When identifying existing elements, I observed that different categories of elements and alternative terms for single element exist. Figure 19 depicts how I summarized similar terms of elements, I referred to the names of elements most frequently used in the literature (similar to Seaborn and Fels (2015)) to answer *RQ1a*. I compared the definitions and/or descriptions of each identified element when making decisions as to their similarity to other elements and terms. Elements with similar designs and/or descriptions were summarized accordingly. I summarized all identified terms under the most prominent identifiable term; for example, "leaderboard" (which is well-known and is used to describe rankings, score tables etc.) was used to derive the characteristics of gamification elements.

The taxonomy comprises 14 different gamification elements. I decided to add two kinds of avatars to the list of elements; some were used as visual representations of users within an IS (Buckley and Doyle 2017), while others refer to avatars that accompany and instruct users (Lee et al. 2013). I added a collection system to the list of gamification elements because some studies refer to gamification elements as "badge systems" or "point systems", which are used to document the collection progress (Denny 2013; Mollick and Rothbard 2014). An overview of the description of each gamification element, which are significant to the taxonomy's development is given in Appendix A.1.

Gamification Elements	
Points	Experience Points, Loyalty Points, Reputation Points, Scores, Credits, Currencies
Badges	Trophies, Medals, Stamps, Icons
Feedback	Audible Feedback
Time Pressure	Deadline, Time Banking, Time Limit, Time Constraints
Leaderboard	Ranking, High-Score Tables, Score Boards, Badge Board, Line Chart
Progress Bar	Progress, Performance Graph, Performance Stars, Progress Notification
Level	User Level, Progression
Tasks	Missions, Quests, Assignments, Goals
Virtual Goods	Virtual Gifts
Avatar	Roles, Virtual Character, Character, User Profile
Narratives	Meaningful Stories
Reminder	History, Progression, Time Line
Collection System	Badge System, Point System, List of Medals, Point Grading System
Dynamics	
Rewards	Incentives, Awards
Cooperation	Collaboration, Team, Team Building, (Social Networking Features)
Competition	
Challenge	
Motives	
Social Facilitation	
Ownership	
Achievement	
Self-expression	
Altruism	

Figure 19: Overview about alternative Terms
Source: Own Illustration

4.4.2 Taxonomy of Gamification Elements and their Characteristics

In a next step, I answer *RQ1b* by presenting the developed taxonomy. First, I derived a meta-characteristic, defining it as a "characteristics of gamification elements", because the goal of my research is to understand the origins and relationships of gamification elements. Descriptions and/or definitions of each element were used for the first version of the taxonomy because definitions are helpful in understanding the meaning of objects and their characteristics (an overview of these definitions is given in Appendix A.6 and Appendix A.7). By definition, dynamics can result from gamification elements and so can be used to better describe the characteristics of those gamification elements. Therefore, I also considered their descriptions and definitions (see Appendix A.7). I then used an inductive empirical-to-conceptual approach to identify dimensions and characteristics. This approach proved to be feasible, as I was able to identify many published gamification studies (Nickerson et al. 2013). I also considered conceptual-to-empirical approaches and referred to important streams of gamification literature to determine dimensions for the taxonomy. Six iterations were needed to develop the first version of the taxonomy, an overview of which is depicted in Figure 20; dimension definitions are provided in Appendix A.2.

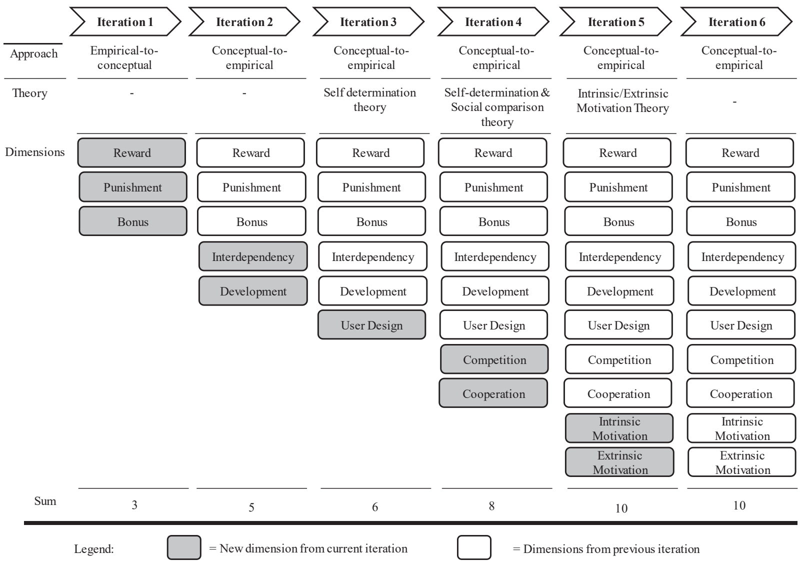


Figure 20: **Iterations**
Source: Own Illustration

Six iterations led to the following taxonomy:

T6= {Reward (Rewarding, Not Rewarding), Punishment (Punishing, Not Punishing), Bonus (Bonus, No Bonus), Interdependency (Independent, Dependent), Development

(Developing, Static), User Design (Partial Involvement, No Involvement), Competition (Competitive, Not Competitive), Cooperation (Cooperation Possible, Individual), Intrinsic Motivation (Intrinsically, Not Intrinsically), Extrinsic Motivation (Extrinsically, Not Extrinsically)}

I then matched the objects with the dimensions and characteristics to assign characteristics to each element that was identified in the first step (see Table 18).

Gamification Elements	**Gamification Element Dimensions and Characteristics**																			
	1		2		3		4		5		6		7		8		9		10	
	Rewarding	Not Rewarding	Punishing	Not Punishing	Bonus	No Bonus	Independent	Dependent	Developing	Static	Partial Involvement	No Involvement of Users	Competitive	Not Competitive	Cooperation possible	Individual	Intrinsically	Not Intrinsically	Extrinsically	Not Extrinsically
Collection System		x		x		x		x	x			x		x		x	x			x
Point	x		x		x		x			x		x	x		x			x	x	
Badge	x		x		x		x			x	x		x		x			x	x	
Virtual Goods	x		x		x			x		x	x			x	x			x	x	
Leaderboard		x		x		x		x	x			x	x			x	x			x
Level		x		x		x		x	x			x		x		x	x			x
Progress Bar		x		x		x		x	x			x		x		x	x			x
Feedback		x		x		x	x			x		x		x		x	x			x
Representing Avatar		x		x		x	x			x	x			x		x	x			x
Interacting Avatar		x		x		x	x			x		x		x		x	x			x
Tasks		x		x		x	x			x	x		x		x		x			x
Narratives		x		x		x	x			x		x		x		x	x			x
Reminder		x		x		x	x		x			x		x		x	x			x
Time Pressure		x		x		x	x			x		x		x		x	x			x
Legend: 1=Reward, 2=Punishment, 3=Bonus, 4=Interdependency, 5=Development, 6=User Design, 7=Competition, 8=Cooperation, 9=Intrinsic Motivation, 10=Extrinsic Motivation																				

Table 18: First Version of Taxonomy
Source: Own Illustration

4.4.3 Taxonomy Evaluation - Expert Interviews

Expert interviews were used to evaluate the taxonomy. I considered both practice (P1, P2, P3) and research (R1, R2, R3, R4) gamification experts, and selected experts based on their experience and their gamification publication expertise (see Table 19 for demographic data of interviewees). To guarantee anonymity, I refer to each interviewee's recommendations by referring to the numbers listed in Table 19 (see section 3.3 about qualitative research and interviews). The final version of the taxonomy and definitions of each dimension were sent to the interviewees one week before the interviews. Interviewees were asked to make comments and note everything that should be changed or revised. The seven interviews were conducted via skype or phone. All interviews were recorded with the permission of their interviewee. The shortest interview lasted 24 minutes, while the longest lasted one hour and 17 minutes. Transcripts were made from each interview recording. Using the transcripts and the evaluation criteria, I was able to consolidate the interview statements given by the interviewees.

Practitioners					
No.	**Work Description**	**Age**	**Gender**	**Years of Gamification Experience**	
P1	Consultant	24	Female	0,5	
P2	Manager	28	Male	5,5	
P3	Senior Consultant	33	Male	1,5	
Researchers					
No.	**Work Description**	**Age**	**Gender**	**Gamification Publications**	**Citations**
R1	Researcher – Professor	35	Male	3	303
R2	Researcher – PhD Student	29	Male	10	151
R3	Researcher – PhD Student	28	Male	7	14
R4	Researcher – PostDoc	31	Male	2	4

Table 19: **Demographic Data Interviewees**
Source: Own Illustration

An overview of these consolidated interviewee suggestions and the corresponding actions I took are presented in Appendix A.3. All recommendations were used to improve the taxonomy. A suggested separation between micro and macro feedback (or absolute and relative leaderboards) was unnecessary because both elements have the same characteristics. Thus, they would be classified in the same way as feedback and a leaderboard, which is why a separation of these elements is not necessary. R3 recommended that I exclude the bonus dimension stating that it was equivalent to the reward dimension. A bonus is defined as additional reward for having completed a series of challenges or set of core functions (Hiltbrand and Burke 2011), and differs from a reward. I decided that the bonus dimension should remain part of the taxonomy. R3 also recommended to use involvement vs. no involvement instead of partial involvement vs. no involvement. At some point, system developers must decide about general game design structure. Even if users can determine all components of an avatar, they must still select their favorite items from a given list included by a system designer. Thus, full involvement of users is impossible. In addition, I decided to differentiate between dimensions that follow an underlying game logic, and those that support the design of a gamification concept. Underlying game logic dimensions are necessary conditions for gamification elements. Game design dimensions are optional (a gamification element is not necessarily be competitive or cooperative). These aspects become important when taxonomies are used to analyze or design those gamification concepts presented in the results section of the final section. Finally, R1 indicated that levels can be both punishing and rewarding; users can be awarded for achieving higher levels, or can be punished for falling to lower levels. However, these awards and punishments depend on the element with which a level is connected, such as points or badges. In this case, points are awarded to, or taken from users, resulting in them having a higher or lower level position. The final version of the taxonomy is described accordingly:

T6= {Reward (Rewarding, Documenting), Punishment (Punishing, Neutral), Bonus (Bonus, No Bonus), Interdependency (Independent, Dependent,), Development (Developing, Static), User Design (Partial Involvement, Prescribed by Developer), Competition (Competitive, Individual), Cooperation (Cooperation Possible, Cooperation Impossible), Surprise (Surprising, Regular), Initial Motivation (Intrinsic, Extrinsic)}

Visual changes in the new version of the taxonomy are marked in green in Table 20.

Gamification Elements	Gamification Element Dimensions and Characteristics																			
	Underlying Game Logic								Game Design											
	Interdependency		*Development*		*User Involvement*		*Initial Motivation*		*Reward*		*Bonus*		*Punishment*		*Surprise*		*Competition*		*Cooperation*	
	Independent	Dependent	Developing	Static	Partial Involvement	Prescribed by Developer	Intrinsic	Extrinsic	Rewarding	Documenting	Bonus	No Bonus	Punishing	Neutral	Surprising	Regular	Competitive	Individual	Cooperation possible	Cooperation impossible
Collection Systems		x	x			x	x			x		x		x		x		x	x	
Points	x			x		x		x	x		x		x		x	x	x		x	
Badges	x		x	x	x			x	x		x		x		x	x	x		x	
Virtual Goods	x	x		x	x			x	x		x		x		x	x	x		x	
Leaderboard		x	x			x	x			x		x		x		x	x		x	
User Level		x	x			x	x			x		x		x		x		x	x	
Progress Bar		x	x			x	x			x		x		x		x		x		x
Feedback	x			x		x	x			x		x		x		x	x		x	
User Avatar	x		x	x	x		x			x		x		x		x	x		x	
Mediating Avatar	x		x	x		x	x			x		x		x		x		x		x
Missions	x			x	x		x			x		x		x		x	x		x	
One-Time Narratives	x			x		x	x			x		x		x		x	x		x	
Processing Narratives	x		x			x	x			x		x		x		x	x		x	
Reminder	x		x			x	x			x		x		x		x		x		x
Time Manipulation	x			x		x	x			x		x		x		x		x		x

Table 20: Revised Taxonomy Version
Source: Own Illustration

Some elements can be assigned to multiple characteristics. Assigning an element to both characteristics of a single dimension removes their mutual exclusivity (Nickerson/Varshney/Muntermann 2013). Developers of gamification concepts must, for example, decide whether to design static or developing badges, or whether to use both variations. To provide further guidance and overcome the limitations of mutually exclusive characteristics, I developed an additional table to assist the design of gamification concepts using the taxonomy. Recommendations concerning design variations were provided either by interviews or from among consulted literature (see Table 21 for an excerpt of the complete table, which can be seen in Appendix A.4).

Element	Characteristic	Implication	Example
Badges	Developing	Developing badges can be used to encourage the progress of users in completing tasks. Particularly if tasks consist of several parts.	Bronze, silver, and gold badges.*
	Static	Static badges can be used to reward users each time they have completed a task and if tasks do not develop.	A user earns a badge for answering quiz questions (Alcivar & Abad, 2016).
* Recommendations given by interviewees.			

Table 21: Excerpt of Implications and Examples for Element Designs
Source: Own Illustration

Badges can be used as developing or static elements: developing badges can be used to further encourage a user when working on tasks incorporating different stages of difficulty by using bronze, silver, and gold badges (mentioned by P2); static badges can be used to reward users when completing a task, such as providing correct answers (Alcivar and Abad 2016).

4.4.4 Case-based Taxonomy Validation

The final step concerned validation of the taxonomy to demonstrate its usefulness and to provide further guidance to gamification concept developers and to answer *RQ1c*. The taxonomy was validated using two case studies (Yin 2003): one demonstrating how it supports the analysis of gamification concepts, the other describing how it can be used to design new gamification concepts.

4.4.4.1 Analyzing Gamification Concepts: Nike+ Case Study

To demonstrate how taxonomy is used to analyze gamification concepts, and to validate the utility of my taxonomy as analysis tool, I used Nike+ (see Figure 21).

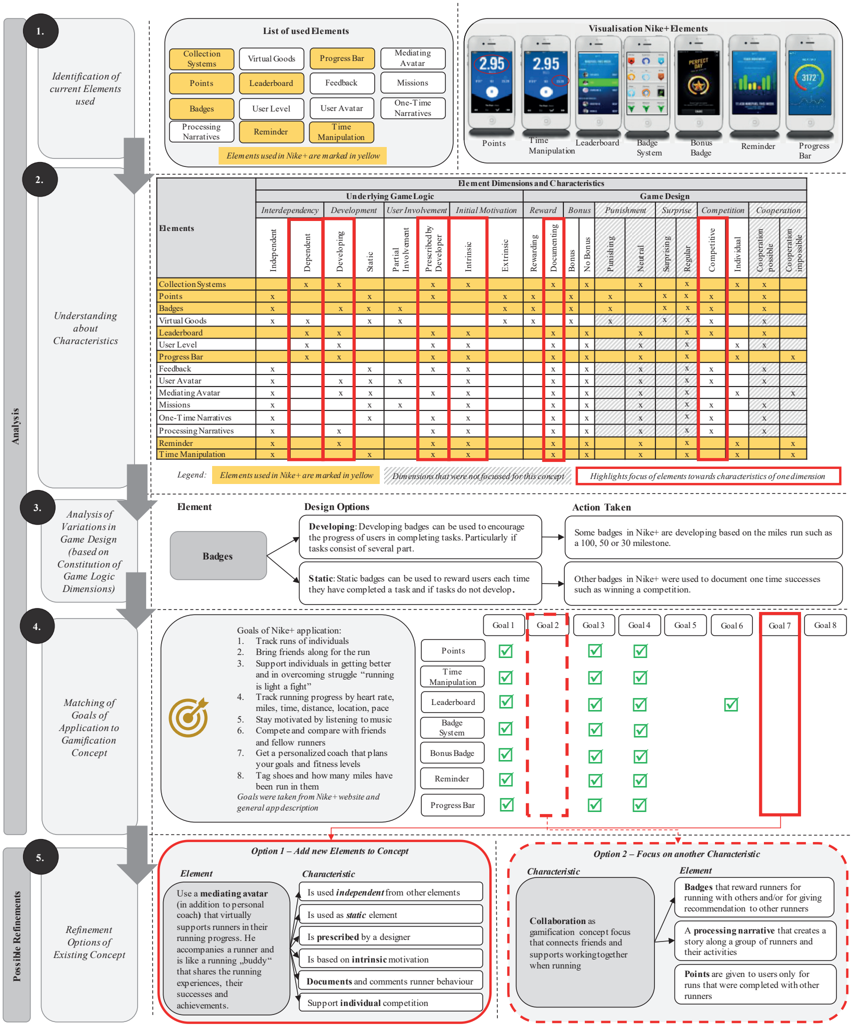


Figure 21: **Nike+ Case**
Source: Own Illustration

The analysis of existing gamification concepts includes five steps: identification of elements, understanding characteristics, analysis of game design variation, matching of goals, refinement of gamification concept. Nike+ is a popular mobile application that supports users' running behavior (Nike 2019). Concerning the related analysis, the *first step* involves identifying those gamification elements. The taxonomy determines that 15 different elements exist, of these, Nike+ uses seven: collection system, points (miles), badges, leaderboard, progress bar, time manipulation, and reminder. Marking these elements according to the taxonomy reveals part of the Nike+ game logic and design, and demonstrates the *second step*. Integrated elements have a dependent focus that reflects the overall concept of the application, which is also reflected by elements focus of acting as developing elements. Most elements are prescribed by the system designer and are grounded on an intrinsic and motivating concept. Looking at selected elements and their use demonstrates that the Nike+ gamification concept does not focus on punishment, collaboration, or surprise. Rather, its concept is grounded on rewards—— badges are given for successful behavior and as bonusses. Regarding bonusses, it was found that most elements do not act as bonus elements, however, the app uses additional badges to highlight progress milestones. The competitive concept is grounded on individual improvement; each time users commence a new run, they are encouraged to surpass previous results. Comparing results among friends using a leaderboard is possible, but does not dominate the overall concept.

The *third and fourth step* concerns understanding variations in the game design based on the logic that certain elements can be represented through multiple characteristics. The list of elements reveals that badges are either developing or static. Static badges remain unaltered, while developing badges change over time; Nike+ uses both. Static badges highlight individual successes and developing badges highlight milestones. After understanding the underlying game logic and design of Nike+, I looked at its overarching goals and how the gamification concept contributes to these goals. The app tracks individuals' running behavior, as reflected by the developing character of the elements used. Supporting individuals to improve is represented by the developing nature of the gamification concept; similarly, progress in running behavior is best reflected in the developing character of game's elements. Competition with one's friends is a central component. Goals not directly addressed by the gamification concept are important in the *fifth step*. Now it is known which goals are addressed by the game concept and which are not, the concept can be further refined by adding new elements or characteristics. The goal of Nike+ is to connect runners to a human personal trainer. Adding a virtual personal trainer supports individuals to work on their running success; this criterion is fulfilled by a mediating avatar. Another option is to select other elements. In the current concept, badges and points serve as rewarding components, however, grounding these on a collaborative concept—together with processing narratives—supports the secondary goal of connecting with friends.

4.4.4.2 Designing Gamification Concepts: Validation of Mobile Learning Application Case Study

Figure 22 provides an overview about the second case study.

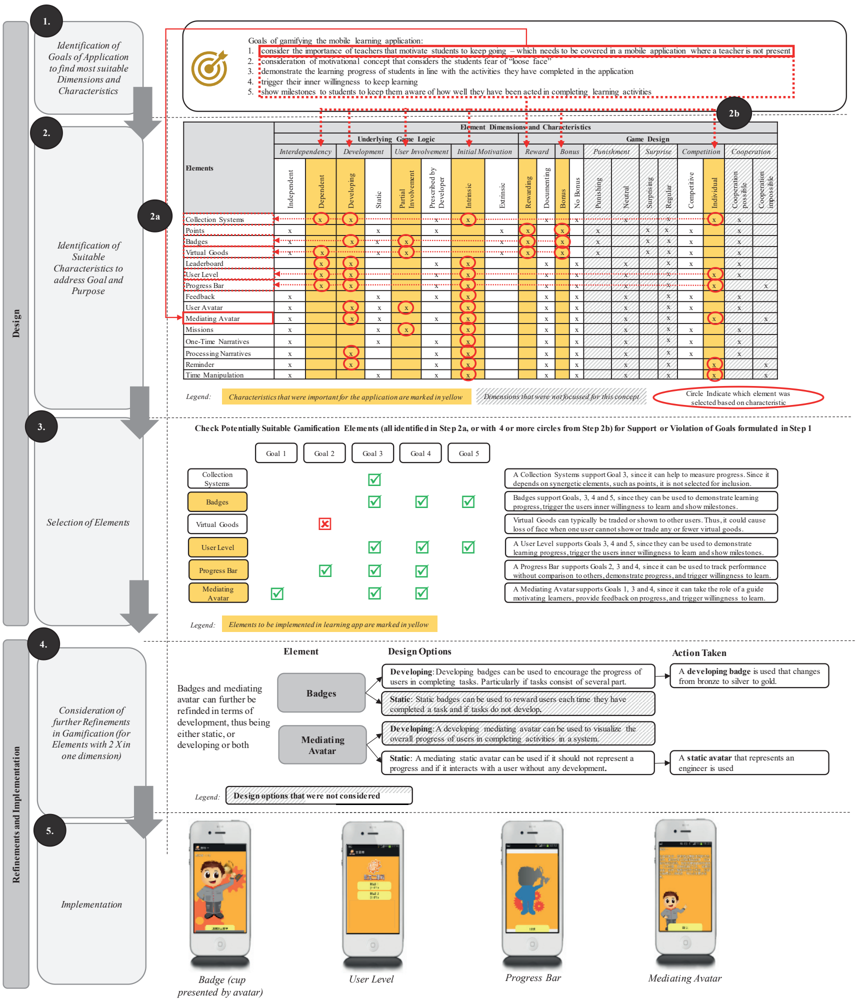


Figure 22: **Learning Application Case**
Source: Own Illustration

To underscore the utility of the taxonomy for guiding and designing user-centered gamification concepts, I discuss the case of a mobile learning application that is designed for Chinese vocational students in the automotive field within the context of a larger design science research project (Ernst et al. 2016). As above, five steps were used to design a new gamification concept: identification of goals, identification of characteristics, element selection, refinement of gamification concept, and implementation. When starting the mobile learning application, users can choose between different learning module tasks. While working on tasks, students can see a short task description as well as their task progress. Some tasks improve students' declarative knowledge; for example, one task involves users finding parts of a car in a scavenger hunt (Ceipidor et al. 2009). Other tasks improve students' procedural knowledge (see section 2.2 about different learning outcomes and types of knowledge); for example, one task poses the following problem: "The street is not illuminated enough. What do you do to fix this problem?" Learners are required to search for a car using QR codes of the relevant car parts that need fixing. After selecting a QR code, an users provide explanations about car parts related to the code.

The *first step* is to identify the goals of the mobile learning application. These goals are then used for the second step, whereby dimensions and characteristics important to the gamification concept are identified, especially when considering specific user contexts. This design step supports the decision to overrule the taxonomy's criteria of mutually exclusivity. If I work using three characteristics for development (developing, static, developing, and static), decide on developing elements, and consider the "developing" row, I will be unable to consider badges as elements because these are assigned to both characteristics. However, to deliver greater support when developing gamification concepts, I present an additional table with suggestions from consulted literature and expert interviews to decide about the characteristics of an element. In China, teachers guide students through different cases while representing someone students respect (Ernst et al. 2016). This supports the implementation of mediating avatars representing teachers within the learning app (*step 2a*). Dimensions and characteristics are used to identify elements for the gamification concept for other goals (*step 2b*). Dependent elements are relevant when demonstrating students' overall progress. Another important characteristic of mobile learning apps is the documentation of a user's development (Hakulinen/Auvinen 2014). To address a student's feelings of autonomy (Deci et al. 2001), a gamification concept allows for the partial involvement of users. Overall, intrinsic motivating components have more positive effects on the quality of a student's learning outcomes compared with extrinsic motivating components (Hanus/Fox 2015). Learners easily become frustrated when punished, so I used a reward-based gamification approach (Hattie/Timperley 2007). To keep students motivated and give them additional rewards, I decided to use a bonus to support the goal pertaining to progress milestones. Cooperation and competition were considered irrelevant because Chinese students tend to lose face when losing competitions or cooperating unsuccessfully (Redding/Michael 1983). Surprises are irrelevant because the milestones goal is supported by bonuses.

The *third step* concerns the identification of elements for a concept, which includes decisions as to how many elements are included. Existing research supports the use of four elements for a learning gamification concept (Schöbel/Söllner/Leimeister 2016). Assessment of characteristics reveals six relevant elements: collection systems, virtual goods, user level, progress bar, mediating avatar, badges. Virtual goods are not part of these concepts because they are rarely shown to other users, potentially resulting in loss of face. As collection systems are based on synergetic elements these were not considered for the gamification concept.

Further refinements of the gamification concept are possible in the *fourth step*. The gamification concept uses badges and a mediating avatar, and both are assigned to developing and/or static element development. At this point a designer must decide on characteristics they want to address. To support the applications goal of highlighting milestones and support the role of teachers in China, a developing trophy badge was used, represented by the mediating avatar. The development aspect is addressed by level and the progress bar, and a static mediating avatar is used for the gamification concept. In the fifth step, elements must be transferred into the app (see Figure 22).

The two cases were used to validate the taxonomy. In addition, the taxonomy addresses Nickerson et al.'s (2013) validation criteria, who suggest five attributes. A concise taxonomy has a limited number of dimensions (Nickerson/Varshney/Muntermann 2013), so I reduced the number of dimensions in the taxonomy to four (game logic), and six (design). A robust taxonomy provides for differentiation among the objects of interest (Nickerson/Varshney/Muntermann 2013). Through the study's interviews and case studies, I have demonstrated that each element has a different meaning and, by presenting both the similarities and differences among these elements, I have thereby contributed to a robust differentiation. Additionally, interviewees' feedback demonstrates that dimensions help explain existing elements, which contributes to the explanatory taxonomy aspect (Nickerson/Varshney/Muntermann 2013). Comprehensive taxonomies classify all objects of interest (in this study the objects are all relevant gamification elements) (Nickerson/Varshney/Muntermann 2013), so I collected descriptions from over 100 research studies. Additionally, I present similar terms to describe gamification elements, thereby addressing the comprehensive taxonomy attribute. Finally, an extendible taxonomy allows for the addition of new dimensions and characteristics (Nickerson/Varshney/Muntermann 2013); adding characteristics to the taxonomy should be unproblematic as there are two for each dimension. With additional meta-characteristics it should be possible to add more dimensions.

4.5 Discussion and Contributions

The goal of this section was threefold. First, I wanted to identify which elements exist in gamification (*RQ1a*). Second, I wanted to present a taxonomy that supports researchers and practitioners in acquiring a shared understanding of existing gamification elements (*RQ1b*). And third, I wanted to demonstrate how a taxonomy can support researchers and practitioners in constructing and understanding gamification concepts (*RQ1c*). *RQ1* is necessary to have a shared understanding about elements that exist in gamification and about their individual characteristics. With a shared understanding about elements and their characteristics I can better understand and interpret the results of my empirical studies in the context of TML.

4.5.1 Discussion of Results

In section 4.2, I present challenges of existing gamification taxonomies. I know demonstrate and discuss how my developed taxonomy addresses some to these challenges. Table 22 shows how I addressed these challenges when developing my taxonomy, and informs this section, whereby I provide insights for future research studies so to improve understanding of the development process of gamification concepts.

I have shown considerable diversity among the classifications and descriptions of gamification elements. An explanation for this might be that we do not yet understand what gamification means in terms of its various elements. Dimensions such as cooperation and competition do not necessarily limit the engagement experience or the fun experienced through elements such as leaderboards.

Challenge	Action Taken	*Concise*	*Robust*	*Comprehensive*	*Extendible*	*Explanatory*	*Applicable*
Encapsulation of elements	• Screening of gamification literature to identify and consolidate all terms and kinds of existing elements • Consolidation of similar terms to describe elements • Separation of elements (user avatars, meditating avatars)	x	x		x	x	
Incomplete list of elements				x		x	
Different categorizations of elements	• Presentation of dimensions and characteristics that describe each element in detail that • Consideration of element definitions and in combination with dynamics, and motives • Possibility to include additional dimensions, characteristics or elements • Additional recommendations about how to design elements under consideration of characteristics (if one dimension has more than two characteristic)	x	x		x		
Generic classification of elements		x	x				
Missing presentation of characteristics		x	x		x	x	x
Different understandings about relationships	• Mapping of elements with dimensions and characteristics	x				x	x
Missing validation	• Evaluation and revision of developed taxonomy • Validation with two cases to design and analyze gamification concepts	x				x	x
Descriptive focus		x				x	x

Table 22: **Taxonomy Challenges and Action Taken**
Source: Own Illustration

Cooperation can also be realized by connecting gamification concepts with social media to enable users to share what they have achieved with others (Aparicio et al. 2012). Additionally, competition is not solely about seeing one's position on a leaderboard, since competitive experiences cannot simply be handled as one-size-fits-all solutions (Santhanam/Liu/Milton-Shen 2016). Although my taxonomy is extendible, I recommend that researchers and practitioners should not limit their concepts to elements of my taxonomy and should consider the aims of their own gamification concepts. The gaming experience is about designing a concept users enjoy (Schmidt-Kraepelin et al. 2018). Gamification taxonomies can therefore be seen as starting points of the gamification development process, one not limited to the selection and combination of elements.

The taxonomy presents a two-staged process for the development of gamification concepts. Existing gamification taxonomies are mostly descriptive and used to describe existing elements and their categorization (section 4.2). Gamification should not be viewed as selecting and combining elements to change users' motivation, rather it is as an ongoing development process incorporating various design steps. Depending on weather a gamification concept is analyzed or designed, the first step in its design concerns selecting the best combination of element in relation to concept characteristics. Further refinements can then to each element's design. Although I present design variations of the taxonomy, its technical aspects—such as the number of points or the concrete design of a leaderboard—require further work. Additionally, gamification should be seen as a process incorporating several iterations needed to develop a meaningful concept. My taxonomy could therefore be used as part of an iterative method to develop gamification concepts and gamification methods requiring more detailed refinement (Deterding 2015). Through a shared understanding of gamification elements, and their characteristics and relationships, I can take a step forward in designing a more gameful experience for users. Furthermore, research is yet to determine the effects gamification on end-users (Seaborn/Fels 2015). The role of motivation is a key component of gamification, but is still not fully understood (Seaborn/Fels 2015), particularly regarding the extrinsic–intrinsic motivation relation, which requires further discussion (Ryan/Deci 2000). The taxonomy I developed categorizes each element in terms of its motivational orientation.

The taxonomy was subject to validation and evaluation, however, more must be learned about those relationships that exist among gamification elements, and how motivation is constituted according to different elements and element combinations. Element combinations may comprise the next step forward in realizing a better understanding of the role and meaning of different motivational orientations. While some literature supports the view that extrinsic motivation can harm intrinsic motivation (Kuvaas et al. 2017), this cannot be explained by the current version of my taxonomy. The addition of further dimensions may help to analyze this issue. Through my taxonomy's dimensions, I present new possibilities of analyzing gamification elements in relation to their expected outcomes, such as increasing cooperation and competition, which supports the identification of different gamification element combinations.

The taxonomy could be further improved by considering contextual aspects. Santhanam et al. (2016) suggest that not all competitions are the same, and that no one-size-fits-all design can be used in gamification design; they recommend that gamification designs should be adapted so that they are more meaningful to users. Accordingly, Liu et al. (2017) presents a list of less successful gamification examples that increase the contextual relevance of gamification design to users. Omnicare developed a gamification approach to improve helpdesk waiting times using time pressure, leaderboard, and point system elements (Hein 2013). Employees reported that they felt like they were being watched, which resulted in increased pressure and dissatisfaction (Liu/Santhanam/Webster 2017). The JetBlue badge programme was used in combination with a leaderboard to engage the airline's customers and motivate spending (Liu/Santhanam/Webster 2017). The concept was unsuccessful because customers felt that the programme requested too much personal information (Meermann 2013). These examples indicate that elements, and the design of those elements, should vary depending on the contexts and user groups addressed by the overall gamification design. The taxonomy is extendible and therefore supports the acquisition of a better understanding of element characteristics.

The JetBlue example also highlights a further issue that requires discussion, namely, that of element combinations and the examination of patterns of element combinations in gamification. The taxonomy introduces a discussion to the literature regarding the relationships that exist among elements. Different element combination patterns might work better in specific contexts. A typical pattern in gamification is the combination of PBL, however, relying on this combination of elements is not the key to successful game design, as has been demonstrated through the implementations of various gamification concepts (Burke 2012; Liu/Santhanam/Webster 2017). Clearly, different kinds of gamification patterns work better than others regarding the effects they have on motivation, and this is seen by observing different element combinations that influence motivation. For example, da Rocha Seixas et al. (2016) combine points, badges, levels, and goals and demonstrate positive effects on user motivation. Hanus and Fox (2015) used the same elements but, instead of using levels and goals, the researchers used a leaderboard to leverage competition among users, though without positive effects on user motivation. Both of these studies were conducted in a learning context and so it is possible that the benefits of competition in learning contexts may depend on how competitive elements are designed. The taxonomy presented in this study helps to better understand characteristics among gamification elements, though the relationship between gamification patterns and the context for which a gamification concept has been developed requires further discussion. I therefore encourage researchers to use the taxonomy to identify different patterns in gamification that might facilitate understanding of the relationships of elements and their characteristics and dimensions.

4.5.2 Practical and Theoretical Contributions

In summary, this study presented in this section provides several theoretical and practical contributions and contributes to type-IV theory (Gregor 2006). First, the literature review provides an overview of how current research studies use taxonomies to gamify ISs. The review highlights inconsistencies regarding the meaning and classification of gamification elements. I provide an overview of all existing gamification elements, and the relationships they hold with other elements, by presenting different element characteristics. I focus on describing and synthesizing gamification, and cover a very broad set of publications form many different disciplines (Leidner 2016); by describing and focusing on constitutions of element characteristics from these research studies, I make a broad sample of literature understandable.

Second, the taxonomy provides a new classification of elements that facilitates the sharing of knowledge and helps researchers avoid the randomized selection and combination of elements. I provide a more rigorous overview about how each element is related to other elements, and thereby assist in providing an improved understanding of effects caused by specific elements. The findings contribute to the body of gamification knowledge, as the taxonomic dimensions I have developed specify the meaning of each individual element. Through this I extend existing research on gamification frameworks by focusing on the unique characteristics and relationships of elements, rather than focusing on an overall understanding of gamification elements and their meta-design principles (Santhanam et al. 2016)). Accordingly, I'm able to better explain concepts behind existing gamification approaches while guiding researchers looking to develop new approaches. Having this in mind, I contribute to a better understanding about the design of gamification concepts. When designing gamification concepts, it is necessary to have a shared understanding about the functionalities and meaning of each individual element. Such a detailed understanding supports the extension of the knowledge base which is an important component to further analyze the environmental effects of gamification elements and to design them more meaningful and effective (see section 3.6 about DSR and the relevance of a knowledge base).

I further enrich theory by presenting a new way of using classifications of elements to support gamification concept developers; development should not be seen as merely selecting and combining elements, rather it should be considered as an ongoing process. Through the development of the taxonomy I found that using element characteristic extends beyond merely finding different classifications of elements, and this allowed me to concentrate on gamification concept design. I present a two-staged process for the development of gamification concepts based on the characteristics of elements used in gamification. Accordingly, I not only contribute to gamification theory but also to theories about the role and meaning of classifying objects within IS. Certain characteristics I present are not mutually exclusive, nevertheless I was able to provide guidance regarding the selection of characteristics for both existing gamification concepts and for the design of new ones.

Practically, the taxonomy offers system designers a solution for solving a real-world problem: the process of selecting, combining, and designing customized elements for IS. The taxonomy helps developers of gamification concepts to design more sophisticated gamification approaches and can be used as a guide for the construction of gamification concepts. By specifying the meaning of each element, practitioners can adapt their approaches to context characteristics and users' needs and interests. Furthermore, this study provides an overview of all element characteristics, thereby improving developers' understanding of existing gamification concepts. Developers can therefore further refine and adapt their gamified ISs to specific contexts or the specific needs of target groups, while also being able to identify element combination types. Finally, through the case-related validation I show how taxonomies can be used to support the developers of gamification concepts. In accordance with this I suggest practical means of overcoming issues related to taxonomic characteristics that are not mutually exclusive by presenting different design variations of elements.

4.6 Limitations and Future Research

This study is not without limitations that provide useful ideas for future research. *First*, I did not apply the taxonomy to different contexts or to different kinds of users, rather, I considered just two areas of application: learning and sports. Therefore, the taxonomy could be used to further explain existing gamification concepts and to develop new concepts in different contexts. In line with this, future research should conduct analyses to determine whether different element combination patterns exist for different gamification contexts.

Second, based on Leidner's (2016) recommendations, I conducted a literature review that focuses on describing and synthesizing existing literature (see section 3.2 about literature reviews), and tried to address the main gamification issues highlighted among existing researches. Comparatively, future literature reviews might instead focus on specific domains, such as crowd systems, health systems, and knowledge management systems (Leidner 2016).

Third, the taxonomy I developed only focusses on element characteristics, while future research could consider design variations of each element. For example, a leaderboard might present individuals with their real names or with self-created usernames; alternatively, the first three positions, or all positions might be shown on a leaderboard. The taxonomy provides a brief overview of how elements differ.

Fourth, I offer new ways of evaluating the success of gamification concepts in terms of specific kinds of criteria. A collaborative or competitive gamification concept can, for example, be tested by asking users about their experiences of a gamification concept and whether it supports cooperation or competition. I also invite other researchers and stem designers to analyze applications of the taxonomy so that it might be improved.

Fifth, the findings indicate that a two-step process might be necessary for developing gamification concepts. According to Deterding (2015), academic research on gamification and gameful design methods is still in its infancy, existing frameworks in gamification do not yet provide guidance as to how appropriate elements might be identified, and current research studies about gamification methods do not match elements with the basic needs of target groups. Future research should focus on the development of a gamification method that systematically guides developers of gamification concepts in selecting, combining, and adapting gamification concepts to specific contexts. Furthermore, future research should focus on providing a deeper understanding about taxonomies, especially in terms taxonomic dimensions do not offer mutually exclusive characteristics. To make characteristics mutually exclusive, most approaches refer to a combined solution, such as categorizing "developing and static" gamification elements. However, if the design of components is to be considered within the development of a taxonomy, then additional explanations and descriptions will be necessary if that taxonomy is to support a better understanding about the characteristics of its dimensions.

Finally, I encourage researchers to analyze and discuss the role and meaning of gamification and gamification elements in general. This will be necessary for an improved understanding of what gamification is and what it is not, and what should and should not be categorized as elements.

This study provides an answer to three research questions (*RQ1a, RQ1b, RQ1c*). At the same time, it delivers important insights for the studies I conducted in the context of TML. The insights gained from the developed taxonomy are useful for the three empirical studies that can be found in section 5, 6, and 7. The taxonomy supports the discussion of the findings of all these studies. By knowing the characteristics of each element, judgments can be made about the learners' reaction towards specific gamification elements. In addition, the taxonomy helps to find the most suitable design for each gamification element that I analyze. Having the taxonomy in mind, I next get a first understanding about which gamification elements learners prefer in TML.

5 Gamification Element Preferences of Users in Technology-mediated Learning[5]

5.1 Introduction

In this section, I address the second research question (*RQ2*) and its sub-questions (*RQ2a* and *RQ2b*):

RQ2: Which and how many gamification elements do learners prefer?

RQ2a: Which elements do learners prefer?

RQ2b: How many elements do learners combine to a bundle of elements?

RQ2 is used to get a first understanding of the users' reaction towards different kinds of gamification elements. The results of this analysis are used to find out which elements in gamification need to be focused on in terms of designing them more attractive for learners. In addition, this study is used to get a better understanding about the amount of gamification elements that should be combined to a bundle of elements. These insights are important for the empirical analysis of gamification elements presented in section 6 and section 7.

Despite some criticism about the overall gamification approaches, gamification projects often fail due to a missing consideration of the needs and preferences of system users. Fleming (2014) and de-Marcos et al. (2016), for example, highlight that current gamification concepts are designed without knowing which gamification elements users really want to have implemented. With regard to this, Santhanam et al. (2016) explain that there might be no one-size-fits-all solution for gamification designs. This criticism is, for example, reflected by the observation that the amount of gamification elements in previous studies varies from one gamification element (Hamari 2013; Pedro et al. 2015; Davis/Singh 2015) to five or more elements (Ibánez/Di-Serio/Delgado-Kloos 2014; Peham/Breitfuss/Michalczuk 2014; Simoes/Díaz Redondo/Fernández Vilas 2013). Consequently, a possible explanation for the limited success of gamification in practice is that different gamification elements are combined and implemented without considering the preferences of users (de-Marcos/Garcia-Lopez/Garcia-Cabot 2016;

[5] The insights presented in this section are based on Schöbel et al. (2016). I thank my co-authors and the reviewers, and associate editor of the ICIS 2016 for their ideas and suggestions to further improve the publication.

Fleming 2014). In this context, Schlagenhaufer and Amberg (2015) note that there are only few empirical studies on user preferences and requirements when aiming to use gamification elements in a non-entertainment-based context. Seaborn and Fels (2015) revealed this point for future research. They explain that it is necessary to determine the usefulness of particular gamification elements and that future research should aim at isolating the most promising and least promising gamification elements for a particular context. This can be supported by Hanus and Fox (2015), who explain that it is more important to investigate specific gamification elements rather than an overarching concept. Furthermore, although gamification can have positive impacts on user engagement, more research has to investigate the role of contextual and situational aspects, as they determine the motivational affordance of gamification element designs (Mekler et al. 2017). All these findings indicate that more research needs to be conducted to determine the usefulness of particular gamification elements by isolating the most promising and least promising elements in gamification (Hanus/Fox 2015).

In conclusion, the goal of this study is twofold. In a first step, I want to find out which gamification elements users in a TML setting prefer (*RQ2a*). By determining which specific gamification elements users prefer, I can better understand how to create a gamified learning solution that increases engagement and motivation (Hanus/Fox 2015). Furthermore, I want to find out how many gamification elements users would combine to a bundle of elements (*RQ2b*). The results of this study are important to draw conclusions about which elements need to be focused on in future research studies.

5.2 Theoretical Background

To analyze preferences of users towards gamification elements, research should focus more on the selection, amount, and combination of gamification elements in different contexts by considering the usefulness of particular gamification elements. Referring to this, Seaborn and Fels (2015) imply that future research should aim at isolating the most and least promising gamification elements for a particular context. As outlined in section 2.1.2, gamification elements are building blocks of the gamification concept. In this study I focus on ten gamification elements[6].

[6] Note: This study was conducted in 2016. The study about the classification of gamification elements was conducted afterwards in 2019. Therefore, the list of elements that were used for this study slightly differs from the list that is presented in the taxonomy.

In addition, I included the element of loss aversion (Thiebes/Lins/Basten 2014), to better judge about the meaning of getting rewards or taking awards such as points. Under some circumstances, feeling pressures or having the feeling of losing something also motivates users to change their behavior known as prospect theory (Abdellaoui/Bleichrodt/Paraschiv 2007). Ten elements are considered: missions, time manipulation, points, badges, progress bar, leaderboard, level, mediating avatar, loss aversion, virtual goods. A definition of each element is shown in Table 23.

Name	Definition of Gamification Element
Missions	Missions are achievable steps that users can accomplish while working on actions and/or activities in an IS.
Time Manipulation	Time manipulations are applied regarding the completion of certain activities and actions in an IS using a counter or an hourglass.
Points	Points are numerical units that are obtained for completing an activity and/or action in an IS.
Badges	Badges are visual icons that signifies an achievement a user accomplishes while working on an activity and/or an action in an IS.
Progress Bar	A progress bar is used to indicate the learner's progress when working on activities and/or actions in an IS without comparing a learner's performance to those of other users, and without challenging them.
Leaderboard	On a leaderboard, a learner can compare their own performance with the performance of other learners. A learner's performance is often presented as a ranking.
Level	A level shows a learner's progress in working on system activities or actions and displays their experience through different level positions. Levels are cumulative, thus a higher level can be reached by completing previous levels.
Mediating Avatar	A mediating avatar guides learners while they use an IS, and provides feedback on their performance and IS outcomes. Mediating avatars are created by the system designer with a specific goal.
Loss Aversion	Loss aversion influences learners not by earning a reward, but by receiving a punishment.
Virtual Goods	Virtual goods are assets with a perceived value that can be purchased or traded (e.g., coins).

Table 23: Definition of Gamification Elements
Source: Own Illustration

This preference analysis helped me to get a better understanding about the learner's reaction towards such elements. These elements were presented in a BWS and in more detail in section 3.4.4.1.

5.3 Methodology

Data were collected by using a survey (see section 3.4.2 about surveys) which is explained in this section. Before deploying the final survey, I conducted a pre-test with 15 graduate students and 20 researchers. The pre-test was intended to assess whether the survey was accurate and whether or not the questions were understandable for the participants. Apart from some typing mistakes, the participants stated that the survey is understandable. After pre-testing the survey, I applied minor changes to the wording and specified the order of appearance of gamification elements within each choice set to avoid any potential order effects.

The final survey consisted of three steps: description of gamification elements, choice task, and combination task. In addition to these tasks, I asked for demographics. In the first task, I described and visualized each gamification element in detail. In addition to the description of each element, I used a screenshot with which I visualized the elements in a learning management system. In the pre-test, I found out that this kind of explanation is helpful for the participants to understand the meaning and purpose of each gamification element.

To ensure that the participants are familiar with the described gamification elements, I added two questions to the first part of the survey. Besides the question whether the participants know the elements, I asked them they came across the respective elements before. In the choice task, each respondent was shown 10 gamification elements in 15 different choice sets. A choice set represents a varying set of four gamification elements. The choice sets were constructed due to the use of BWS for the evaluation of user preferences. In general, 2^k choice sets are necessary to obtain valid results (Cohen 2003). According to this, k stands for the number of attributes in the analysis. As I used 10 attributes, I would normally have to present 1024 choice sets. However, most studies use a balanced incomplete block design (BIBD), which offers a smaller amount of choice sets to receive valid results as well (Flynn et al. 2007; Severin et al. 2013; Lansing/Schneider/Sunyaev 2013). A BIBD is a type of design in which each choice option (i.e., gamification element) appears and co-appears equally often with each of the other choice options (Louviere et al. 2013; Lee/Soutar/Louviere 2008). By using the find.BIB command in the statistical software program R, I was able to identify a sufficient amount of choice sets.

According to the identified choice sets, I followed the guidelines by Orme (2005). In accordance with Orme (2005), there are four different general recommendations that I fulfilled. An overview about the different criteria and how I addressed them is given in Table 24.

Criteria by Orme (2005)	Criteria for this Study
Display four or five items per choice set.	For the analysis, I displayed four items per choice set.
Make sure each item is displayed three or more times for each respondent.	For the analysis, I displayed each item six times for each respondent.
Show an item just once in one choice set.	For the analysis, I presented four different items (gamification elements) in one choice set.
For 10 or less items, stop around 15 choice sets.	For the analysis, I used 10 items (gamification elements) with 15 choice sets.

Table 24: Criteria for the Construction of Choice Sets
Source: Own Illustration, based on Orme (2005)

Additionally, to avoid order effects, I showed each gamification element at each position (Cohen 2003). A complete list of the identified choice sets can be seen in Table 25. The visualization of the elements and their description and the combination task are demonstrated in Appendix B.

Gamification Elements	**Choice Set Number**															**Appearances**
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	
Level	0	1	0	0	0	1	0	0	1	0	1	0	1	1	0	6
Points	0	1	0	1	1	0	0	1	0	0	1	1	0	0	0	6
Missions	1	0	1	0	1	0	0	1	0	0	0	0	1	0	1	6
Progress Bar	1	1	0	0	0	1	1	0	0	1	1	0	0	0	0	6
Badges	1	0	0	0	0	0	1	0	1	0	0	1	0	1	1	6
Leaderboard	0	0	0	1	1	0	1	1	0	1	1	0	0	0	0	6
Virtual Goods	1	0	1	1	0	1	0	0	1	1	0	0	0	0	0	6
Mediating Avatar	0	0	1	0	1	0	0	0	0	1	0	1	1	0	1	6
Time Manipulation	0	0	1	1	0	0	1	0	0	0	0	1	0	1	1	6
Loss Aversion	0	1	0	0	0	1	0	1	1	0	0	0	1	1	0	6
Total	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	-
Note: 1 indicates a gamification element is present in a set, 0 indicates the gamification element is not present in a set.																

Table 25: Design for Choice Sets
Source: Own Illustration

Except for the position of each gamification element, I present the appearance and the total number of elements in one choice set. In the third step, I asked the participants which elements they would like to have in a bundle in a IS to suit their preferences. The participants were instructed to select the gamification elements out of a list that they would like to have within a bundle. More precisely, the participants could freely choose how many and which gamification elements they would combine. Thus, I made a descriptive analysis for identifying which and how many gamification elements users would like to combine. Hence, I used a frequency distribution to present and analyze the results of the combination analysis. More precisely, I calculated the frequency of the gamification bundles and identified the frequency of each individual gamification element in the constructed bundles. Finally, in the last part of the survey, I added some scales for evaluating demographic data. Therefore, I constructed an online survey and asked university students who regularly use an IS to study for university to participate. The respondents for the survey were recruited via a social network asking for participants who use an IS to study at their university. Additionally, I sent the survey to several universities via email. In total, I was able to obtain 287 completed and usable surveys for the analysis. Overall, 145 (50.52%) participants were female, 142 (46.98%) male. The youngest participant was 17 years old and the oldest 51 years old. The participants' average age was 26 years.

5.4 Results

5.4.1 Results of Best-Worst Scaling

I made two different kinds of analyses to answer *RQ2a*. I used a counting analysis and two kinds of conditional logistic regressions (see section 3.4.4.1 about regression analyses). The results can be seen in Table 26.

Element	**Counting Analysis**				**Conditional Logistic Regression**				**Rank**
	B	**W**	**Mean**	**STD**	**MaxDiff Model**		**Linear Prob. Model**		
					Coef.	*STD*	*Coef.*	*STD*	
Level	826	82	0.4320	0.3676	1.1367	0.0368	0.0720	0.0026	1
Points	746	60	0.3983	0.3868	1.0636	0.0373	0.0663	0.0026	2
Missions	752	99	0.3792	0.4531	1.0209	0.0375	0.0632	0.0026	3
Progress Bar	550	209	0.1980	0.1980	0.5725	0.0401	0.0330	0.0026	4
Badges	312	450	-0.0801	0.5216	-0.2385	0.0414	-0.0133	0.0026	5
Leaderboard	396	538	-0.0824	0.6135	-0.2454	0.0414	-0.0137	0.0026	6
Virtual Goods	319	495	-0.1022	0.5644	-0.3031	0.0412	-0.0170	0.0026	7
Mediating Avatar	158	604	-0.259	0.4829	-0.7327	0.0393	-0.0431	0.0026	8
Time Manipulation	189	646	-0.2653	0.5177	-0.7490	0.0392	-0.0442	0.0026	9
Loss Aversion	49	1114	-0.6184	0.3879	-				10
All regression coefficients are significant at p<.001									

Table 26: Results of Best-Worst Scaling
Source: Own Illustration

With the counting analysis, I calculated a score for each gamification element for each of the 287 respondents. I first calculated the difference between the number of times each gamification element was chosen as most preferred (best) and the number of times each gamification element was chosen as least preferred (worst). Afterwards, I divided the difference by the number of times each gamification element was shown (hence, six times) multiplied by the total number of responses (Lansing/Schneider/Sunyaev 2013; Flynn et al. 2007). For example, the calculation for the element *level* would be the following: mean= (826-82)/(6*287) = 0.4320. The resulting scale ranges from -1 to 1. A higher score implies a higher preference and vice versa.

In addition, I made two conditional logistic regressions. Marley and Louviere (2005) as well as Orme (2005) in their research study argue that a conditional logistic regression should lead to the same results as the counting approach which can be supported for this analysis. As I needed a dependent variable for the regression analysis, I followed the guidelines by Flynn et al. (2007) and Hair (2010). Therefore, I used a binary coded dummy variable. More precisely, I created one observation for each possible best-worst pair per choice set per respondent. For example, if a choice set with *points*, *level*, *mediating avatar*, and *leaderboard*, would result in 24 possibilities of best-worst combinations for one respondent for this choice set. As an example, the participant could choose *points* as best and *mediating avatar* as worst. In this case, the dummy variable would be coded with 1, with the combination indicating *points* as best and *mediating avatar* as worst; it would be coded with 0 for all other possibilities. The gamification elements were used as independent variables for the regression analysis.

To avoid the dummy variable trap, I chose one independent variable as reference category and excluded it from the data sets (Hair et al. 2010). I decided to exclude *loss aversion*, as it is the element with the lowest rank in the counting analysis. Table 26 indicated that both regression analyses and the counting analysis deliver the same ranking positions.

5.4.2 Results of Combination Analysis

To understand how many elements learners would combine in a bundle and to further verify the results of the BWS and to answer *RQ2b*, I added a combination section to the survey. More specifically, I wanted to find out which gamification elements users would combine to bundles. Therefore, I first counted the frequency of how many gamification elements the participants included in a bundle. The results can be seen in Table 27.

The results indicate that the amount of gamification elements within a bundle varies. The participants created bundles consisting of numbers between one and eight gamification elements. Most participants would integrate 3 or 4 gamification elements (the overall mean is 4.164, see Table 27).

Number of Elements	Frequency
1	7
2	31
3	65
4	80
5	39
6	46
7	12
8	7
Mean	**4.1637**

Table 27: Combinations of Gamification Elements
Source: Own Illustration

I identified 167 different combinations of gamification elements. Most combinations included four (48 different combinations) and three (37 different combinations) gamification elements. Twenty-four different combinations included five elements, whereas 27 combinations included six gamification elements. Ten and five different combinations included seven and eight gamification elements, respectively.

Element	Frequency (in %)	Rank BWS
Points	75.61%	2
Missions	66.55%	3
Level	63.41%	1
Progress Bar	54.01%	4
Leaderboard	41.46%	6
Virtual Goods	27.87%	7
Badges	26.83%	5
Mediating Avatar	26.48%	8
Time Manipulation	26.48%	9
Loss Aversion	7.67%	10

Table 28: Frequency of Elements in a Bundle
Source: Own Illustration

As a next step, I assessed the frequency of the gamification elements in the created bundles. More precisely, to measure the frequency regarding the bundles, I counted each gamification element in the bundles in relation to the total amount of participants. The frequency of the gamification elements in the bundles is similar to the results of the BWS. From rank 1 to 7, the order of the frequency is different to the order of the BWS. However, in both rankings, I can identify the same elements for ranks 1 to 4 with a different order (please recall that the mean value for the number of gamification elements that should be included is 4.164). The results can be seen in Table 28. After analyzing the frequency of each gamification element, I focused on the frequency of the most preferred gamification elements in the bundles. Therefore, I focused on the most preferred bundles of three, four, five, and six gamification elements. Hence, I counted the amount of the best-ranked gamification elements *progress bar*, *level*, *points*, and *missions* in the most preferred bundles of three to six gamification elements (Table 29).

Number of Elements in a Bundle	**3**	**4**	**5**	**6**
Number of Participants	65	79	39	46
Level	26	**60**	31	36
Points	**40**	58	**36**	**45**
Missions	26	**60**	31	42
Progress Bar	22	45	26	38

Table 29: Frequency of best Ranked Elements in Bundles
Source: Own Illustration

Sixty-five participants wanted to have an element bundle consisting of three elements. Forty participants integrated *points*, 26 integrated *level* as well as *missions*, and only 22 integrated *progress bar* regarding a bundle consisting of three gamification elements. Based on the results, 79 of the participants preferred having a combination of four elements. Regarding this, 60 participants integrated the gamification element *level* as well as *missions* into a bundle consisting of four gamification elements. Fifty-eight participants integrated *points* and 45 integrated *progress bar*. Regarding bundles consisting of five elements, most participants integrated *points* compared to *level*, *missions*, and *progress bar*. However, 36 of these 39 participants included *points* in their bundles of five gamification elements. Thirty-one participants integrated the gamification element *level* as well as *missions* into a bundle consisting of five elements. The element *progress bar* was included by 26 participants in a bundle consisting of five gamification elements. In a bundle of six gamification elements, 45 participants included *points* and 42 participants included *missions*. Thirty-eight participants integrated *progress bar* and 36 integrated *level* into a bundle of six gamification elements.

In a next step, I analyzed how often the four most preferred gamification elements were combined together. More precisely, I analyzed how many participants combined *points*, *level*, *progress bar*, and *missions* in one bundle. Hence, I analyzed how often all four, three, two, and one of the most preferred gamification elements were combined within a bundle. The results can be seen in Table 30. The previous results show that 65 participants wanted to have a bundle consisting of three gamification elements. Thirteen (20.00%) of these 65 participants integrated three of the best four gamification elements into a bundle. More precisely, the bundles with the best-ranked elements are: *progress bar, missions, level; points, missions, level; points, progress bar, level; points, progress bar, missions*. Further, 28 (43.08%) of the 65 participants integrated two of the most preferred gamification elements into their bundles of three elements, whereas 19 (29.23%) of the 65 participants integrated at least one of the most preferred elements.

Number of Elements in a Bundle		**3**	**4**	**5**	**6**
Number of Participants (total)		65	79	39	46
Amount of participants who integrated best elements in bundles*	All four elements	0	16	15	30
	At least three of the best four elements	13	37	17	10
	At least two of the best four elements	28	20	7	5
	At least one of the best four elements	19	6	0	1
	None of the best four elements	5	0	0	0
*Each participant was considered only once.					

Table 30: Combination of best Ranked Elements in Bundles
Source: Own Illustration

Five (7.69%) of the 65 participants included none of the four most preferred gamification elements in their bundles of three gamification elements. Most combinations could be identified in a bundle consisting of four gamification elements. One combination integrates the four most preferred gamification elements. Sixteen (20.25%) of these 79 participants chose the combination of *missions, points, level*, and *progress bars*. Thirty-nine (46.84%) of the 79 participants used at least three of the four most preferred gamification elements in their bundles consisting of four elements. Further, 20 (25.32%) of the 79 participants used at least two of the four most preferred elements. Six (7.59%) of the 79 participants integrated at least one of the four most preferred elements. Consequently, there were no participants who included other gamification elements than the four most preferred elements in their bundles of four elements. Thirty-nine participants wanted to combine five gamification elements. Fifteen (38.46%) of these 39 participants integrated all four most preferred gamification elements together with a further element into a bundle consisting of five elements. Seventeen of the 39 participants integrated at least three of the four most preferred gamification elements into their bundle of five gamification elements. The remaining 7 (17.95%) of the 39 participants included at least two of the four most preferred elements in their bundles. Finally, 46 participants wanted to combine six gamification elements.

Thirty (65.22%) of these 46 participants integrated the four most preferred gamification elements together with two of the six other elements, and 10 (21.74%) of the 46 participants integrated three of the four most preferred gamification elements into their bundles of six gamification elements. Furthermore, 5 (10.87%) of the 46 participants included at least two, and one (2.17%) of the 46 participants included one of the four most preferred gamification elements in their bundles of six elements. Again, there is no bundle without at least one of the most preferred elements.

5.5 Discussion and Contributions

The study was used to get a first understanding of how learners react towards gamification elements in terms of their preferences. To further get insights about which elements need to be analyzed in more detail regarding their design. I analyze badges in combination with points (section 6) and mediating avatars (section 7) in more detail to identify how they should be designed to motivate users and to even change their behavior (learning success). The discussion of this study is guided by the insights gained by the taxonomy about the characteristics of gamification elements (section 4).

5.5.1 Discussion of Results

According to the results, learners prefer the gamification elements *level*, *points*, *missions* and a *progress bar*. Learners do not prefer *badges*, *leaderboard*, *virtual goods*, *mediating avatars, time manipulation*, and *loss aversion* (*RQ1a*). Unlike the results of this study, existing research studies mainly used the gamification elements *badges*, *leaderboard*, and *points* (Davis/Singh 2015; Domínguez et al. 2013; Hamari 2013). In contrast to previous research results, the findings show that learners prefer intrinsically motivating gamification elements. Apart from *points* and *badges*, all of the most preferred elements motivate users intrinsically (section 4). Therefore, current studies clarify that gamification approaches should focus more closely on intrinsic motivation. Cruz et al. (2017) explain that motivation caused by extrinsic gamification elements is just short-term. While previous research studies primarily used *badges* in TML for motivating extrinsically, the results indicate that learners, to the contrary, do not prefer *badges*. For example, Haaranen et al. (2014) evaluated that learners have strong negative emotions towards *badges*. Hence, to achieve long-term effects regarding motivation, more approaches should focus on the use of intrinsically motivating gamification elements (McKernan et al. 2015). More precisely, basic psychological literature demonstrates that individuals are intrinsically motivated to fulfill activities that satisfy their basic psychological needs (Deci/Ryan 2000). However, the results indicate, that intrinsically motivating gamification elements might be more effective because elements such as *levels* or *progress bars* clearly visualize the individual progress learners achieve (Melero/Hernándes-Leo/Manatunga 2015). These insights were used for another study I present in this dissertation that focuses on designing *badges* for TML situations (section 6).

The results of this study suggest that learners prefer gamification elements that support them in challenging their own results by achieving a higher *level* or by finishing a certain *mission* (Melero/Hernándes-Leo/Manatunga 2015; Passos et al. 2011). A *level* is an element that develops and shows the overall progress of users whereby *missions* are static but support learners in focusing on the most important activities (section 4). The results of this study indicate that learners do not prefer *leaderboards,* which are competitive elements (section 4). Competition refers to the individuals need take part in competitions to feel more competent and efficient (Mummendey 1990). Strong competence indicates that individuals want to compare their achievements with those of others because they think that they are superior to them. More precisely, competence refers to self-presentation, which means that an individual can impress other individuals with a positive self-presentation (Mummendey 1990). According to the results of this study, competitiveness seems to have a different role and meaning for learners. Sanathanam et al. (2016) analyzed the role of competition in their recent research study. They found support for the idea that effects of competition on learning outcomes vary across different competitive structures. Overall, the results of this study indicate learners prefer gamification elements that provide assistance in their individual learning progress without considering the progress of other users (Schöbel/Lehmann/Oeste-Reiß/Söllner 2016).

The second goal of this analysis was to get a better understanding of how many gamification elements should be combined to a bundle of elements (*RQ2b*). The participants of the survey integrated one to eight gamification elements into their bundles. More precisely, learners wanted to integrate four gamification elements on average. Referring to previous research studies, the amount of gamification elements in IS that is used for learning purposes varies from one (Davis/Singh 2015; Fernandes et al. 2012; Hamari 2013) to six elements (Ibánez/Di-Serio/Delgado-Kloos 2014; Peham/Breitfuss/Michalczuk 2014). True to the saying “less is more,” the results of this study indicate that users would prefer a combination of four gamification elements.

Regarding this, long-lasting motivational effects may be reduced by implementing a greater amount of gamification elements (Hanus/Fox 2015). Based on the amount of gamification elements, I evaluated which elements learners would combine. This results strengthen the results of the BWS. Most learners integrated the gamification elements *points*, *level*, *progress bar*, and *missions* into their bundles. More precisely, learners preferred to have at least three of the four most preferred gamification elements in their bundles of four elements. Hence, it is important to focus on the design and combination of specific gamification elements rather than on constructing an overarching game with the highest possible amount of elements (Hanus/Fox 2015).

5.5.2 Practical and Theoretical Contributions

This study provides theoretical and practical implications. Under the light of Gregors (2006) explanations of theory, I would judge about this study as a typ II theory. I present a list of gamification elements in relation to user preferences. I contribute to gamification theory by indicating which of the ten analyzed elements are of relevance in digital learning in relation to user preferences. Based on the characteristics (section 4) of each ranked element I can better explain which elements users prefer and which they do not prefer. The results indicate that gamification element preferences might be determined by contextual and situational aspects. Therefore, I also contribute to learning theory and the relevance of using specific gamification elements in TML. Learners prefer gamification elements that provide guidance for their individual learning progress regarding a certain task. Further, the results indicate that learners such as to compete against themselves instead of competing against others. More precisely, using *levels* instead of *leaderboards* might be more appropriate to challenge learners to achieve better results. Therefore, gamification elements in TML should clearly refer to certain tasks of learners by focusing on and rewarding the individual success of them. According to the results, the importance of experiences that are intrinsically motivating, meaning enjoyable, might dominate as predictors of better learning outcomes.

From a practical perspective, the findings indicate that learning can be optimized by gamification elements based on the needs and preferences of users. Organizations and gamification project managers must understand the potential of gamification to develop the skills of learners to lead them to better learning outcomes. In many cases, gamification is not working because most gamification projects focus on obvious gamification elements such as *badges*, *leaderboards*, and *points* rather than the more subtle game design that considers contextual aspects as well as the needs of the target group (Fleming 2014). Referring to this, the results indicate that gamification elements should be designed under consideration of contextual aspects to make the system use more engaging for the target audience. Hence, gamification designers should consider a gamification element design that visualizes the individual learning progress of users. For constructing gamified TML solutions, gamification designers should integrate a maximum of four gamification elements. Having a large number of gamification elements might have contrary effects on motivation and learning outcomes (Hanus/Fox 2015). Furthermore, gamification designers should consider that gamification elements such as *time manipulation* or *loss aversion* might work in daily life but not in learning.

5.6 Limitations and Future Research

This study is not without limitations, which provides implications for future research. Relating to the survey participants, I focused on university students. Therefore, the average age was 26 years. Hence, further analyses should consider older learners, maybe in a company setting. Additionally, I focused on TML. That is why future research studies should have a closer look on different kinds of IS (Hess/McNab/Basoglu 2014). Furthermore, I did not consider gamification dynamics and motives such as achievements or challenges which could also be a part of future analyses (Blohm/Leimeister 2013). I conducted an online survey for analyzing user preferences regarding gamification. This is not a real-life setting in which learners could work with the elements or experiences them. Therefore, further analyses are necessary that measure the reaction of learner towards different elements in a real-time setting while working in an online learning system. Finally, the results of this study reveal that more research should focus on dynamics such as competition (or cooperation) which was not a part of this study. Santhanam et al. (2016) suggest that it is necessary to isolate the effects of different competitive structures because not all competitions are the same and there may be no one-size-fits-all solution. Liu et al. (2013) point out that very little research has considered the cooperative, competitive, and cooperative-competitive design of gamification elements. This comes along with further research on the combination of cooperative and competitive gamification elements.

In summary, this study was used to get a first understanding about the gamification element preferences of learners (*RQ2a*) and about the way they combine elements (*RQ2b*). In the next section I present how badges should be designed to be motivating, engaging, and effective in terms of problem-solving skills. In section 7, I present the results of an mediating avatar-based study. I encourage other researchers to analyze how the designs of the remaining least preferred gamification elements can be adapted to make them more attractive to learners.

6 Exploring the Role and Meaning of Points and Badges in Technology-mediated Learning – An Experimental Analysis of Engagement, Satisfaction, Motivation, and Problem-solving Outcomes[7]

6.1 Introduction

The sixth and seventh section are used to demonstrate how to design points, badges, and mediating avatars in TML. I use this section to answer *RQ3*:

RQ3: How does the usage of points and badges in TML influence motivation, engagement, satisfaction with the learning process, and problem-solving skills of learners?

Problem-solving skills – such as business model development (Bertels 2018) – are critical to cope with our changing society as well as a central construct in management education (Kuo/Hwang/Lee 2012; Bigelow 2004; Smith 2005). Information technologies (IT) offer new ways of self-directed and individual learning of these problem-solving skills (Delen/Liew/Willson 2014; Rubin et al. 2010), by using online training which entails videos, knowledge tests or learning materials. However, due to the complexity of developing problem-solving skills via online training, it is important and yet difficult to keep learners engaged in the learning (Eseryel et al. 2014). Engagement in learning processes is concerned with the degree to which learners are actively involved from the beginning to the end of a learning process (Brown 2005; Henrie/Halverson/Graham 2015). Typically, the degree of engagement is influenced by a learner's motivation (Arbaugh 2000), which often suffers in complex online training. Reasons for decreased engagement include boredom, being distracted during a learning process, and fatigue. These ultimately lead to participants just clicking through the online training without focusing on the learning content, thereby resulting in insufficient learning outcomes (Davis/Singh 2015; de-Marcos/Garcia-Lopez/Garcia-Cabot 2016; de-Marcos et al. 2014).

[7] This section is based on the following submission: Schöbel, S.; Janson, A.; Hopp, J. C. & Leimeister, J. M. (2019): Gamification of Online Training and its Relation to Engagement and Problem-solving Outcomes. In: Academy of Management Annual Meeting (AOM). Boston, Massachusetts, USA. I thank my co-authors and the reviewers, of the AoM for their ideas and suggestions to further improve the publication. In addition, I thank all mentor of the MED paper development workshop (2019) where the paper was presented as well. The paper will be shortly submitted the Journal of Management Education (JME)

To overcome these challenges, gamification can be used. Literature calls for more research to analyze the role and meaning of engagement in learning when using specific gamification elements (Seaborn/Fels 2015; Hamari et al. 2016) for two reasons. First, gamification research in management education is still scarce. Second, gamification research still has to identify and analyze the variables surrounding engagement in gamification to investigate their relationships to a learner's skill development (Hamari et al. 2016). Thus, research still needs to figure out in more detail what engagement constitutes when using gamification elements and how it is related to problem-solving, especially in management learning. In line with this, research still must determine how gamification can influence complex learning goals and a learner's problem-solving skills.

The goal of this section is to better understand how gamification can influence learning performance in the form of problem-solving skills in management education and to better understand what engagement constitutes in learning. I will refer to badges in combination with points. Badges were not preferred by learners (section 5). Instead points were preferred. With this study I want to get a better understanding of how to design badges and points to make them more appealing to learners. Points and badges are oftentimes used in combination with a leaderboard (PBL) (Liu/Santhanam/Webster 2017). However, in line with the results of my preference analysis presented in section 5, the usage of competitive elements is still controversial discussed (Santhanam/Liu/Milton-Shen 2016). Both badges and points are collection elements and share the same characteristics, and their effects can be interpreted in the same way (section 4).

6.2 Theoretical Foundations

To analyze the role and meaning of engagement I next present the theoretical model of this section that highlights the relationship of engagement, motivation, problem-solving outcomes, and learning process satisfaction. I chose a theory-motivated design to develop the research model for this study.

6.2.1 Hypotheses Development

The research model is shown in Figure 23. I discuss the different hypotheses in the next subsections.

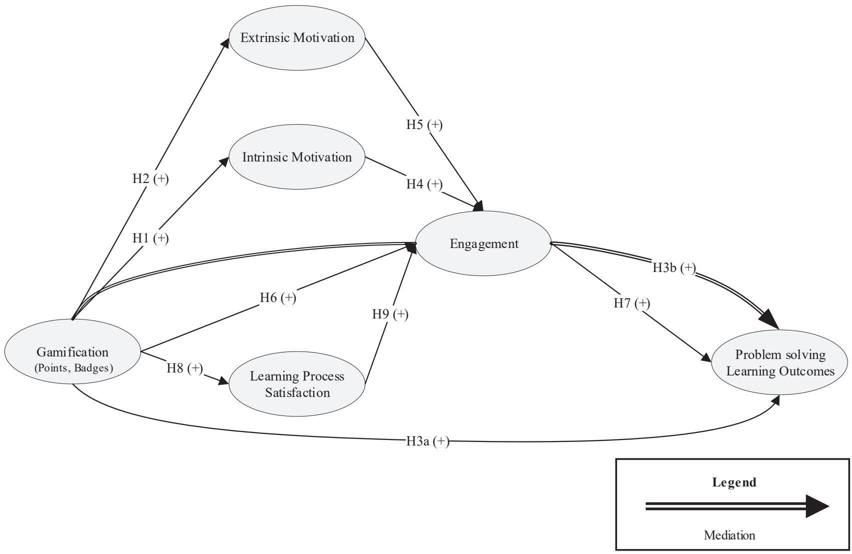


Figure 23: **Research Model**
Source: Own Illustration

6.2.1.1 Motivation

Gamification can promote motivation as well as engagement (Khan/Ahmad/Malik 2017). Two different kinds of motivation are typically distinguished: intrinsic and extrinsic motivation. Both intrinsic and extrinsic motivation in TML help to better stimulate, energize and manage a learning process because effective learning cannot happen without motivation (Hrbackova/Suchankova 2016; Mayer 2019; Garaus/Furtmüller/Güttel 2016). *Intrinsic motivation* is a form of self-regulation in which learners demonstrate their own interest in an activity and it denotes the pursuit of an activity because it is interesting and enjoyable (Mekler et al. 2017; Hrbackova/Suchankova 2016). Gamification can positively stimulate learning by assisting learners in managing their learning process (Khan/Ahmad/Malik 2017). Such stimulation can be achieved by delivering feedback to learners and enhancing learners' motivation (Garaus/Furtmüller/Güttel 2016) However, to have positive effects on learning, feedback needs to be related to a task (Attali/Areli-Attali 2015). Therefore, gamification elements that are designed to provide feedback to learners about their overall progress in learning can have motivating effects. Accordingly, I hypothesize:

H1: Gamification has a positive effect on intrinsic motivation.

Extrinsic motivation is about doing something due to an external outcome such as exerting pressure or extrinsic rewards (Mekler et al. 2017). By offering learners extrinsic rewards for their success and progress in a learning process, learners can be energized (Khan/Ahmad/Malik 2017). When using IT in learning, learners should comprehend why they are using a specific technology, to better understand what they will learn and what the need of the system is to better enhance their performance to be extrinsically motivated (Arbaugh 2000). Additionally, being more motivated in learning is linked to a need to feel more competent (Newmann 1992). Such a feeling of being more competent can be achieved by using game elements such as points or badges that signal the learners progress in finishing tasks – e.g., giving correct answers in a knowledge test (Christy/Fox 2016). More precisely, extrinsic motivation reflects an activity or behavior of a learner undertaken for some instrumental value or an external reason (Pintrich 2003). Therefore, by providing rewards such as points or badges, learners are driven by an external force that assists them in isolating the most important aspects in a learning process. Therefore, I hypothesize:

H2: Gamification has a positive effect on extrinsic motivation.

A gamification concept can be designed to signal competence to learners and address personal importance by showing learners their individual progress and by continuously supporting them in their learning process. Because learners with lower competences can be easily frustrated (e.g., as when they fail to get the right answer in a knowledge test), the gamification concept should be independent from achievement (Hanus/Fox 2015; Jang 2008; Newmann 1992). By knowing the personal importance and relevance of learning materials, learners tend to invest more effort and achieve more (Jang 2008). Keeping leaners motivated to have long-lasting effects on their academic achievement is also about giving them the feeling of being able to succeed even in mastering difficult tasks (Pintrich/de-Groot 1990; Maurer 2001). Therefore, high levels of self-efficacy can be associated with higher levels of learner achievement across all types of learning goals (Pintrich/de-Groot 1990). Such feelings of being able to successfully handle a learning process can be better controlled by using gamification. More precisely, gamification can be used as instrument to better guide learners in during their learning process by showing them their progress and rewarding them for continuing with a learning process. The more confident a learner is that he can perform an activity successfully, the more likely it is he will participate in the activity and continue with a learning process (Maurer 2001). Therefore, gamification can assist learners to better focus on their learning material by providing for example badges that learners receive for completing a goal and that document their progress in learning (Davis/Singh 2015). Summarizing this, I hypothesize:

H3a: Gamification has a positive effect on problem-solving learning outcomes.

6.2.1.2 Engagement

One important construct in gamification and learning is engagement. So far in gamification research, there has been little research on engagement's research models, its variables, and their interdependencies to learning (Hamari et al. 2016). Engagement is about being concentrated while working, being interested in doing something, and in enjoying what you are doing (Hamari et al. 2016). It is a psychological investment in and effort directed towards learning, understanding, or mastering knowledge or skills that are being promoted in a learning process (Khan/Ahmad/Malik 2017; Khan/Ahmad/Malik 2017; Brown 2005). In general, motivation is necessary to remain engaged; by being motivated and interested in something, people are engaged to continue with their actions – like continuing with learning (Hamari et al. 2016; Ding/Kim/Orey 2017). Being interested in something directs the attention of learners to that task, and attention in turn shows intrinsic motivation (Hamari et al. 2016). Thus, gamification elements that direct the attention of learners to what is most important in their learning process can have positive motivating effects. Extrinsic rewards can harm the effects of intrinsic motivation, because by relying on extrinsic rewards, individuals inner motivation to do something because they like to do it, can suffer (Attali/Areli-Attali 2015; Deci/Ryan 2000), intrinsic rewards are connected to extrinsic rewards. On the other hand, learners cannot rely only on intrinsic motivation to reach their learning goals; autonomous forms of extrinsic motivation should be considered as well (Garaus/Furtmüller/Güttel 2016). Furthermore, gamification elements that are related to educational outcomes can have positive motivating effects (Hanus/Fox 2015). Intrinsic motivation can mobilize learners to act, whereas extrinsic motivation refers to reward when an activity is finished (Ryan/Deci 2000). Thus, both extrinsic and intrinsic motivation promote performance gains, but intrinsic motivation can create psychological well-being (Mekler et al. 2017; Pintrich/de-Groot 1990). To achieve positive engaging effects, gamification concepts should be based on intrinsic motivating elements that deliver feedback to learners as well as extrinsic motivating components that additionally support learners in their learning progress. Overall, I hypothesize:

H4: Intrinsic motivation has a positive effect on engagement.

H5: Extrinsic motivation has a positive effect on engagement.

Understanding how engagement develops in TML is also about getting a better understanding about how to create an online training that has motivating instructions (Khan/Ahmad/Malik 2017). Such instructional designs help learners to better manage their own learning process and their self-regulated learning in which teachers are not available to give instructions. A gamification concept should keep learners steadily motivated, lead to a higher level of concentration, and result in more engaged learners (Newmann 1992; Khan/Ahmad/Malik 2017). More precisely, a gamification concept that specifies what rewards can be earned motivates learners as they clearly know what to do to get a reward; this in turn can lead to greater engagement (Ding/Kim/Orey 2017). However, besides knowing how to earn a reward, a reward should be related to what learners actually are learning so that learners better understand how it is connected to what they have to learn. Thus, I hypothesize:

H6: Gamification has a positive effect on engagement.

Engagement is closely related to a learner's problem solving skills (Pike et al. 2011). Engaged learners focus on what they are learning and concentrate during the learning process which supports deeper learning (Mayer 2019). Referring to this, engaged learners can focus on the most important content and keep learning without giving up or being distracted (Ding/Kim/Orey 2017). In TML such an engagement constitutes by guiding learners about what to focus on and by visualizing what their goal in learning is, which helps them to better understand how to proceed in a learning process (Ding/Kim/Orey 2017). Engaged learners can better focus on learning material which is why engagement leads to academic achievements, especially when learners can better control their learning process by deciding about their actions and next steps they will work on (Brown 2005; Henrie/Halverson/Graham 2015; Reschly/Christenson 2012). Engagement can also be a key to train more complex learning goals because learners have a better understanding about the overall learning process and keep working although some material might be more complex or difficult to understand (Arbaugh 2000; Eseryel et al. 2014). Summarizing this, a higher level of motivation leads to increased learner's willingness to engage in learning, which in turn can improve the learner's problem solving ability (Venkatesh 2000; Pike et al. 2011; Jang 2008). Overall, I hypothesize:

H7: Engagement has a positive effect on problem-solving learning outcomes.

Besides the direct influence of gamification elements on problem-solving learning outcomes, I consider in this study, I also hypothesize that engagement is a central construct influencing the effects of gamification on problem-solving learning outcomes. Engagement in learning can better explain the relationship between gamification elements and learning outcomes (Landers 2015). An important educational outcome is learner engagement which depends on the quality of implications given to learners and on how well their need of autonomy, competence, and relatedness is addressed (Jang/Reeve/Kim 2012). I posit that with a guiding and supporting design, gamification elements can support learner engagement and support their need for competence. As thus, engaging gamification elements will further influence problem-solving learning outcomes, thus mediating the influence of gamification elements on problem-solving learning outcomes. In consequence, I hypothesize:

H3b: Gamification mediates the influence of engagement on problem-solving learning outcomes.

6.2.1.3 Satisfaction with the Learning Process

Satisfaction with a learning process is an affective outcome (section 2.2.1). It can be described as the level of a learner to which he is immersed with an object. It also includes the additional positive feelings associated with their higher level of engagement (Fisher 2003; Gupta/Bostrom/Huber 2010; Garaus/Furtmüller/Güttel 2016). Satisfaction is the extent to which users believe the learning and teaching system they use meets their information requirements (Eom 2014). It is the perception of being able to achieve success and about having positive feelings about achieved outcomes (Hui et al. 2008; Keller 1987). Therefore, a gamification concept should be based on creating positive feelings in learning. These kinds of feelings can be achieved by showing and supporting the learner's progress in learning by using gamification elements that trigger positive feedback and feelings. This feeling of being satisfied with the learning process can be achieved by informing learners how well they have performed (Fisher 2003; Ferguson/DeFelice 2010). If a gamification element in learning can show how well learners have performed, it can have positive effects on their learning process satisfaction. This in turn will make learners want to continue with their learning process, which can be observed as greater engagement (Ferguson/DeFelice 2010; Lee et al. 2011). Overall, learners do best when they are engaged and this engagement can be determined by learning process satisfaction (Watson/Sutton 2012). Therefore, I hypothesize:

H8: Gamification has a positive effect on learning process satisfaction.

H9: Learning process satisfaction has a positive effect on engagement.

6.3 Research Design and Methodology

6.3.1 Study Context and Participants

I evaluated the theoretical model by conducting a fully randomized, pre-post-test, between-subjects experiment with students at a western European university (see section 3.4.3 about experiments). I developed online training on the value proposition canvas concept which is used as the design artifact of this analysis (Osterwalder et al. 2014). The training was embedded in the course "Introduction to Business and Information Systems Engineering", typically attended by 100-150 undergraduate freshmen students. Participation was voluntary but embedded in the mandatory tutorial sessions on campus. The specific learning goals of the training focused on the value proposition canvas and required building business models on value proposition. The training was provided within the open-source LMS Moodle (Moodle Pty Ltd.), which is also used for the course itself. To avoid common method bias (CMB) in this study, I considered several procedural remedies ex-ante as well as statistical remedies ex-post according to (Podsakoff et al. 2003) in this study. Concerning the participants of this study, I first collected 74 data sets. Concerning the above described statistical remedy to account for CMB, a Harmann's single factor test showed that CMB should not be a problem in this study. For the final data analysis, I had to delete six data sets because the participants did not answer the final survey that I used for the analysis of the hypotheses. Thus, I ended up with 68 valid data sets. The sample consisted of 39 female (57.35%) and 29 (42.65%) male students with an average age of 22.22 years. A detailed overview of the age and the participants' prior knowledge is depicted in Table 31.

Participants	n	Mean	Std. Deviation	Median
Age - Total	68	22.22	3.189	21
Age - Gamified Group	36	22.55	3.9	
Age - None Gamified Group	32	21.84	2	
Prior Knowledge – Total	68	6.764	2.9985	7.00

Table 31: Age and Prior Knowledge
Source: Own Illustration

6.3.2 Online Training and Learning Goals

To analyze the role and meaning of gamification in learning, I developed an online training program. I selected a topic that is based on the content of the course and, thus, relevant for all students and that provided additional learning material about the value proposition canvas. The online training was created with Adobe Captivate, a state-of-the-art tool for developing web-based trainings. To develop the online training, I used an instructional design – a systematic development of learning materials by considering empirical results. I began by developing learning goals for the online training. I concentrated on developing the participants' problem-solving skills – i.e., their cognitive processes such as analyze, evaluate, and create (Jonassen 2000; Anderson/Krathwohl 2016). I focus on three different kinds of problem-solving (Jonassen 2000). The trouble shooting problem-solving refers to the participants' abilities of solve case problems by, for example, finding a mistake in a described situation or context. Decision-making problem-solving requires the participant to select a single option from a set of alternatives by, for example, identifying weaknesses and strengths of an existing value proposition canvas. And finally, case analysis problem-solving refers to using alternative solutions for a given problem that goes beyond using learned methods and techniques by, for example, suggesting alternative canvases to make a business model more valuable for a company. I formulated two overarching learning goals (LG) with respect to the type of knowledge and the problem-solving skills (see section 2.2 about Blooms learning goal taxonomy):

- *LG1*: The participants are able to **apply** their knowledge about value propositions canvases to given case – (conceptual knowledge & story problem-solving).

- *LG2*: The participants are able to **analyze** and **evaluate** the value proposition canvas and the value proposition of a company – (procedural knowledge & trouble shooting problem-solving & decision-making problem-solving).

- *LG*3: Based on their analysis, the participants are able to **evaluate** a future value proposition and **create** an informed investment decision – (procedural knowledge & decision-making & case analysis problem-solving).

Based on these learning goals, I developed the training in three steps. First, I started with a rough concept of the online training. Second, I developed a story board. And third, I transferred the story board to the online training program by using Adobe Captivate as the development tool.

6.3.3 Experimental Manipulation

I decided to use points and badges for this training. Points can be used as basic elements because they can be used to document the overall learning progress of users (see section 4 of this dissertation). I decided to use badges to get a better understanding about how to design them to make them more appealing to learners (badges were not preferred by learners regarding the preference analysis I conduced – see section 5). Both badges and points share the same characteristics (section 4). Points were given to users for rewarding their progress in the training and not for giving correct answers in the knowledge tests, as the participants failure in giving wrong answers and thus getting not points can lead to demotivation (Santhanam/Liu/Milton-Shen 2016). In the study I present in section 5, points have the function of rewarding users for their success in giving correct answers to knowledge test questions, and in this study, I want to find out if changing their design leads to positive motivating and engaging effects. To keep participants motivated and to additionally reward their progress, I used badges. The results of section 5 revealed that badges are not that much preferred by learners. Having this in mind, I changed the design of badges and the way they are typically used, such as in section 5 were they used in relation to the user's achievements. Normally, badges are designed in the way that users have to earn them. However, they can be designed to support the progress of learners. The study results of section 5, indicate that learners prefer elements that support their progress. Such an additional reward becomes even more important in longer learning units that require the continuous attention of learners to keep them motivated to concentrate and to continue, and to support them in their behavior. I designed two different types of badges: trophy badges that are given to learners after completing each unit; and regular badges that are only given to participants after they have viewed supplementary material not necessary to finish the online training. The participants were informed about the option of collecting additional rewards (section 4) in the beginning of the training. I included audible feedback to underline that participants had received a reward in form of points or badges (Li/Grossman/Fitzmaurice 2012). The collected points and badges were visible from the first moment they were gained. Points were summarized to an overall score (Hiltbrand/Burke 2011). To analyze the effects on gamification, I used two different groups: a gamified group with points and badges; and a none-gamified group without any gamification element. The participants were randomly assigned to one of the two groups. The structure of the online training and the reward concept is presented in Figure 24.

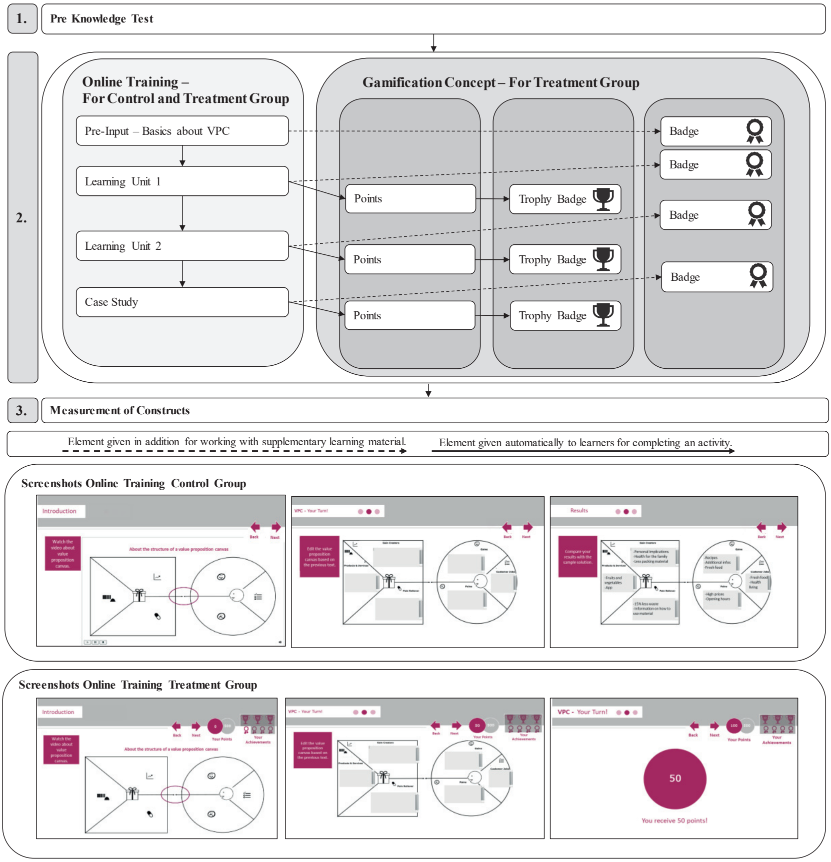


Figure 24: **Overview about Experimental Structure**
Source: Own Illustration

Overall, the training consisted of three different parts. The first part was about answering a pre-knowledge test to determine the prior knowledge and demographical data of the participants. The second part was about conducting the online training that consisted of a repetition unit to learn the basics about value proposition canvases, two learning units and a case study to measure the learning outcomes. The learning units that had the same structure so that the participants can easily get used to the structure. Each learning unit was split into three parts: absorb, do, connect (Horton 2011) – whereby absorb is about a passive activity such as reading a text, do is about using what was learned during the absorb part to solve a task, and connect is about combining the learned aspects with the participants' own experiences. The connect part was voluntary and was rewarded with optional rewards. In a third part, the participants had to fill out a questionnaire that was used for the analysis of the hypotheses. In total, the training took 90 minutes.

6.3.4 Questionnaire Development

I measured all dependent variables with established scales and where necessary adapted scales to the research context. I measured intrinsic and extrinsic goal orientation to identify the participants motivational structures (Pintrich et al. 1991). Engagement was measured with items provided by Hamari et al. (2014). I used a bipolar scale from Gupta and Bostrom (2013) to measure the learners learning process satisfaction concerned with the use of IT (Chin 1998), instead of relying on typical measures for affective outcomes and reactions of learners (Brown 2005). In addition, I measured control variables that relate to individual differences in the learning behavior of individuals which may influence the outcome of the results (Gupta/Bostrom/Huber 2010). I measured participants' prior knowledge in a pre-test. I also measured self-efficacy using scales provided by Beierlein et al. (2012). To consider individual differences in IT use, I evaluated the participants technology readiness by using scales from van der Rhee (2007). The measurement model is shown in Appendix C.1. The dependent and control variables were evaluated by using a 7-point Likert scale to measure satisfaction with the learning process, technology readiness, and intrinsic and extrinsic goal orientation, and a 5-point Likert scale to measure engagement, immersion, and challenge. All items of the model were measured as reflective constructs. To measure problem-solving learning outcomes, I constructed three different tasks, that participants had to solve after completing the second learning unit. The tasks addressed the overall learning goals I formulated. For the tasks, I developed a case description by presenting different companies and their value proposition canvases to the participants, along with additional information such as company news. The tasks can be found in Appendix C.2.

6.3.5 Data Analysis

To evaluate the research model of this study, I used the variance-based partial least squares (PLS) approach (explained in section 3.4.4.2) for four reasons (Hair et al. 2010). First, PLS is more suitable than other covariance-based methods (Hair et al. 2010). Second, PLS is better suited for evaluating data sets with smaller sample sizes. The sample size (n=68) is sufficient for the PLS approach according to Chin's rule of thumb (Chin 1998); the minimum number of required instances is derived from the maximum number of structural paths affecting the reflective construct. In this study, the main construct of problem solving is influenced by two constructs. According to the rule of thumb, this number 2 is multiplied with 10 in order to derive a minimum acceptable effect size of 20, which I exceeded with the sample sizes of 68. Third, PLS is more suitable for exploratory research than for confirmatory research approaches. Fourth, identification of covariance-based approaches can arise when using single item measures such as the learning outcome scores. I used SPSS for the descriptive analysis and to analyze the experimental manipulation. For the analysis of the problem-solving learning outcomes, the answers given to the three tasks were coded by two independent raters with a fully crossed rating (every rater rated every of the three tasks) to account for the issues of ill-structured measurement designs (Putka et al. 2008). The raters scored each task independent without seeing or talking to the other rater. In addition, they had no knowledge about the group assignments of each participant. Both raters that were used were experienced in VPC because they taught a tutorial during the semester for the course for which the data were collected.

To rate the tasks, two dimensions were considered (Yoo/Kanawattanachai/Citurs 2002). The dimension of differentiation considered the distinct dimensions of the problem and the solution that a learner considers. On the other hand, integration (presentation) was used that refers to the development and presentation of complex connections among differentiated characteristics. For each task a score of 0,1,2 or 3 was used for the rating. Similar to the work presented by Yoo et al. (2002), a 0 reflects that both dimensions are absent. Having a score of 1 indicates a moderate differentiation and low integrations and presentations. A score of 2 highlights the use of simple integrations (presentations) and a differentiation of the solution. Finally, a score of 3 reflects a complex integration (presentation) and a comprehensive differentiation. To analyze the agreement of both raters, interrater reliability was measured: Pearson correlation coefficient: $r=0.772$; $n=68$, $p<0.001$.

6.4 Results

In the following I present the results of the PLS analysis. I start with the results of the control variables and manipulations and continue with presenting the results of the outer model and closing with the results of the inner model.

6.4.1 Control Variables and Manipulation Check

In this study, I used two different control variables: technology readiness, and self-efficacy. None of them had a significant influence on problem solving: technology readiness (t-value = 1,612 p>0.10); self-efficacy (t-value = 0.612, p>0.10); and immersion (t-value = 0.867, p>0.10). I also evaluated the participants' prior-knowledge. The average prior knowledge was 6.46 in the gamified group, and 7.08 in the non-gamified group. The t-test for independent variables revealed that prior knowledge did not significantly differ between the two groups (p>0.10). Additionally, I asked participants three questions (marked on a 5-point Likert scale from '1 Totally Disagree' to '5 Agree') to see if they recognized the different gamification elements: points, trophy badges, and badges. Results of a t-test for independent variables revealed that all three manipulations (points, badges, trophy badges) were recognized by the gamified group, whereas the none-gamified group did not recognize any of the elements (for all three manipulation checks p<0.001; mean points: gamified group:4.66, none-gamified group: 1.37; mean badges: gamified group: 4.50, none-gamified group: 1.10; mean trophy badges: gamified group: 4.71, none-gamified group: 1.24).

6.4.2 Model Evaluation

To evaluate the results of this analysis, I used a two-step approach, starting with analyzing the outer model and continuing with the inner model (Hair et al. 2010). In the first step, I evaluated the reliability and validity of the outer model using quality criteria (as shown in Table 32).

Indicator reliability was measured, with indicators loading above the minimum value of 0.7 (Hulland 1999). I measured internal consistency by referring to the means of construct reliability; values should be above 0.70 to have an acceptable construct reliability (Bagozzi/Yi 1988) and indeed they were. Convergence validity was measured using the average variance extracted (short AVE). The value should be above the minimum of 0.50 so that at least the half of the variance of the constructs is explained by the measured indicators (Bagozzi/Yi 1988); indeed, all of the constructs have an AVE above 0.50. Discriminant validity was measured with the Fornell-Larcker criterion, which states that the square root of AVE of a construct should be higher that the correlation of the latent construct with other constructs of the measurement and indicates if a construct shares more variance with its own indicators than with other constructs (Fornell/Larcker 1981).

Construct	Indicator	Loading	AVE	Composite Reliability	Mean
Learning Outcomes*	Problem-solving Outcomes	1.00	-	-	Overall: 6.69, (S.D.: 3.03) Treatment: 7.25, (S.D.: 3.03) Control: 6.02, (S.D.: 3.05)
Gamification*	Group	1.00	-	-	-
Engagement**	E3	0.939	0.8771	0.9554	Overall: 2.66, (S.D.:0.948) Treatment: 3.06, (S.D.: 0.800) Control: 2.20, (S.D.: 0.906)
	E4	0.928			
	E5	0.942			
Learning Process Satisfaction**	Satis1	0.832	0.6764	0.8926	Overall: 4.36 (S.D.:1.12) Treatment: 4.66, (S.D.: 0.84) Control: 4.03, (S.D.: 1.31)
	Satis2	0.858			
	Satis3	0.719			
	Satis5	0.870			
Extrinsic Motivation	EM1	0.754	0.6724	0.8909	Overall: 3.18, (S.D.:1.23) Treatment: 3.39, (S.D.: 1.28) Control: 2.95, (S.D.: 1.15)
	EM2	0.824			
	EM3	0.904			
	EM4	0.790			
Intrinsic Motivation	IM1	0.858	0.6881	0.8979	Overall: 4.30 (S.D.: 1.16) Treatment: 4.54, (S.D.: 0.92) Control: 4.03, (S.D.: 1.35)
	IM2	0.881			
	IM3	0.756			
	IM4	0.818			

*Constructs were operationalized with one indicator. Therefore, AVE and composite reliability could not be computed.
** E1, E2, and Satis4 were removed due to loading below 0.7.

Table 32: Reliability and Validity
Source: Own Illustration

I assessed heterotrait-monotrait ratio (HTMT) and the hetero-trait-monotrait interference criteria ($HTMT_{inference}$). The results in Table 33 show that discriminant validity through consideration of Fornell-Larker Criterion and the conservative HTMT85 measure (indicated through all HTMT measures under 0.85) is established. Also, the $HTMT_{inference}$ values are all significantly below the threshold of 1. Table 33 indicates that the constructs fulfill all these criteria.

Construct	(1)	(2)	(3)	(4)	(5)	(6)
(1) Problem solving Learning Outcomes	**NA**					
(2) Gamification	0.1967 (0.197)	**NA**				
(3) Engagement	0.0574 (0.394)	0.4527 (0.470)	**0.936**			
(4) Learning Process Satisfaction	0.3912 (0.433)	0.2818 (0.310)	0.6062 (0.678)	**0.822**		
(5) Extrinsic Motivation	0.3826 (0.081)	0.1812 (0.199)	0.2965 (0.315)	0.2389 (0.278)	**0.819**	
(6) Intrinsic Motivation	0.3941 (0.428)	0.2181 (0.234)	0.6073 (0.681)	0.5194 (0.607)	0.3682 (0.429)	**0.829**

*In bold are square roots of AVE; and off-diagonal elements are correlations of latent variables. The computation of the Fornell-Larcker criterion was omitted for the manifest variables (NA). Values in parenthesizes show the HTMT criterion, whereby .85 represents a conservative threshold. Therefore, the values show that the conservative HTMT85 criterion is fully satisfactory and confirming discriminant validity.

Table 33: Discriminant Validity
Source: Own Illustration

Additionally, cross-loadings (Chin 1998) show that all indicators load the highest on their own constructs; this can be seen in Table 34.

Indicator	(1)	(2)	(3)	(4)	(5)	(6)
E3	**0.939012**	0.267286	0.371937	0.600449	0.399205	0.591542
E4	**0.928192**	0.275019	0.441212	0.572104	0.285484	0.493820
E5	**0.942277**	0.290629	0.460796	0.534663	0.383224	0.610773
EM1	0.154379	**0.754373**	0.106507	0.253660	0.111638	0.209247
EM2	0.161059	**0.823789**	0.219430	0.239765	0.116383	0.166013
EM3	0.343144	**0.904089**	0.131143	0.375386	0.009539	0.261938
EM4	0.257467	**0.790333**	0.142391	0.308438	-0.005479	0.140367
Gamification	0.452734	0.181172	**1.000000**	0.218060	0.196690	0.281827
IM1	0.473269	0.238933	0.167519	**0.857740**	0.449112	0.550954
IM2	0.503091	0.297472	0.122884	**0.881411**	0.261590	0.418764
IM3	0.478220	0.514098	0.204094	**0.755874**	0.263533	0.319414
IM4	0.548395	0.182702	0.220825	**0.817705**	0.332869	0.433506
Problem-solving Outcomes	0.382580	0.057352	0.196690	0.394114	**1.000000**	0.391160
Satis1	0.476563	0.194500	0.159445	0.431414	0.477515	**0.832680**
Satis2	0.560793	0.243289	0.231480	0.528410	0.290166	**0.858275**
Satis3	0.394694	0.113165	0.309040	0.236338	0.246076	**0.719114**
Satis5	0.544195	0.221127	0.231805	0.481871	0.288213	**0.870881**
(1) Engagement, (2) Extrinsic Motivation, (3) Gamification, (4) Intrinsic Motivation, (5) Problem-solving Outcomes, (6) Learning Process Satisfaction						

Table 34: Cross-loadings
Source: Own Illustration

In the second step, I evaluated the inner model. I analyzed the path coefficients, r-squared, significance levels, effect sizes, and predictive relevance (Hair et al. 2014a). The results of the structural model can be seen in Figure 25.

Three of my hypothesized relationships are not significant ($p>0.05$). So, there is no significant relationship between gamification and problem-solving learning outcomes, no significant relationship between gamification and extrinsic motivation, and finally no significant relationship between extrinsic motivation and engagement. All other relationships are significant at least at $p<0.05$. Engagement has the greatest effect on problem solving learning outcomes (ß=0.368), followed by the effect of intrinsic motivation on engagement (ß=0.362) and then the effect of learning process satisfaction to engagement (ß=0.333) according to the path coefficient. Concerning gamification, the strongest relationship is between gamification and learning process satisfaction (ß=0.282), followed by the relationship between gamification and engagement (ß=0.274), and between gamification and intrinsic motivation (ß=0.218).

Furthermore, I analyzed if engagement mediates the effect of gamification on problem-solving learning outcomes following the recommendations of Nitzl et al. (2016) by estimating the significance of the direct effects and indirect effects. The bootstrapping of the sampling distribution of the indirect effect shows that the effect is significant. The analysis shows that engagement mediates the effect of gamification on problem-solving outcomes, thus confirming H3b. A closer look at the mediation effect shows that there is an indirect-only, full mediation present for the effect of gamification on problem-solving outcomes (mediated through engagement), since the direct effect of gamification on problem-solving outcomes is insignificant without the mediator present (ß=0.030; p>0.05).

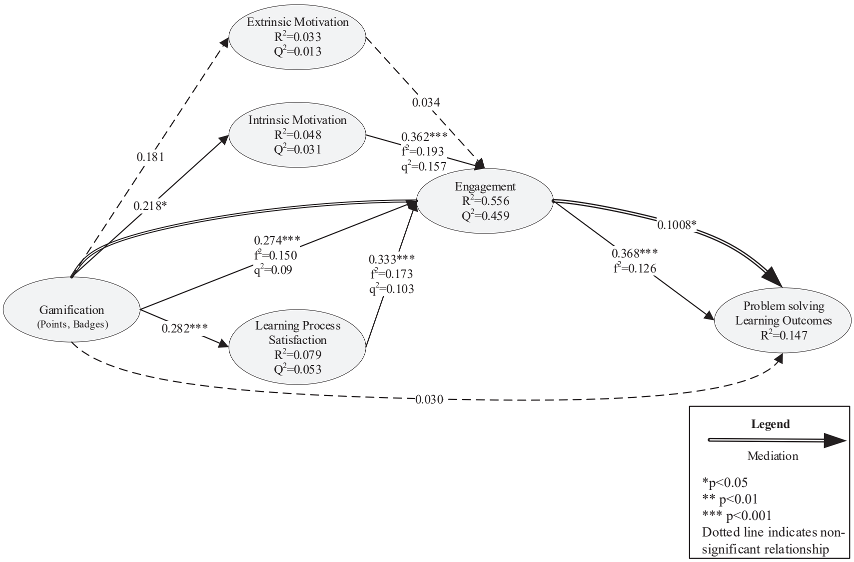


Figure 25: **Results**
Source: Own Illustration

The explained variance of the main construct of problem solving can be described as weak ($R^2<0.25$) (Hair et al. 2010). However, the model can explain more than 50% of the variance of engagement ($R^2=0.556$). In a final step, effects sizes were calculated for the determinants of problem solving and engagement. As the relationship between gamification and problem solving is not significant, I analyzed the relationship between engagement and problem solving. The effect size f^2 constitutes the influence of an exogenous construct on endogenous constructs by considering the changes of the coefficient of determination, R^2 (Cohen 1988) whereby values above 0.02, 0.15, and 0.35 indicate a low, moderate, and high effect on the structural level (Henseler/Ringle/Sinkovics 2009). The results indicate that the effects on problem solving by engagement can be considered as low (f^2=0.126). The effect sizes between learning process satisfaction and engagement can be considered as medium (f^2=0.173), as can the effect sizes between intrinsic motivation and engagement (f^2=0.193) and between gamification and engagement (f^2=0.150).

I evaluated the predictive relevance as a conclusive assessment of the structural model (Chin 1998) by using the blindfolding procedure proposed by Stone (1974) and Geisser (1975), which omits one part of the data in a systematic way and uses the resulting estimates to predict the omitted part (Hair et al. 2014a). I chose d = 7 as omission distance, which is not a multiple integer of the analyzed cases (N=68) (Hair et al. 2014a). I assessed Q^2 as the cross-validated redundancy measure to estimate the structural model and measurement models for the data prediction (Hair et al. 2014a). The blindfolding procedure is applied to endogenous reflective constructs and if the value of Q^2 is larger than zero for a particular construct, its explanatory variables have a predictive relevance (Henseler/Ringle/Sinkovics 2009). This is the case for all constructs: intrinsic motivation (Q^2=0.031), extrinsic motivation (Q^2=0.013), engagement (Q^2=0.459), and learning process satisfaction (Q^2=0.053). The relative impact of the predictive relevance can be evaluated by the measure q^2: values above 0.02, 0.15, and 0.35 respectively indicate a small, medium, or large predictive relevance of constructs, explaining the endogenous construct that is evaluated (Henseler/Ringle/Sinkovics 2009). There is a medium effect for the relationship between gamification and engagement (q^2=0.09), the relationship between intrinsic motivation and engagement (q^2=0.157), and the relationship between learning process satisfaction and engagement (q^2=0.103). All values can be seen in Figure 25. A summary of the results is presented in Table 35.

Hypothesis		Path Coefficient	T-Value for Path	Support for Hypothesis
H1	Gamification → (+) Intrinsic Motivation	0.218	1.977	Yes
H2	Gamification → (+) Extrinsic Motivation	0.181	-	No
H3a	Gamification → (+) Problem solving Learning Outcome	0.030	-	No
H3b	Gamification → (+) Engagement → (+) Problem solving Learning Outcomes	Mediation Analysis		Yes
H4	Intrinsic Motivation → (+) Engagement	0.362	3.496	Yes
H5	Extrinsic Motivation → (+) Engagement	0.034	-	No
H6	Gamification → (+) Engagement	0.274	3.117	Yes
H7	Engagement → (+) Problem solving Learning Outcome	0.369	2.727	Yes
H8	Gamification → (+) Learning Process Satisfaction	0.282	2.719	Yes
H9	Learning Process Satisfaction → (+) Engagement	0.333	3.327	Yes

Table 35: Overview about Results
Source: Own Illustration

6.5 Discussion and Contributions

To answer *RQ3*, the results of this study deliver important insights about the role and meaning of different kind of learning outcomes, motivation, and engagement. In addition, this study provides evidence that badges (in combination with points) can lead to a better learning success when designing them in line with a learning process. Next, a discussion and implications follow.

6.5.1 Discussion of Findings

Seven of the ten hypotheses could be supported. The experiment reveals several results. First of all, gamification has an important role in keeping learners engaged during training to develop their problem-solving skills (H6). This is contrary to prior research which delivered mixed results regarding the effect of gamification on problem solving. Some studies showed positive motivational effects on learners but no effects or even negative effects on learners' problem solving (Denny 2013; Christy/Fox 2016), whereas other studies showed positive effects on problem-solving (Wang 2015; Faghihi et al. 2014). Additionally, many studies focus on rewarding lower learning goals instead of higher learning goals because it still needs to be determined how gamification can support learners in solving complex learning tasks (Haaranen et al. 2014).

The results also indicate that gamification has no direct effects on a user's problem solving (H3a). However, a deeper analysis related to the mediating role of engagement that was positively mediating the role of gamification on problem-solving skills (H3b). Engagement fully mediates the relationship between gamification and problem-solving skills. There is some support in research that gamification has no direct effects on the user's outcome behavior (such as learning outcomes) and that we need to better understand how engagement along gamification constitutes (Hamari et al. 2016). If gamification is used to make online trainings more fun, it should be carefully considered how to design engaging elements. I used points and badges that were embedded in the training by supporting the individual progress of learners. Many studies connect their points and badges to test results which probably can threaten the engaging effects of gamification. In the results of section 5 points were related to the learner's achievements in answering test questions. Similar to this, badges were related to how well learners achieve different activities. Badges are probably more difficult to earn, because they are oftentimes connected to completing a series of different activities (Thiebes/Lins/Basten 2014) and were not preferred by learners. When badges are easier to earn and at the same time support the progress of learners, they can have positive effects on engagement, motivation, and satisfaction with the learning process. At the same time, points seem to be effective as well when they are used as progress supporting elements. Elements in gamification should therefore focus on the learning process and it is important to understand what learners need and want and were engaging support by using gamification elements is most effective.

In addition, using points and badges, it has strong effects on user engagement, intrinsic motivation, and learning process satisfaction (H1, H6, H8). Therefore, I can draw conclusions about how gamification can influence engagement and how engagement differs depending on different kind of knowledge and skills. Therefore, designing gamification concepts to better adapt them to different contexts and to what users need becomes important (Schlagenhaufer/Amberg 2015). As learning content becomes more complex and requires analysis, evaluation, or creation of content, learners need more assistance in focusing on the most important issues and in filtering the important information out of a larger mass of information. Therefore, gamification might help learners in focusing on the most important issues of a training program and help keep them motivated in the learning process.

Another important finding of this study refers to the role and meaning of engagement in learning and gamification. The results indicate that engagement is the most important construct to improving problem solving (H7). So far, there has been little research on variables surrounding engagement (Hamari et al. 2016). The results of the study indicate that engagement is influenced by intrinsic motivation, learning process satisfaction, and gamification – with intrinsic motivation having the strongest effect (H4, H6, H9). Gamification on the other hand has the strongest impact on learning process satisfaction (H8). Therefore, it is important to construct a gamification concept that is focused on making learning concepts more engaging by showing the progress in learning and by steadily rewarding users for continuing. The gamification concept should not reward learners just for being successful in finding the right answer in knowledge tests as this can have contrary effects on motivation. In summary, gamification concepts in learning should concentrate on rewarding users independent of their learning results, keeping learners motivated in a longer process of learning, and supporting them in learning by directing their attention to the most important content. By being guided more by game elements, learners are more satisfied and therefore more engaged in continuing with their learning process.

Referring to motivation, I differentiated between intrinsic and extrinsic motivation in this study. The results indicate that gamification has significant effects on intrinsic motivation (H1) but not on extrinsic motivation (H2). Similarly, it is intrinsic motivation that is important in promoting engagement, not extrinsic motivation. Although I used gamification elements that can be collected by users and that therefore address a user's extrinsic motivation, and extrinsic motivation is not relevant for greater engagement or better problem solving. Deci et al. (2000) mention that there is a relationship between extrinsic and intrinsic motivation. In some cases, extrinsic motivation can harm the positive effects of intrinsic motivation. However, the effects of intrinsic motivation seem to be more powerful and longer lasting that the effects of extrinsic motivating, especially for longer duration online trainings. Under this light, extrinsic characteristics of badges and points (section 4) seem to be less important. More precisely, collecting elements (which addresses basically extrinsic motivation) seems less important than seeing the progress in learning (which contributes to intrinsic motivation) which is further supported by the results presented in section 5, where progress elements were preferred by learners (level, progress bar).

6.5.2 Practical and Theoretical Contributions

This study makes several contributions to theory. Because I develop and analyze different hypotheses and thus statistically tested theoretical assumptions, this study contributes to a type IV theory of prediction and explanation (Gregor 2006). First, I contribute to a better understanding of the role of engagement in learning and about the relevance of points and badges on the engagement of management students and contribute to important streams of gamification literature. We should think about gamification as a construct for motivating learners, not by relying on gamification elements, but by constructing and designing meaningful gamification elements that act as guiding feedback elements. Second, I contribute to the body of knowledge about motivation in online scenarios and the relationship between intrinsic and extrinsic motivation as I provide guidance on how to design intrinsically motivating learning materials by using gamification. Third, I contribute to gamification theory in general, as I offer suggestions on how to design gamification concepts that positively address the motivation, learning process satisfaction, and engagement of learners. I also contribute to design theory by presenting gamification element designs that are adapted to the context of learning and which design support to increase learner engagement, intrinsic motivation, satisfaction with the learning process and lastly problem-solving skills.

I also make several practical contributions. First, I contribute to knowledge on design theories. I demonstrate to designers of TML solutions and online learning materials that a detailed and embedded gamification concept can lead to better problem solving. Such a gamification design can improve the learning process of learners by motivating them to continue with the online training, and by rewarding them based on the progress made thus far – instead of rewarding or punishing their success or failure in knowledge tests. To make gamification meaningful and to construct an effective gamification concept, designers should carefully consider the needs and interests of a target group and contexts instead of randomly selecting and combining gamification elements. Second, developers of gamification concepts should carefully select, and design the gamification elements for their TML solutions. Gamification elements such as leaderboards represent the users progress in relation to others. However, they may not be helpful in TML since they do not provide any information on or guidance during the learning process. Therefore, gamification concepts in learning and the gamification elements used should be designed on rewarding the progress of users no matter how they performed in knowledge test or tasks. Furthermore, developers should develop their gamification concepts for training higher-level learning goals and problem-solving skills.

6.6 Limitations and Future Research

There are some limitations of this research study, however they also indicate opportunities for future research. This study compared gamified online training with a none-gamified training. To analyze the role and meaning of gamification in more detail, future research should focus on conducting experiments with different gamification designs. The sample size of this study is rather low. In addition, a 2x2 experiment could be conducted to analyze different constellations of badges and points. The results revealed that engagement driven by gamification has positive effects on problem solving by referring to problem-solving skills. Future research should try to isolate how gamification concepts should be designed to achieve positive effects on lower-level problem solving. In addition, this study uses points and badges. Having points and badges in a gamification concept makes it difficult to judge about the effects of each individual element. However, points and badges have similar characteristics (section 4) and belong to the same class of elements. In section 5, I present the results of a preference analysis were badges were least preferred by learners. Comparing points with badges in TML, points are used to reward a learner's process, but badges do not necessarily focus on rewarding a learner's progress. In this study both elements are designed as elements that reward the progress of a learner without combining it to their achievements in exams. Having this in mind, conclusions can be made about both elements and their designs. Future research should use the developed research model to analyze the effects of each element that can be used to gamify TML solutions. Finally, future research should focus on analyzing the role and meaning of prior experiences of learners about a topic in relation to their openness to gamification and the resulting effects on learner engagement and problem-solving skills.

7 A Configurational View on Designing Mediating Avatars in Technology-mediated Learning and how they Support Emotional Attachment, Satisfaction, and Extraneous Cognitive Load[8]

7.1 Introduction

The seventh section is used to answer *RQ4* of this dissertation:

RQ4: Which mediating avatar design configurations constitute emotional attachment, satisfaction with the learning process, and extraneous cognitive load in TML?

In private life as well as in work routines, digital learning is becoming increasingly relevant and important due to a proliferating need of upskilling (Bughin et al. 2018). It is well established in the learning literature that direct and individual feedback is one of the most critical drivers influencing learner reaction and behavior and it is necessary to acquire complex cognitive skills (Shute 2008). In a traditional classroom setting, teachers can provide feedback to students through direct and immediate interactions to better support their needs (Means et al. 2009). Such opportunities, however, are limited in TML settings, such as massive open online courses. In fact, there is a large number and variety of digital learning environments where the assistance of a teacher or a trainer is not immediately available (Means et al. 2009).

The lack of a physical presence of a teacher in digital learning environments makes it more challenging to provide helpful, engaging, and motivating feedback to learners about their learning progress (Burgers et al. 2015). An approach to support users with teacher-based feedback is to use a mediating avatar (see section 4, about more details on mediating avatars). Such avatars are used in several different contexts. They can be used as pedagogical agents (Pérez-Marín/Pascual-Nieto 2013), in combination with smart personal assistants (Pfeuffer et al. 2019), or in the context of games and gamification (Chini/Straub/Thomas 2016; Kim/Baker/Song 2007). Besides analyzing the role and meaning of mediating avatars, gamification focusses on the meaning of engagement and motivation in relation to mediating avatars. As presented in section 4, two kinds of avatars can be used. Avatars can be either used to represent a user or to

[8] These insights presented in this section are based on Schöbel et al. (2019). I thank my co-authors and the reviewers, and associate editor of the ICIS 2019 for their ideas and suggestions to further improve the publication.

guide a user (Schöbel/Janson 2018). Mediating avatars seem to be less preferred by learners (section 5) and their design needs to be analyzed in more detail.

As highlighted in section 4, research still needs to better understand the relevance of each individual element for different kinds of contexts (Seaborn/Fels 2015). In addition, most studies that focus on gamification try to understand its effects on behavioral outcomes that are oftentimes controversial and do not show direct effects (Super et al. 2019). Referring to this, it is critical to take into consideration the purpose for which an avatar will be used while identifying the most effective design combinations (Mull et al. 2015; Schmidt-Kraepelin et al. 2018; Scott/Pereira/Oakley 2014). In TML, it is important to analyze in more detail if and how an emotional bond forms between a learner and an avatar (Thomson/MacInnis/Park 2005). Designing a mediating avatar that emotionally attaches learners can influence learning outcomes (Scaife/Rogers 2001; Witmer/Singer 1998). Additionally, affective outcomes (see section 2.2.1 for different kind of learning outcomes and the relevance of affective ones) in learning, such as satisfaction, are important because these may influence the perception of learners of being able to achieve success and generate positive feelings towards an achieved outcome, which is normally instantiated by a teacher in a traditional classroom setting (Hui et al. 2008). Therefore, it is important to understand how an avatar design can contribute to the satisfaction of learners (Fisher 2003). Finally, digital learning situations present potential for cognitive overload (Mayer/Moreno 2003). Thus, cognitive load aspects of mediating avatar designs for digital learning solutions should be carefully considered by designing mediating avatars that better assist learners when interacting with the system. In particular, designers should consider if a particular design may force learners to interact with the system in an inefficient way or if the design is inadequate (Steed et al. 2016).

The goal of this section is to get a better understanding about how to design mediating avatars in TML. In section 5, avatars (that were used as mediating avatars – see section 4 about mediating avatars) were not preferred by learners. Therefore, I want to get a better understanding about how to design more attractive avatars in learning that better address the needs and interests of learners. Under this light I now focus on affective learning outcomes (satisfaction with learning process), emotional attachment, and extraneous cognitive load. All three constructs are important to better understand the relevance of mediating avatars designs in learning.

7.2 Conceptual Background

Figure 26 provides an overview of the design configurations I focus on in relation to emotional attachment, satisfaction with the learning process, and extraneous cognitive load. To derive different design configurations, I refer to a theory motivated design.

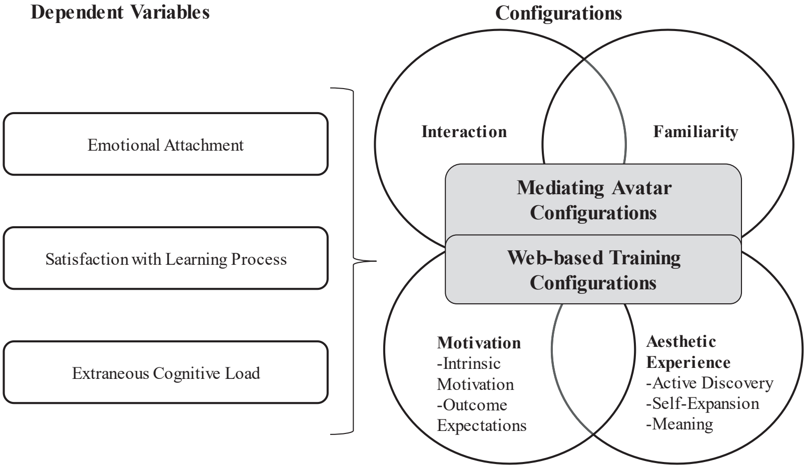


Figure 26: Dependent Variables and Configurations
Source: Own Illustration

7.2.1 The Role of Emotions, Satisfaction with the Learning Process, and Extraneous Cognitive Load

An avatar can be defined as a "picture, drawing, or icon that users choose to represent users, typically including images of animals, cartoons, celebrities, or user photographs that embody evil, idiosyncrasy, position, power, and seduction, among other things" (Lee/Kwon 2008, 461). Besides using avatars to represent users, they can be used to provide feedback to users (Lee et al. 2013) as mediating avatars (section 4). Avatars can be used for different learning purposes, for example, as pedagogical agents, or as a game element to motivate users. Thus, in the context of learning, avatars can serve a critical function by representing a teacher or trainer (Bedwell et al. 2012). In online learning settings, it becomes more important that learners develop a positive feeling about their virtual teacher by feeling closer to something or someone (Aron et al. 2006). This kind of positive feeling can be described as emotional attachment and can be described as "an emotion-laden, target specific bond between a person and a specific object"

(Thomson/MacInnis/Park 2005, 77). In TML settings, where teachers are oftentimes absent, avatars can fulfill the role of a teacher (Christy/Fox 2014; Hoffner/Buchanan 2005). In an TML setting, avatars have to be designed to support the creation of an emotional bond, which in turn creates a feeling of trust and being supported (Hazan/Zeifman 2008; Mattingly/Lewandowski 2013). Emotional attachment is highly relevant in learning because it supports a person's affection for a specific object (or avatar), which can result in an intention to use an IS more regularly (Suh/Kim/Suh 2011).

A second aspect that is important to design avatars for learning purposes, is the affect they engender in learners. In this study, I focus on the satisfaction of learners with the learning process. Satisfaction with the learning process can be characterized as an affective learning outcome that "enhance the level to which someone is immersed with an object" (Gupta/Bostrom 2009, 692) (see also section 2.2.1 about different learning outcomes). Satisfaction with the learning process can be described as the positive feelings of learners related to their performance and related to affective outcomes of learning (Gupta/Bostrom/Huber 2010). In a classroom setting this kind of feeling is typically triggered by a teacher who can support learners in improving their performance because satisfaction is higher when users believe the learning and teaching system they use meets their information requirements (Eom 2014). To fulfill this role in a TML setting, mediating avatars should be based on creating positive feelings in learning so that learners are more satisfied with their learning process. This feeling of being satisfied with the learning process can be achieved by informing learners how well they have performed and by interacting with them (Ferguson/DeFelice 2010; Fisher 2003). Thus, if a mediating avatar in learning can show how well learners have performed, it can have positive effects on their learning process satisfaction. This in turn will make learners want to continue with their learning process (Ferguson/DeFelice 2010).

Finally, a mediating avatar facilitates learning by interacting with a user during a learning process. Therefore, cognitive load should be considered when designing avatars because online learning situations provide potential for cognitive overload (Mayer/Moreno 2003). Cognitive load is most often considered when researching IS, TML, and/or the instructional design of online learning materials. In an online learning environment, where instructors are absent, reducing cognitive load might be even more important because learning happens best when materials are adapted to the human cognitive architecture (Paas/Renkl/Sweller 2003). Especially extraneous cognitive load is, among other cognitive load constructs (see Sweller (1994) for more details), of relevance when we consider avatars as an important part of the presentation of online learning materials. Extraneous cognitive load is closely related to the level of usefulness demonstration and a higher level of usefulness demonstration results in a lower level of extraneous cognitive load (Ayres/Youssef 2008). Hence, along with the design of the online training itself, designers should consider a design that supports learners in working and interacting with a mediating avatar (Artino 2008).

7.2.2 Design Configurations for Mediating Avatars in Learning

Two kinds of avatar design configurations are important in relation to the three dependent variables I derived in the motivation of this section: mediating avatar configurations and web-based training configurations. Regarding the mediating avatar design configurations, it is important to consider the familiarity of a mediating avatar in online trainings (Mattingly/Lewandowski 2013; Scaife/Rogers 2001). The relevance of familiarity can be explained by self-expansion theory, which predicts that engaging in an activity with a friend or a known person leads individuals to experience self-expansion (Aron et al. 2006). When using a familiar mediating avatar, learners might be able to develop a relationship and an emotional bond with their avatar. Additionally, with a familiar mediating avatar, learners may experience the feeling of presence, which contributes to more satisfaction (Scaife/Rogers 2001). Extraneous cognitive load is related to the level of usefulness of a demonstration (Ayres/Youssef 2008). Thus, with a familiar avatar it becomes easier for learners to focus on the most important aspects of a training. Another important aspect regarding avatar configuration is the interaction of a mediating avatar with a learner. Interaction can support the development of emotional attachment. Learners who are guided by direct interactions are more likely to have more positive emotional experiences in learning situations (Eccles/Wigfield 1995; Marchand/Gutierrez 2012). Interaction with an avatar is also important to keep learners satisfied. By involving an avatar in an online training, learners have the feeling of being part of a conversation; they feel supported and more satisfied with their learning process (Paas/Renkl/Sweller 2003; Van Gerven et al. 2002). Lastly, interaction is important in terms of avoiding cognitive overload. Learners in multimedia environments experience a cognitive overload when dealing with the complexity of textual and instructional presentations (Paas/Renkl/Sweller 2003). Therefore, a mediating avatar should interact with a learner to help them to focus on the most important issues.

Besides configurating the design of a mediating avatar, it is important to configurate the design of web-based training as well. These configurations are also important to better understand how an avatar can contribute to better learning success. I derived two web-based training configurations: motivation and aesthetic experience. Motivation can be classified into intrinsic and extrinsic motivation (Pintrich 2003). Intrinsic motivation is connected to one's inherent pleasure and interest in the activity (Noels 2001). Extrinsic motivation or outcome expectations is about the judgement of consequences resulting from a behavior (Bandura/Jourden 1991; Gupta/Bostrom 2013). In line with the embedded mediating avatar, the web-based training design (for which the avatar is one component) should be motivating in both ways, addressing intrinsic motivation as well as supporting outcome expectations. A mediating avatar that motivates can support the development of an emotional relationship with a teacher, can reduce cognitive load, and supports learning process satisfaction (Poonam 1997).

Aesthetic experience can be described as a state of mind in which a learner's focus is given to an intentional field of actions to accomplish a desired outcome (Suh et al. 2017). Three components are important regarding aesthetic experience: meaning (MEA), active discovery (ACD), and self-expansion (SEP) (Suh et al. 2017). MEA is about the extent to which a learner understands the meaning of an activity. SEP is about a learner's sense of self by knowing things or broadening their perspective and experiencing personal growth. Finally, ACD is important to support learners in actively seeking answers or resolutions to cognitive challenges to achieve their personal goals. Overall, the aesthetic experience contributes to the development of an emotional bond, the reduction of cognitive load, and a higher learning process satisfaction (Jia et al. 2016). Therefore, avatars in learning should facilitate learning to better demonstrate the meaning of the most important aspects they have to learn. Having a mediating avatar that supports learners in actively discovering learning materials, the learner will develop a more stable bound to the avatar (Derrick/Jenkins/Nunamaker Jr 2011). Finally, SEP in traditional classroom settings can be developed by a teacher who directly gives feedback to a learner (Mayer/Moreno 2003; Means et al. 2009). In TML settings, a mediating avatar should fulfill this function by giving learners the feeling of being accompanied.

In relation to the three dependent variables, I also consider that learners differ in terms of which mediating avatar configuration they like. Therefore, I consider prior knowledge and gender in relation to the dependent variables. Referring to prior knowledge, experts might be able to process information faster than novices, who need more guidance

(Felder/Brent 2005; Hailikari/Katajavuori/Lindblom-Ylanne 2008). Therefore, mediating avatar design configurations (especially interaction) might differ regarding cognitive load. In addition, I will consider gender with regard to mediating avatar designs. Women and men might differ regarding their emotional bond towards mediating avatars. Women might be more attached to a familiar mediating avatar than men because they are more interpersonally oriented to something or someone than men (Venkatesh/Morris 2000). Furthermore, females might be more interested in familiar mediating avatars because they are more interested in actions that involve social interactions and have a greater awareness of other's feelings (Greenberg et al. 2010; Sun/Ping 2006). In summary, there is support that gender and prior knowledge might be important when considering emotional attachment and cognitive load. A more detailed analysis of subsamples regarding satisfaction is not part of this section or study but relevant for future research.

7.3 Research Methodology

7.3.1 Study Design and Manipulations

To collect the data for this study, I developed an online 2x2x2 pre-post-test, between-subject experiment with an additional control group (see section 3.4.3 about experiments). I considered female as well as male mediating avatars to analyze if there is a difference between their impacts on outcomes of interest. An example of the training is given in Figure 27.

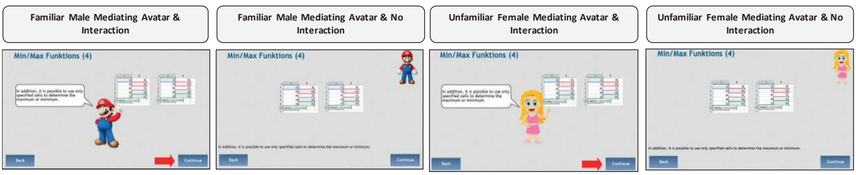


Figure 27: Examples Online Training
Source: Own Illustration

In this study, I have two different design artifact: the online training, and avatars (see section 3.6 about the meaning of design artifacts). To analyze the familiarity, I used Super Mario as the familiar male mediating avatar and Princess Peach as the familiar female mediating avatar. I designed an unfamiliar male avatar, which was already implemented and evaluated in another learning application (Ernst et al. 2016). Following the clothes and hair color of Princess Peach, I also designed the unknown female mediating avatar. With regard to the interaction between the mediating avatars and learners, direct instructions were used as design component of mediating avatar by using a speech bubble and gestures. Indirect instructions were placed near a task. One group without a mediating avatar was considered to determine the overall influence of mediating avatars. Motivation and flow were covered by the overall presence of mediating avatars as well as by the implemented interactions and were measured in a post-test after the participants had completed the training.

The learning goal of the online training was to train the participants in Microsoft Excel. I decided to use Excel because Excel has also been used in previous studies of online learning, thus making results of the study more comparable to the existing literature (Gupta/Bostrom 2013). I used a five item, bipolar 7-point Likert scale from Gupta and Bostrom (2013) to measure learning process satisfaction. Emotional attachment was measured with 10 items and a 7-point Likert scale (Thomson/MacInnis/Park 2005). Extraneous cognitive load was measured with 3 items and a 7-point Likert scale (Ayres/Youssef 2008). I measured intrinsic motivation (three items) and outcome expectations (seven items) with a 7-point Likert scale (Gupta 2006). SEP, MEA, and ACD were measured with three items, each on a 7-point Likert scale (Mattingly/Lewandowski 2013; Suh et al. 2017).The participants' prior knowledge was measured on a 7-point Likert scale with two items asking them about their experience with Excel in general and their experience with functions in Excel. An overview about the measurement instruments is given in Appendix D.1.

7.3.2 Data Collection and Measurement Validation

To assess the quality of the survey and the online training, I conducted a pre-test. I asked ten graduated students to test the Excel Training. Overall, apart from some typing mistakes, the students stated that the online training is understandable. After applying minor changes to the wording and adding information about the structure in the beginning of the online training, I collected the data via e-mail. I asked students for participation. Student samples have been used in the prior literature for evaluating online learning models or training interventions (Gupta/Bostrom 2013; Santhanam/Liu/Milton-Shen 2016), thereby enabling us to compare the results. I used a javascript-based randomization procedure to randomly assign participants to one of the nine groups, and I assured by setting mandatory cookies that participants could not change groups or do the training more than once.

Students were recruited via e-mail. I sent five e-mails in total: The first one as an initial invitation, the other ones as friendly reminders. Students from different subjects, different ages, and degrees participated. The e-mail was sent to all students of one university. The students did get course credits for completing the web-based training as well as the post-survey. They had to enter their mail address at the end of the survey so that we could check if they completed the training and the survey. In addition, I included control questions to see if the participants concentrated during the training. The training started with a background survey that was used to evaluate demographic data such as age and gender. Additionally, I evaluated the participants' prior knowledge on using and working with Excel. Afterwards, the participants were randomly assigned to one of the nine groups. In a last step, a questionnaire was included to measure the dependent variables and conditions. On average, the training lasted between 50 and 60 minutes. In total, I obtained 998 complete responses for the analysis. Table 36 provides an overview of the demographic data.

Group	**Number**	**Age**	**Gender**
Control Group (C)	101	Mean: 25.52 (Min: 18, Max: 54)	F: 41, M: 60
Male, Known, Direct (MKD)	103	Mean: 24.77 (Min: 19, Max:38)	F: 45, M: 58
Female, Known, Direct (FKD)	106	Mean: 25.49 (Min: 19, Max:63)	F: 63, M: 43
Male, Known, Indirect (MKI)	102	Mean: 25.05 (Min: 18, Max:39)	F: 52, M: 50
Female, Known, Indirect (FKI)	128	Mean: 25.22 (Min: 18, Max:39)	F: 79, M: 49
Male, Unknown, Direct (MUD)	101	Mean: 24.62 (Min: 17, Max: 40)	F: 58, M: 43
Female, Unknown, Direct (FUD)	118	Mean: 25.14 (Min: 18, Max: 51)	F: 64, M: 54
Male, Unknown, Indirect (MUI)	125	Mean: 25.04 (Min: 18, Max: 49)	F: 54, M: 71
Female, Unknown, Indirect (FUI)	114	Mean: 25.07 (Min: 17, Max: 39)	F: 52, M: 62
Total	**998**	**Mean: 25.10**	**F: 431, M: 567**
F= Female, M=Male			

Table 36: Demographic Data
Source: Own Illustration

To ensure validity, reliability as well as rigor of the measurement instruments, I calculated the loadings, and Cronbach's alpha (above 0.707) for each construct. All loadings were above 0.7 and indicate an adequately fulfillment of Fornell Larcker criterion (Fornell/Larcker 1981). Table 37 shows the results.

The collected data analyzed by using QCA (see section 3.5 about more details regarding QCA). For this analysis I use a fuzzy set QCA (FsQCA) for emotional attachment, satisfaction with the learning process, extraneous cognitive load, motivation, and aesthetic experience. I used a crisp set for interaction and familiarity. For this analysis a case is represented by the answers given to the scales by the participants. A case also reflects if a participant was working with a direct or indirect avatar and a familiar or unknown one by coding them with 1 for familiar and interactive and with 0 for unknown and not interactive.

Construct	Factor Loadings (>0.7)	Cronbach's Alpha (>0.707)
Outcome Variable		
Emotional Attachment	0.770 - 0.817	0.899
Satisfaction with Learning Process	0.766 - 0.901	0.883
Extraneous Cognitive Load	0.737 - 0.949	0.807
Causal Conditions		
Meaning (MEA)	0.872 - 0.906	0.875
Active Discovery (ACD)	0.878 - 0.912	0.886
Self-Expression (SEP)	0.872 - 0.920	0.880
Outcome Expectations (OE)	0.771 - 0.914	0.938
Intrinsic Motivation (IM)	0.935 - 0.966	0.947

Table 37: Measurement Scales
Source: Own Illustration

As described in section 3.5, Ragin (2009) suggests three steps to conduct a QCA: (1) calibration, (2) construction of truth tables, (3) truth table analysis. Regarding the first step, for this study I used 7-point Likert scales and used 1 as the minimum value, 4 as the crossover value, and 7 as the maximum value for the Likert scales. In the data set, interaction and familiarity are crisp set values indicating whether they are present (using a 1) or not (using a 0). The constructs I used consist of several items. The mean values for each construct were then used for the calibration procedure that is provided in the FsQCA software program and that transfers all values to so-called "fuzzy values". The calibration procedure of the FsQCA software calculates fuzzy set values for each of the constructs based on the membership values I set.

To derive the truth table, I have 7 conditions for emotional attachment, satisfaction, and cognitive load, respectively, and thus 128 possible configurations. For large-scale N QCAs, at least seven conditions are necessary (Greckhammer et al. 2013). The truth table is calculated by using the FsQCA software and is refined in a next step. In this refinement process each possible combination is assessed based on the frequency and consistency of each condition. I considered around 95% of all cases and used a cutoff for the frequency of 3 as suggested by Greckhammer (2013). In a third and last step, the truth table is analyzed. The approach that is used to analyze the truth table is based on the Quine-McCluskey algorithm.

The analysis of the tables is conducted in two stages. First, a parsimonious solution is important for the analysis, which includes all assumptions derived from counterfactuals in contrast to the intermediate solution. Second, an intermediate solution is calculated, which represents a subset of the parsimonious solutions. Both solutions are compared to identify which conditions are core and which are peripheral conditions. The intermediate solutions highlight the consistency and coverage values as well as the different configurations that are relevant for a dependent variable. Based on this analysis, I will present the results in the following section.

7.4 Results

To analyze and to discuss the data, I analyzed different pattern. Patterns were extracted comparing different structures of configurations (Fiss 2011). For the analytical analysis, I refer to recommendations given by Greckhammer et al. (2013) that give recommendations regarding small-N QCA and large-N QCA (see Table 38, and complete Table and a more detailed description about small-N and large-N QCA in section 3.5).

Criteria	**Small-N QCA**	**Large-N QCA**
Number of Cases	12-50	50+
Relationship of Cases	Close, based on knowledge of each case	Distant, based on knowledge of conceptual relationship
Number of conditions	4-8	6-12
Consistency	Should be 1 (0.8 is also acceptable)	>= 0.8
Coverage	Typically high	Relatively lower

Table 38: Criteria for Small-N QCA and Large N-QCA
Source: Greckhammer et al. (2013)

For the analysis of the three dependent variables, I used three different steps.

First, I analyzed the overall values regarding the different configurations and the conditions. *Second*, I analyzed which conditions are overall present and which ones are overall absent to better judge about their role in relation to the dependent variables. QCA outputs indicate if conditions are present or absent. In addition, they show if a condition is a core condition or if it is peripheral. More precisely, black circles indicate the presence of a condition, crossed-out circles indicate their absence, large circles indicate core condition, and small circles indicate peripheral conditions. Blank spaces indicate a condition may be either present or absent. *Third*, I compared the best configuration of conditions of the subsamples to identify, if the subsamples differ in relation to present and absent conditions.

7.4.1 Emotional Attachment

I started analyzing emotional attachment as dependent variable. The results for the complete dataset can be seen in Table 39. Eight different design configurations could be identified.

Conditions	Configurations							
	1	2	3	4	5	6	7	8
Avatar Design								
Interaction		●	⊗	●		●		⊗
Familiarity		⊗	⊗	⊗	●	●	●	●
Aesthetic Experience								
MEA	●		●	●			●	⊗
ACD	●	●		⊗	●	●	⊗	●
SEP	●	●	●		⊗	●	●	●
Motivation								
IM	●	⊗	●	●	●	●	●	●
OE	⊗	⊗	⊗	●	●	⊗	●	●
Consistency	0.875	0.831	0.843	0.883	0.896	0.883	0.899	0.858
Raw Coverage	0.407	0.093	0.133	0.092	0.180	0.092	0.168	0.085
Unique Coverage	0.023	0.010	0.002	0.013	0.020	0.004	0.017	0.003
Overall Solution Consistency								0.844
Overall Solution Coverage								0.501

Table 39: Results for Emotional Attachment
Source: Own Illustration

Consistency for configurations ranges from 0.831 to 0.899. Raw coverage ranges from 0.085 to 0.407. The overall solution consistency indicates these eight conditions can result in a high likelihood of emotional attachment with 84% and the overall solution coverage indicates that the extent to which these eight configurations cover a high likelihood of emotional attachment is 50% (of all cases). If we look at the sixth configuration, interaction and familiarity are present as core conditions. If an interactive and familiar mediating avatar is used, designers should consider ACD, SEP, and IM which are also present and core conditions besides interaction and familiarity. OE is an absent core condition. In this situation, designers should focus on triggering IM instead of OE to address emotional attachment.

With a familiar mediating and not interactive avatar (see configuration 8), MEA is not present and a core condition, but all other conditions are present. With a familiar mediating avatar OE seem to be more relevant. On the other hand, having an interactive mediating avatar, where familiarity is absent (configuration 2 and 4), results in either a mediating avatar that supports ACD, and SEP or a mediating avatar that supports MEA, SEP, and IM. The first one could probably be used for learners that need interactive mediating avatars and that do not need to be motived by their avatars because they want already are familiar with the learning content and are motivated in other ways.

Next, I analyzed emotional attachment of females and males, starting with the subsample with females (see Table 40). The four different design configurations result in a high emotional attachment with 80% and cover 60% of cases with this outcome. Raw coverage ranges from 0.092 to 0.425 and all consistency values are above 0.8.

Conditions	**Configurations**			
	1	**2**	**3**	**4**
Avatar Design				
Interaction		●	⊗	⊗
Familiarity				●
Aesthetic Experience				
MEA	●	●	⊗	●
ACD	●	●	●	●
SEP	●	●	●	⊗
Motivation				
IM	●	●	●	●
OE	⊗		●	●
Consistency	0.848	0.810	0.812	0.855
Raw Coverage	0.425	0.339	0.092	0.105
Unique Coverage	0.139	0.135	0.006	0.016
Overall Solution Consistency				0.808
Overall Solution Coverage				0.594

Table 40: **Emotional Attachment Females**
Source: Own Illustration

If females get an interactive mediating avatar, a designer should focus on addressing MEA, ACD, SEP, and IM. Such as the results of the complete data set, an interacting avatar does not necessarily need to focus on OE (configuration 2). On the other side, with a familiar mediating avatar, OE become more relevant for female learners, but SEP is absent (configuration 4). To better demonstrate how the results for females and males differ, I present the results for the male participants in Table 41.

The thirteen different design configurations for the male subsample result in a high emotional attachment of 81% and a coverage of 64%. Raw coverage ranges from 0.077 to 0.213. All consistency values are above 0.8. For males, having an interactive mediating avatar (configuration 10 and 13). One group of males (configuration 10) probably needs more explanations (MEA) whereby the other group of male learners (configuration 13) needs MEA, ACD, SEP, OE, and IM in combination with an interactive mediating avatar.

Conditions	Configurations												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Avatar Design													
Interaction	⊗	⊗	⊗	⊗		⊗	⊗	⊗	●	●	⊗	●	●
Familiarity	⨂	⨂	⨂	⨂	⨂			●	●	⨂	⨂	●	⨂
Aesthetic Experience													
MEA	⊗	●	●	●	●	●	●	●		●	●	●	●
ACD	⨂	●	●		●	●	●	●	●	⨂	⨂	⨂	●
SEP	⨂		●	●	●	●	⨂		●	⨂	●	●	●
Motivation													
IM				⊗	⊗	⊗	●	●	●	●	●	●	●
OE	●	⨂	⨂	⨂	⨂	⨂	●	●	⨂	●	●	●	●
Con-sistency	0.842	0.844	0.851	0.859	0.880	0.865	0.885	0.848	0.877	0.910	0.880	0.881	0.857
Raw Coverage	0.122	0.129	0.150	0.132	0.213	0.209	0.234	0.163	0.087	0.076	0.131	0.077	0.151
Unique Coverage	0.006	0.000	0.008	0.002	0.009	0.013	0.013	0.063	0.027	0.003	0.008	0.017	0.65
Overall Solution Consistency										0.818			
Overall Solution Coverage										0.647			

Table 41: Emotional Attachment Males
Source: Own Illustration

Comparing the subset for males with the subset for females indicates that with a familiar mediating avatar, SEP seems to be more relevant for females than for males. With an interactive mediating avatar, it is of relevance that male users are supported in OE whereby this condition is not present for female learners.

7.4.2 Satisfaction with the Learning Process

Next, I assessed how avatars impact learning process satisfaction. The results are presented in Table 42. These solutions consistently result in a likelihood of satisfaction with 94 % and cover 58 % of cases with this outcome. All consistency values are above 0.8 and raw coverage is between 0.054 to 0.329. The most absent one is interaction.

With an interactive mediating avatar one design configuration result that support satisfaction with the learning process (configuration 4). If an interactive avatar is used, it is important to underline MEA of what is learned. In addition, both IM and OE are present core conditions and of relevance. ACD is absent in this configuration. Having a familiar mediating avatar (configuration 7), results in a combination of ACD, SEP, OE, and IM. MEA is an absent core condition in this configuration.

With both a familiar and interactive avatar, all aesthetic components seem not to be relevant because they are all absent and core conditions. In addition, IM is absent and

OE present. An interactive, familiar mediating avatar should concentrate on supporting a learner's OE.

Conditions	**Configurations**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Avatar Design									
Interaction	⊗			●		⊗	●	⊗	⊗
Familiarity	⊗		⊗		●		●	●	⊗
Aesthetic Experience									
MEA	●	●	●	●	●	●	⊗	⊗	●
ACD		⊗		⊗	●	●	⊗	●	●
SEP	●	●	●		⊗	⊗	⊗	●	
Motivation									
IM	●	●	●	●	●	●	⊗	●	●
OE		●	●	●	●	●	●	●	●
Consistency	0.946	0.964	0.951	0.973	0.964	0.962	0.953	0.955	0.940
Raw Coverage	0.236	0.329	0.363	0.076	0.151	0.206	0.054	0.074	0.220
Unique Coverage	0.015	0.019	0.069	0.003	0.012	0.000	0.008	0.006	0.002
Overall Solution Consistency									0.941
Overall Solution Coverage									0.579

Table 42: Results for Satisfaction with Learning Process
Source: Own Illustration

I did not further analyze gender or prior knowledge that is different towards satisfaction with the learning process. I found theoretical support to analyze gender differences for emotional attachment and differences in prior knowledge for extraneous cognitive load deeper. However, a deeper analysis of satisfaction with the learning process could be relevant for future research, which I outline in more detail in section 7.6.

7.4.3 Cognitive Extraneous Load

Next, I present the results for extraneous cognitive load. Therefore, I will start with the complete data set and will continue with comparing experts and novices to get a better understanding about how they differ regarding extraneous cognitive load. The results are shown in Table 43.

The solution consistency results in a low likelihood of extraneous cognitive overload of 92% and cover 50% of all cases that were analyzed. Consistency values are above 0.8, and raw coverage values are between 0.133 and 0.352. The most present condition in all configurations is IM. The most absent conditions are interaction and ACD.

Overall, familiarity seems not to be relevant to reduce cognitive load. If an interactive mediating avatar is used, it is important to focus on IM and not on MEA, and SEP. This group of users might be experienced in a topic and just wants to focus on the most important aspects of an online training.

Conditions	**Configurations**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Avatar Design								
Interaction	⨂			⨂	⨂	●	⨂	⨂
Familiarity								
Aesthetic Experience								
MEA	●		●	⨂	⨂	⨂	●	●
ACD	⨂	⨂	⨂	⨂	•	•		
SEP	●	⨂		⨂		⨂		●
Motivation								
IM		●	●	●		●	●	●
OE		●	●		●		⨂	⨂
Consistency	0.934	0.960	0.955	0.954	0.944	0.948	0.949	0.956
Raw Coverage	0.215	0.315	0.352	0.328	0.182	0.191	0.133	0.188
Unique Coverage	0.015	0.005	0.032	0.012	0.009	0.011	0.017	0.016
Overall Solution Consistency								0.918
Overall Solution Coverage								0.502

Table 43: Results for Extraneous Cognitive Load
Source: Own Illustration

To understand how learners', differ regarding their extraneous cognitive load, I divided the overall sample into two sub-samples by analyzing Excel experts and novices, starting with experts. The results for experts in relation to extraneous cognitive load can be seen in Table 44.

Conditions	**Configurations**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Avatar Design								
Interaction			●		⊗	⊗	●	⊗
Familiarity								
Aesthetic Experience								
MEA	⨂	●	●	●	⨂	●	⨂	⨂
ACD	⊗	●		●	⊗	●	●	●
SEP	⨂	●	⨂	⨂	⨂	●	●	●
Motivation								
IM	⊗	●	●	●	●	⊗	⊗	●
OE	⨂	⨂	●	●	⨂	⨂	⨂	●
Consistency	0.961	0.954	0.969	0.968	0.964	0.953	0.955	0.964
Raw Coverage	0.249	0.303	0.131	0.307	0.148	0.149	0.113	0.162
Unique Coverage	0.021	0.043	0.004	0.027	0.016	0.018	0.007	0.010
Overall Solution Consistency								0.932
Overall Solution Coverage								0.475

Table 44: Results for Extraneous Cognitive Load – Experts
Source: Own Illustration

All eight design configurations that were identified result in a low likelihood of extraneous cognitive overload with 93% and cover 47% of all cases. Raw coverage ranges from 0.113 to 0.307 with consistency values all above 0.8. Again, familiarity of a mediating avatar is not of relevance for experts. For interaction, two configurations result (3, and 7) that support reducing extraneous cognitive load. For one configuration (3) it is important to support MEA, IM, and OE. These experts might get easily be bored and need to be motivated in both ways by supporting IM, and OE. The other group (7) doesn't not need any kind of motivation and are probably motivated by ACD (which is not present for configuration 3) or are motivated enough and do not need to be further motivated by a mediating interactive avatar. Overall, familiarity seem to be not of relevance when reducing extraneous cognitive load. However, with no interactive, and familiar mediating avatars learners also differ. There seems to be a group of users that is not interested in any kind of aesthetic experience or motivation (configuration 1). These learners might be distracted by such aspects and just want to have the learning materials for learning. The same analysis was made for the group of novices (see Table 45).

Conditions	**Configurations**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Avatar Design											
Interaction	⊗	⊗				⊗	⊗			•	⊗
Familiarity											
Aesthetic Experience											
MEA	●	●	●	●	⨂			●	●	⨂	⨂
ACD	●		●	●	⨂	●	⨂		●	●	●
SEP		●	●	●	⨂	●	⨂	⨂	●	⨂	●
Motivation											
IM	⨂	⨂		⨂	⨂	⨂	•	•	•	⨂	•
OE			⨂		●	⨂	●	●	●	⨂	●
Consistency	0.871	0.876	0.917	0.894	0.923	0.930	0.945	0.938	0.946	0.934	0.959
Raw Coverage	0.251	0.253	0.412	0.414	0.304	0.202	0.203	0.219	0.353	0.138	0.195
Unique Coverage	0.004	0.004	0.030	0.014	0.014	0.001	0.005	0.010	0.031	0.012	0.005
Overall Solution Consistency										0.848	
Overall Solution Coverage										0.617	

Table 45: Results for Extraneous Cognitive Load – Novices
Source: Own Illustration

Having little experience with Excel results in a low likelihood of extraneous cognitive overload with 85% and 62% coverage. All consistency values are above 0.8 and raw consistency ranges from 0.138 to 0.414. Regarding the most present and absent conditions, in the data set with experienced learners, ACD, and IM are present in almost all configurations. For the data set with novices, ACD is present in almost all configurations. For novices interactive and familiar avatars are not of relevance (configuration 10 presents interaction but just as peripheral present condition).

Interaction and familiarity of mediating avatars might be too distracting for novices and makes it difficult for them to concentrate on their learning process. However, there are other constellation about aesthetic experience and motivation that support designers of learning applications to assist novices in reducing extraneous cognitive load. For example, leaners that like ACD, do not want to be further motivated or need to know the MEA of learning materials (configuration 10). They want to explore the learning material on their own. If MEA and ACD are supported motivating components are absent (configuration 1). Having the results of the study in mind, I now discuss them in more detail in the next section.

7.5 Discussion and Contributions

The results of this section deliver important insights about designing mediating avatars that are used for TML. I use literature and theories that are relevant for designing mediating avatars for learning as knowledge base and analyze the environment by designing mediating avatars for TML solutions (see section 3.6 about design science research and the connection between knowledge base, environment, and the final design of avatars). Although I can present more details on how to design mediating avatars in TML research still needs to better understand how mediating avatar configurations are connected to different kind of learning outcomes. This aspect is going to be discussed in the next section.

7.5.1 Discussion

The results of this study provide room to discuss them in more detail. The results indicate that we need to rethink the concept of gamification in terms of the oftentimes used one-size-fits-all solutions which also supports the findings of section 6.

There is some support that different designs are necessary to better address behavioral outcomes of users (Santhanam/Liu/Milton-Shen 2016). This is further supported by the recommendation to pay more attention to each individual element used in gamification (Seaborn/Fels 2015). This recommendation can be supported when we look at the results of the study about avatar designs. Female users are emotionally attached to familiar mediating avatars, in contrast to males, who are more interested in having interacting mediating avatars in relation to their emotional attachment. For learners with high prior knowledge about a topic interaction of mediating avatars, extraneous cognitive load is important, whereby learners with low prior knowledge do not need interactive mediating avatars in relation to extraneous cognitive load. The results of this study indicate that avatars are important to address emotional attachment, satisfaction with the learning process, and extraneous cognitive load. However, the results also demonstrate that for some variables web-based training configurations are even more important. Looking at satisfaction with the learning process reveals that the most present condition along the configurations is IM, mediating avatar interaction is mostly absent. Similar to this, IM and ACD are important when looking at the configurations of extraneous cognitive load. Thus, it can be assumed that for both satisfaction with the learning process as well as extraneous cognitive load, it is important to care about motivational as well as aesthetic components. A closer look at OE, reveals that it is not important to develop an emotional attachment because it is absent in most configurations for emotional attachment. So, it is up to a system designer to find the right balance between both kinds of motivational orientation, which can be very difficult because intrinsic and extrinsic motivation can be related (Deci et al. 2001). If web-based trainings are not grounded in a motivational design or do not address aesthetic experience (e.g., by better demonstrating the meaning of learning material), it can assumed that a mediating avatar would not contribute to any of the outcome variables. On the other hand, if a training supports motivation and the aesthetic experience of a mediating avatar, then its design might be effective in creating an emotional bond increasing satisfaction or lowering cognitive load.

Interaction and familiarity are two important constructs to design mediating avatars for learning. However, interaction can result in negative consequences regarding extraneous cognitive load, especially when operating in the area of TML (van Merriënboer/Sweller 2005). Mediating avatar interactions can also be connected to sounds (audible feedback (Thiebes/Lins/Basten 2014) or further animated movements (Lin et al. 2013)). Due to this reason I kept the interaction of the mediating avatars relatively simple by integrating speech bubbles and gestures. With a more animated or interactive mediating avatar in learning, extraneous cognitive overload might result, which can also affect other learning-related outcomes. In addition, learners differ in interaction in terms of their prior experience and extraneous cognitive load. In the best configuration interaction for experts is present whereby it is absent for learners with low prior experience. At some point interaction might be helpful for experienced learners to faster identify learning content that they do not know in detail, and it helps them to better focus on knowledge that they still need to improve.

Lastly, the results of this study demonstrate that it is useful to analyze a target group or context in detail before developing any kind of gamification concept or learning materials. Depending on different kind of criteria, learners differ in how they experience mediating avatars and learning materials. Females are emotionally connected to mediating avatars when they are familiar, when they better understand the meaning of a training, when they are supported in active discovery and intrinsic as well as extrinsic motivation. Men are more emotionally attached to interactive mediating avatars and a training that supports meaning and both kinds of interaction. When I use prior knowledge as subgroups to analyze configurations for extraneous cognitive load, I could observe that interaction is crucial for experts but not for learners with low experience, which is the same with MEA, which is important for experts but not for novices. Besides gender and experience, other aspects can be used to identify and consider different subgroups among a specific context, such as age or the aspect of whom learners want to compete with (Santhanam/Liu/Milton-Shen 2016; Shen et al. 2016). Such aspects need to be carefully analyzed and considered before developing any kind of online learning material or any gamification concept (these observations find support for other elements such as competition – see Santhanam et al. (2016)).

7.5.2 Practical and Theoretical Contributions

Summarizing the results, this study provides several theoretical as well as practical implications. This study contributes to a type IV theory (Gregor 2006), because I explain different kinds of mediating avatar design configurations and can predict how these configurations affect emotional attachment, satisfaction with the learning process, and extraneous cognitive load. First, the results of this study demonstrate which configurations are important for designing mediating avatars in learning. The results have the potential to contribute to different streams of literature. I contribute to learning theory because I can give implications about how to design emotionally attaching mediating avatars. In addition, I contribute to literature on learning material in general because I'm able to better explain how online learning materials presented by a mediating avatar can influence a learner's extraneous cognitive load. I contribute to streams of learning theory because I can better explain the role and meaning of the relationship between mediating avatars that are used as tutors or teachers and learners that work with them. Therefore, I can explain how the familiarity (by referring to self-expansion theory) can influence specific outcome variables such as satisfaction or emotional attachment. Second, the results of this study provide more information about configurations that are important for web-based trainings, such as motivation and aesthetic experience. Furthermore, I can give implications about the relevance of mediating avatar interaction in learning processes and how an interaction between a learner and a mediating avatar can influence extraneous cognitive load, satisfaction with the learning process, and emotional attachment. Finally, I can contribute to literature streams such as gamification or game design because I can provide precise implications regarding design components of mediating avatars.

From a practical perspective, this study can provide insights to designers of TML solutions or learning-related gamification concepts about what to consider when designing mediating avatars for learning purposes. Seaborn and Fels (2015) claim that more research should focus on the design and meaning of individual gamification elements. With this implication in mind, this study can assist practitioners in developing mediating avatars for learning applications. Further on, I can give implications about what to consider when designing online trainings in combination with mediating avatars. Therefore, motivational components as well as the meaning of aesthetic experience are important to consider when designing online trainings. Designers should think about using avatars in learning as process rather than a selection of avatar components. It is important to better understand the target group a mediating avatar is used for. Thus, it is important to consider the knowledge base (section 3.6), before starting to design mediating avatars for a specific context.

7.6 Limitations and Future Research

Referring to *RQ4*, the goal of this study was to analyze different mediating avatar designs in relation to how they affect emotional attachment, satisfaction with the learning process, and extraneous cognitive load of learners.

This study is not without limitations that provide implications for future research. First, this study did not consider the effects of mediating avatar designs on learning outcomes or on a learner's general intention to use an avatar-based learning system more regularly. However, research indicates that emotional attachment, satisfaction, and cognitive load can be important to positively influence learning outcomes (Scaife and Rogers 2001; Witmer and Singer 1998). Future research could develop online trainings with mediating avatars to determine how a specific mediating avatar design can affect learning outcomes by referring to skill-based, procedural, or declarative outcomes (Gupta and Bostrom 2013). Such studies could use a quantitative approach by developing hypotheses and testing them with a PLS-SEM. Such an analysis could also support a more detailed analysis about the relationships of all three outcome variables. This would also allow to analyze some control variables in more detail. Therefore, the results of this study can be used to derive a mediating avatar design that emotionally attaches users, influences their learning process satisfaction, and reduces extraneous cognitive load. Additionally, further analyses can be used to create a design theory about mediating avatars in TML (section 3.6.1) and should consider and compare various avatar designs. Second, more research should focus on analyzing sub-samples of satisfaction with the learning process in relation to different avatar designs. Gender as well as experience with Excel (or any other system that is used for an analysis) could be used. Studies could also analyze if satisfaction is related to the gender of mediating avatars. Third, other conditions should be considered for the configuration of dependent variables such as faithfulness of technology appropriation or self-efficacy. Finally, more research should analyze if users react differently to female or male avatars. In this study, I could not detect any effects as to whether male or female avatars affect the learner's emotional attachment, satisfaction, or if they help to reduce cognitive load.

In summary, this study indicates, that interaction and familiarity of mediating avatars can be important when females or males are emotionally attached. Furthermore, designing intrinsically motivating mediating avatars is more important in terms of positively addressing the emotions of learners. Females and males especially about the presence of interactive mediating avatars in learning. For male learners, interactive mediating avatars are a core condition to develop emotional attachment, other than for females where interaction is peripheral absent. Regarding the development of satisfaction with the learning process, both intrinsic and extrinsic motivating design components for avatar are important whereby interaction should be considered in combination with meaning and both motivating components in a satisfactory avatar design. For decreasing extraneous cognitive load with mediating avatar designs, it is important to consider intrinsic motivating components in the mediating avatar design. Learners differ in terms of their experience. Experienced learners such as to have interactive meditating avatars whereby interaction is not of relevance for novices. Overall familiarity is not important in terms of mediating avatar designs that reduce extraneous cognitive load. Overall, when designing mediating avatars researchers and practitioners should carefully develop their mediating avatar designs before integrating them as tutors or teachers in a learning system. However, this study supports that each element that is used in gamification needs to be specified to make it more appealing to IS users (or learners), especially those that are not preferred by learners (section 5).

8 The Role and Meaning of User-centered Gamification Concepts – A Review and Synthesis of Gamification Methods[9]

8.1 Introduction

The eighth section is used to present the results of *RQ5*:

RQ5: Which insights can be gained from existing gamification methods about the process of developing more user-centered gamification concepts?

In section 5, 6, and 7, I presented the results from empirical studies that were conducted in the context of TML. They were necessary to see how gamification can be added to a group of users or to a context. However, to provide more general guidelines towards the adaption of gamification concepts to the needs and interests of users or to a specific context, I present the results of this research study. This study focusses on how existing gamification methods support researchers and practitioners in gamifying IS that are adapted to users.

Oftentimes, gamification concepts are handled as one-size-fits-all solutions without considering what users need and want (Santhanam/Liu/Milton-Shen 2016; Deterding 2015). The studies presented in section 5 and 7 support the idea that one-size-fits-all solutions do not work properly in gamified learning and that more needs to be done to develop individual gamification concepts by understanding users and the context in which they interact. Standardized solutions such as a combination of points, badges, and leaderboards are used without knowing if these elements are really motivating for a group of users (Fogel 2015). Ignoring user needs in the development of a gamification concept can lead to the failure of the developed concepts because users are not motivated and do not enjoy the usage of the gamified system (Morschheuser et al. 2018; Eckardt/Grogorick/Robra-Bissantz 2018). On the other side, considering what users need and involving them in the development process of a gamification concept can have positive effects on the usability of a concept and on experiencing more fun (Eckardt/Grogorick/Robra-Bissantz 2018). Examining the needs of users means to better understand what motivates them and what drives their behavior and their work routines (Deterding 2015; Petrelli et al. 2004). Such an examination and consideration of user needs is possible by referring to user-centered designs that involve users along

[9] This paper is currently under review for ECIS2020. Thank you to the co-authors of this paper for their ideas and thoughts that were helpful to further improve the paper.

the complete development process of an IS or a gamification method (Mao et al. 2005; Reed 2014; Baek et al. 2008). Several methods exist that are used to support developers in gamifying an IS (e.g. Korhonen et al. (2017) or Deterding (2015)). In general, a method can be described as a development project that is structured in a systematic way by referring to different development activities (Brinkkemper 1996). Thus, methods allow for a stepwise, systematic development of gamification concepts and support researchers and practitioners in getting away from standardized gamification solutions to more user-centered solutions (Deterding 2015; Morschheuser et al. 2018).

The goal of this section is to learn from existing methods about how users can be involved in the development process of gamification concepts not only for gamified learning but also for other contexts. To answer *RQ5*, I present the result of a systematic literature review about gamification methods. In addition, I want to give implications for future research because research needs to get a better understanding about the meaning of user-centered gamification concepts (Helms/Barneveld/Dalpiaz 2015; Tondello/Orji/Nacke 2017). These insights are helpful to summarize future research ideas that result from this dissertation.

8.2 Theoretical Framework

To systematically guide such a development process and to better adapt a gamification concept to the needs of users, methods can be used that assist researchers and practitioners in the systematic development of gamification methods. A method for developing ISs can be defined as "an approach to perform a systems development project, based on a specific way of thinking, consisting of directions and rules, structured in a systematic way in development activities with corresponding development products" (Brinkkemper 1996, 275, 276).

Regarding IS-related methods, there are some general recommendations on what is important (Sunyaev/Hansen/Krcmar 2009). While IS development methods differ in their content (i.e., the directions and rules they provide), there are some general recommendations on what is important to consider when developing the method itself. An IS development method, by default, always involves considering the IS that is being developed or that is being adapted for a specific group of users or a specific context; a method also always comprise different steps, such as design, redesign and refinement of the system (Brinkkemper 1996; Iivari/Iivari 2011).

Gamification has been accused of applying the same few game design elements to any given problem (Deterding 2015). Many different approaches for gamification methods exist in different contexts, such as learning or e-banking (Rodrigues/Costa/Oliveira 2016; Eckardt/Grogorick/Robra-Bissantz 2018). Such methods allow researchers and practitioners to better adapt gamification concepts to a context, to a target group, or to a domain. Although many methods exist that can deliver such a support, the mechanisms behind a gameful design are still not fully understood, especially when it comes to personalizing gamification to the needs of users, their personality, preferences, and interests (Brito/Vieira/Duran 2015; Tondello/Orji/Nacke 2017). In addition, many of these methods are still in its infancy (Deterding 2015). Recent studies have started to address these challenges and have begun to develop the structure and key elements necessary to develop gamification concepts in relation to user needs (Deterding 2015; Morschheuser et al. 2018). To better understand what user-centeredness in gamification is about and how researchers and practitioners can proceed when developing gamification concepts, I summarize the knowledge of existing methods by analyzing how and in which parts they acted user-centered. Therefore, I first need to specify what user-centered designs mean and what is important about it.

To analyze existing gamification methods, I derived a framework to better guide the discussion of the results and the implications I want to give about how to act more user-centered when developing gamification concepts with a method. Figure 28 provides an overview about the framework.

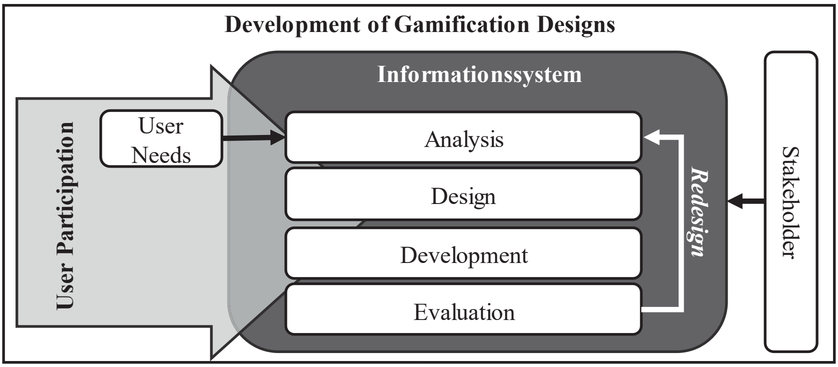


Figure 28: Theoretical Framework
Source: Own Illustration

To derive this framework, I considered three different literature streams. The most important one is literature about user-centred designs in general. This literature helped me to derive the different steps in a development process in line with the consideration of different stakeholders. General literature about methods was considered to better understand the function and meaning of methods such as the fact that it is a step-by-step development process. Finally, gamification literature was used to better understand where needs of users can or should be considered in the development process and thus in a method. Most gamification projects are designed for a crowd of system users without considering the users' characteristics and interests (Fleming 2014). However, the voices of primary IS users should be respected in each decision-making process (Baek et al. 2008). The consideration of users in each phase of the decision-making process is called user-centered design (Mao et al. 2005; Reed 2014). The term was originally defined as an as human-centered design with four principles, namely the active involvement of users, a clear understanding of user and task requirements, an appropriate allocation of function between user and system, and iteration of design solution and multidisciplinary design (International Standard 1999).

Research on user-centered design highlights its most important principle: users and their needs should be respected in each decision-making process, from stages of planning and designing a gamification approach to testing it (Baek et al. 2008). Regarding the consideration of users' needs in general three different aspects are important. First, it should be outlined what user needs are and how they can be addressed. Considering users during the development of a gamification concept is about identifying their attitude, their behavior, and the tasks they work on (Gulliksen et al. 2003). In general, attitude is a strong predictor of behavioral intentions and, thus, is a driver of a user's behavior (Hamari 2013). Such drivers describe why users would like to use a gamified IS, be it for a worthwhile experience or because users think of it as a good idea or describe it as favorable (Domínguez et al. 2013; Fishbein/Ajzen 1975). This involves the consideration of user differences such as the user's different interests in taking part in a competition (Santhanam/Liu/Milton-Shen 2016). The behavior is important to know how users really behave when using a gamified IS and to consider the psychology of individual users (Tellegen 1982). More precisely, it is about being engaged and in a state of flow while using an IS, meaning the user's ability to block other distractions or having the feeling that time flies while using an IS (Agarwal/Karahanna 2000). Additionally, gamification concepts are developed for a specific system. This system has a specific meaning and purpose for a user in which he or she has to complete and focus on different kind of tasks. Tasks in real environments are important for a user-centered gamification concept to better understand the tasks and their structure and to allow for a good adaption of game design elements to a user's tasks (Deterding 2015; Petrelli et al. 2004).

Because users have individual needs, and utilize and benefit from ISs in different ways, it is required to initiate early as well as continuous interactions with the target users to find out what they need (Cooper 2004; Reed 2014). User-centeredness is also about involving users when developing something. This can be realized by letting them participate in the development process. In general, four steps are important when developing a user-centered concept: analysis, design, development, evaluation (Iivari/Iivari 2011). In general, users should be considered as early as possible in the development process (Reed 2014). Users can participate in all four steps. First, the users' needs can be analyzed (Morschheuser et al. 2018). Second, they can be involved when designing a game concept, for example, by arranging a workshop with users to develop the game design of an IS (Deterding 2015; Mao et al. 2005). Third, users can be involved when a prototype is developed and evaluated (Petrelli et al. 2004).

In addition, it is also important to consider different stakeholders when developing a user-centered gamification design. To guarantee that the gamification concept is transferred as suggested by the users, it is useful to consider different stakeholders in the development process (Gulliksen et al. 2003). Besides the consideration of users, experts should be considered too. In gamification, experts know how gamification elements work and how their designs can be adapted to what users need (Morschheuser et al. 2018). System developers should be considered because they know the system and its functions and are able to determine how a game concept can be best adapted to users and what they need and want (Symon 1998). Finally, usability designers can assist in adapting gamification elements to make them more appealing to users with regard to their usability (Gulliksen et al. 2003).

Besides considering the user and his or her needs, it is also important to consider the system and the context for which a gamification concept is developed. Since gamification is defined as the use of game design elements in an IS that is used for non-entertainment-based purposes (Deterding et al. 2011a), it is important to consider the IS that is gamified. This development process has an iterative phase as it is a creative process that comprise different steps that are revised and refined based on evaluations or recommendations given by users (Mao et al. 2005; Morschheuser et al. 2018; Petrelli et al. 2004). In user-centeredness it is important to carefully consider the users' needs by adapting a system to his needs and wishes. The redesign of the developed gamified IS is useful to evaluate the success or failure of the developed IS and to make changes (Iivari/Iivari 2011). Gamification is more than selecting and combining gamificaion elements; it is a design process and the redesign of gamification concepts that are developed becomes even more important (Hamari/Koivisto/Sarsa 2014; Schmidt-Kraepelin et al. 2018). Such refinements allow for the best possible adaptions of gamification concepts to the needs of users to guarantee that their wishes are transferred in an IS in the right way.

8.3 Methodology

To identify existing methods, I conducted a systematic literature review (see section 3.2 about literature reviews). For the identification of the relevant literature, the following databases were used: EBSCO, Science Direct, IEEE, ACM Digital Library, AIS Electronic Library, Emerald Insight, JSTOR. For the coverage of a broad set of publications for this study, the keywords "gamification" and especially "method" were used. I used an asterisk in combination with the term method to include terms such as methodology or methods.

As seen in Figure 29, the search resulted in numerous publications, so certain criteria had to be used to limit the number of publications. First, I excluded papers that were not written in English. Secondly, the papers had to use a method to gamify their IS or they had to present a developed method they used to gamify an IS. Third, I excluded papers that did not focus on gamification because they just mentioned the term, did not explain how they developed their gamification concept, or just referred to gamification in a general matter without using gamification itself. Finally, I excluded duplicate papers.

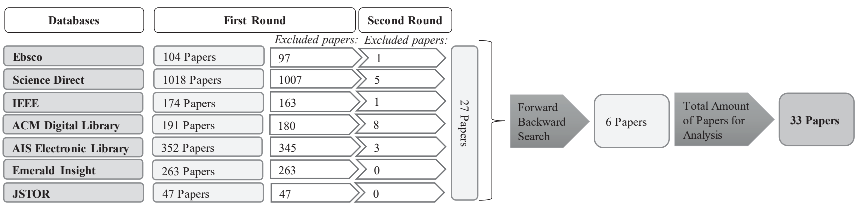


Figure 29: Overview about Systematic Literature Review
Source: Own Illustration

After the first round, 45 papers remained for the analysis. In the second round, I screened each paper to identify if it was relevant for the analysis. Again, I could exclude some papers that did not focus on designing or using a gamification method. Furthermore, I excluded those that were written by the same author and used the same method to gamify ISs. At this stage of the process, six more papers were found through cross-referencing. In total, 33 papers and one book remained for the final analysis. To analyze each paper, I created a coding scheme in relation to the presented framework. This coding scheme allowed me to make a more detailed analysis regarding the different methods and their main objectives. The coding scheme is shown in Figure 30.

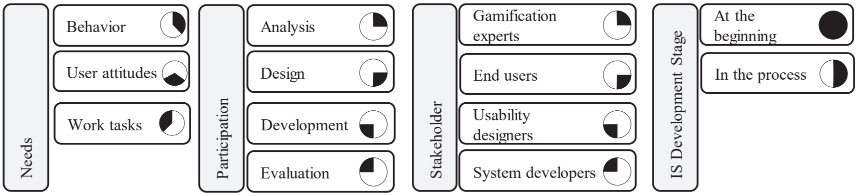


Figure 30: **Coding Scheme**
Source: Own Illustration

Each paper was read in detail and parts of the paper that fit into a coding scheme were transferred into a separate table. All tables can be seen in Appendix E.

8.4 Results

The results are presented in two different parts. First, I present the results of the systematic literature review by giving an overview about what each method focuses on. Second, I give implications about how to act more user-centered regarding the framework I present in section 8.2.

8.4.1 Overview about Literature Review Results

In a first step, I outline the results of the coding that are presented in Table 46.

The results indicate that each method has a different focus regarding the consideration of user needs, participation, and stakeholder consideration. Referring to the needs of users, four studies (12.50%) consider all needs. Most often tasks were part of the methods. In 28 (87.50%) of the 32 methods tasks are considered. The attitude of users seems to be important too, because they are used in 53.13% of all methods (17 methods).

Tasks as well as attitude seem to be important in terms of considering the needs of users. Both are oftentimes part of the analysis.

Paper	User Needs	Participation	Stakeholder	Development Stage
Brito et al. (2015)				
Colteli et al. (2014)(2014)*				
Eckardt et al.(2018) *				
Erenli (2013)				
Garcia et al. (2017)				
Gonzales & Carreno (2014)				
Helms et al. (2015)				
Khaleel et al. (2017)				
Marques et al. (2018)				
Mijangos et al. (2017)				
Mlinar & Weppel (2015)				
Moreta et al. (2016)				
Aparicio et al. (2012)				
Supendi & Prihatmanto (2015)				
YanFi & Sari (2017)				
Paravizo et al. (2018)				
Tondello et al. (2017)				
Klapztein & Cipolla (2016)				
Korhonen et al. (2017)*				
Gaers & Braun (2013)				
Mozgaleva et al. (2018)				
Simoes et al. (2013)				
Urh et al. (2015)				
Rodrigues & Oliveria (2016)				
Rothschild (2008)*				
Kirkley et al. (2005)*				
Ho et al. (2006)				
Zin et al. (2009)				
Mettler & Pinto (2015)*				
Deterding (2015)				
Morschheuser et al (2018)				
Werbach and Hunter (2012)				
* Studies use their methods in a serious games context				

Table 46: **Overview about Results**
Source: Own Illustration

Besides considering the needs of users, I analyzed where users participate in the development process of a gamification concept. Nine of the 32 methods (28.13%) considered users in the evaluation and analysis phase. Seven methods (21.88%) considered users in the evaluation phase by letting them evaluate the developed gamification concept. Four methods (12.50%) considered users in all phases of the development process. Overall, in 84.38% of all methods users participated in the evaluation phase. Another 62.50% of the methods considered user participation in the analysis by for example interviews with users (Deterding 2015; García et al. 2017). Along all methods users were considered in the design phase in 34.37% of all methods, and for the development phase 31.25% of all methods considered users. Four of the methods I identified were developed for the context of serious games. It can be observed that an overall participation seems to be important for the development of serious games. Korhonen et al. (2017) and Mettler and Pinto (2015) considered users in three phases of the development process. Kirkley et al. (2005) consider users in all phases and Colteli et al. (2014) consider users in two phases. Therefore, user participation seems to be very important when developing a complete game.

Regarding the involvement of different stakeholders, users were part in all methods. In 37.50% (8 methods) usability designers were involved as stakeholders for the design of the gamification concept or for the overall system design. Two methods (6.25%) considered all stakeholders and four methods considered users and system developers (12.50%). Overall, system developers were part of 37.50% methods. Most often, developers are necessary if a new system is developed. For existing systems that are gamified system developers seem not to be relevant. However, they can also be involved for the development of gamification concepts for existing systems. Game experts and usability designers are a part of 25% of all methods.

Summarizing this, depending on the stage of the development process and on the condition of the system that is gamified, it is determined which stakeholders are involved and which not. However, the user is always considered. Finally, I analyzed how often the system that is gamified was part of the method. Most often, the system is a part of a method, when a new system is developed. Additionally, in the analysis phase some systems are considered by determining the different tasks a user has to work with. In a learning system, users for example have to complete different tasks (Mettler/Pinto 2015). Each task has a different structure which determines the overall system structure. For 19 methods (59.38%) the system was considered from the beginning of the method process. In 13 methods (40.63%) the system was just considered in the end of the method or in the middle but not from the beginning. Overall, the system is always a part of the method and the gamification concept that is developed. Based on the general analysis, I want to give more detailed information and insights about each of the aspects in the following. The insights are next used to give precise implications to developers of gamification concepts and to researchers.

8.4.2 General Aspects about Gamification

Regarding the different methods and their detailed analysis, the first step will be to understand the overall purpose of the methods I identified in line with their goals and the phases of each method. Overall, most of the methods I identified are from the learning (or educational) context. Figure 31 provides an overview about all contexts I identified and about the target groups that were defined by each of the methods (a detailed overview is given in Appendix E.1).

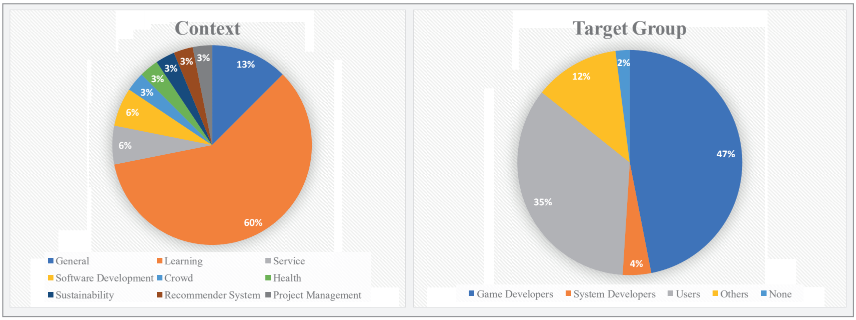


Figure 31: Context and Target Group
Source: Own Illustration

Most often, methods in gamification are developed to support gamification developers and at the same time to provide a more meaningful gamification concept to a group of users. Other target groups for example are teachers or project developers that should be supported when developing a gamification concept for a specific group of users (Simoes/Díaz Redondo/Fernández Vilas 2013; Gears/Braun 2013). In addition, Figure 31 points out that most methods were developed for the context of learning. Additionally, four methods are without any context and try to give general recommendations about how to develop gamification for any group of users. For crowd, health, sustainability, recommender systems, and project management, only one method exists (Brito/Vieira/Duran 2015; Korhonen et al. 2017; Paravizo et al. 2018). There seems to be a difference between a method that is used for a general purpose and a method that is used for a learning context. This difference can be observed when looking at the different steps of each of the method I identified. Appendix E.2 provides an overview about the steps of each method. Most of the methods that were used for a learning purpose consider the analysis of users in a first step. Other methods that are used for a different context consider a problem analysis in a first step. Therefore, other contexts such as crowd or health might not be able to follow a linear process to gamify an IS. The process of learning might be more standardized than in other contexts. Ho et al. (2006), for example, start with an analysis of learners, Yanfi and Sari (2017) start with understanding the target audience and both studies refer to methods that are used for the learning context. Gears and Braun (2013) developed a method for the context of project management and start with an analysis of business problems. Rodrigues and Olivera (2016) focus on a business object definition in a first step for their method in the context of e-banking.

The overall analysis of all methods reveals that all four phases I presented in section 8.2 are present. In the analysis phase, most methods refer to a user analysis to learn more about the target audience or to describe the players that are the focus of a system. The design phase is about the game concept, or about creating learning objectives in combination with a game concept. The development phase is oftentimes used to develop a prototype and the evaluation phase to test the success of a developed gamification concept. Regarding general aspects about all methods I documented, I identified what each of the studies measured in the end of their studies. I identified four different ways to analyze the result of the method usage or the gamification concept itself. First, some studies analyzed if the method itself was effective (Kirkley/Tomblin/Kirkley 2005; Zin/Jaafar/Yue 2009). Second, other studies analyzed the success of a gamification concept by measuring how the users behaved in relation to the developed concept (Mozgaleva et al. 2018; Helms/Barneveld/Dalpiaz 2015). Third, other studies analyzed the psychological effects and finally some studies analyzed the success of the game process (Mettler/Pinto 2015; Werbach/Hunter 2012). Appendix F shows the different outcomes that were measured. An overview about what was measured in each method is given in Figure 32:

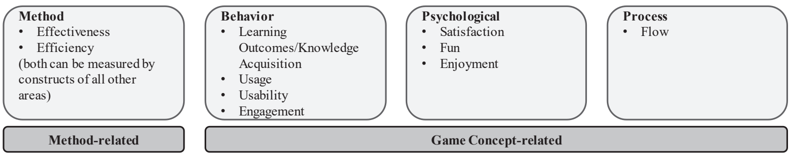


Figure 32: Outcome Variables
Source: Own Illustration

In summary, by looking at the overall aspects of gamification methods that exist, much can be learned about what to consider when developing gamification concepts by using a method. In a next step, I focus on the needs of users and how they can be considered by using a gamification method.

8.4.3 Users and their Needs

As described in section 8.2, there are three different aspects that constitute user needs: attitude, tasks, and behavior. However, before gamifying an IS it should be carefully decided if gamification is useful for an application or IS or not. Therefore, a project preparation is suggested by one of the methods (Morschheuser et al. 2018). Such a preparation is about identifying all objectives of all involved stakeholders such as users, developers, or game experts. The identified objectives are then ranked and it is discussed whether the organization or purpose for which a system is gamified benefit from them or not. If gamification is a suitable approach for an IS, the tasks users have to work with become more relevant. More precisely, the goals of users, the application, or its collective should be discussed (Marques et al. 2018). If the user's goals are specified, it is easier to decide where and if users can participate in the game development process. In addition, having an overview about the goals helps to better identify the additional needs such as the user's attitude and their behavior. Afterwards, gamification elements can be selected based on the goals and the other needs. These insights and present them in Figure 33.

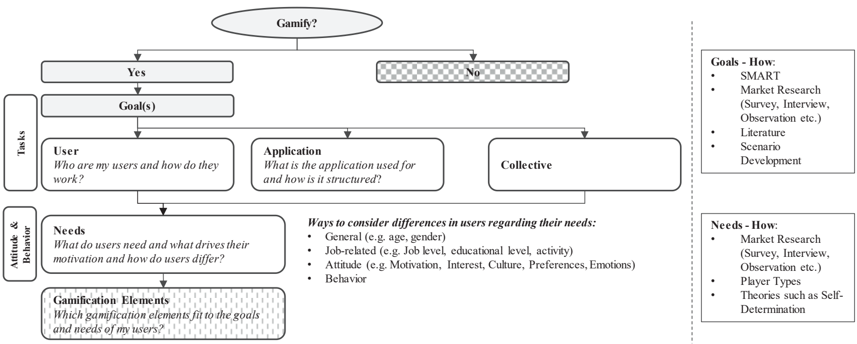


Figure 33: Overview about User Needs and Steps to Start Gamifying an IS
Source: Own Illustration

The goals are closely related to the task's users have to complete and work on in an IS. It should be carefully determined who the users are and how they work in a system to better understand their working routines (Werbach/Hunter 2012; Gears/Braun 2013).

This helps and assists in getting a better understanding about what motivates users and it helps to get an overview about where to implement game design elements. To better understand how users' work, the goals of an application should be determined by considering what the application is used for and how it is structured. The next step is about the user's attitude or behavior. Users differ in their needs, which should be considered when developing a gamification concept. They can vary by gender or age (Gonzalez/Carreno 2014) or in terms of their job experience (Brito/Vieira/Duran 2015; Werbach/Hunter 2012). A gamification concept for experts might be structured in a different way than a system that is for beginners who need more support in keep working in a IS. Finally, an understanding about user attitudes such as motivation or preferences helps to better understand how users are motivated and what engages them. Besides understanding what should be considered it is also of relevance how the methods analyzed goals and needs. Goals can be analyzed by referring to the SMART criteria or by using market research (Marques et al. 2018). Other possibilities are scenario developments or referring to the literature (Gears/Braun 2013). Needs are oftentimes considered by referring to overarching theories such as SDT or by classifying users in groups of player types (Klapztein/Cipolla 2016; Marques et al. 2018). In addition, market research such as interviews with users might help to better understand user needs (Zin/Jaafar/Yue 2009). Having goals/task and needs in mind, a next step can focus on the right selection and design of gamification elements. All aspects are part of the analysis. The methods I have analyzed have different focusses: some start with a user analysis, others with the analysis of tasks, and some with a detailed problem analysis. Figure 34 summarizes implications about the consideration of users' needs.

Implications for Consideration of User Needs:
- Determine if gamification is suitable as motivational concept.
- If gamification is selected as concept, the first step is to analyze the users goals.
- The users goals and/or the goals of the application should be analyzed to understand how users work in a system and what drives their behavior.
- The next aspect focusses on user needs and about deciding and analyzing how and if users can differ in their needs.
- Goals can be identified by using the SMART criteria or market research.
- Needs can be evaluated by using different techniques such as market research, theories like self-determination, or observations.
- Goals and needs are used to develop game design concepts (selection and design of elements).

Figure 34: Summary User Needs
Source: Own Illustration

The consideration of tasks, attitudes, and behavior are mostly considered in the analysis phase to understand users and to use this information to develop a suitable game concept. Some of the methods let users participate in the analysis phase by for example interviewing them. Others only refer to player types and to not consider the users themselves when analyzing their needs. I present the different possibilities of participation in the next paragraph.

8.4.4 User Participation and System

Overall, users can participate in all four phases of the gamification development process. In the analysis phase, users can be considered by interviewing or by observing them. In the design phase, users can support gamification developers by developing a suitable game concept in a workshop (Deterding 2015). Development with users is for example possible by an iterative prototyping and evaluation is about asking users again by using questionnaires (Khaleel/Ashaari/Tengku 2017). Table 47 summarizes insights from all methods regarding the participation of users. An overview about how each method handled user participation is presented in Appendix E.4 - Appendix E.7.

Phases	What	How – with users	How – without users
Analysis	Decision about if gamification is the suitable motivational concept in a first step. Definition of goals of target users and of the application as well as the analysis of the needs of users to better understand how users can differ in their behavior and attitude.	• Interviews • Observation • Questionnaires • Focus Groups	Literature *(Note: most methods consider users in the analysis phase)*
Design	Connect gamification elements to goals and needs of users by selecting the right elements and by adapting the design to their needs. Therefore, differences in the needs should be determined to construct different kinds of game concept based on the needs.	• Game Development Workshop • Paper-based Prototyping	Simple matching of elements to needs/goals by referring to gamification element characteristics.
Development	Developed gamification concept is transferred in the IS that is gamified. Therefore, users can support in adapting the transferred gamification concept to their needs and interest.	• Playtesting • Workshops • Prototyping	Prototyping without users Interaction examples
Evaluation	An evaluation is used to determine the success of the gamification. This can be game-related and/or user-related.	• Interviews • Observation • Questionnaires	-

Table 47: User Participation in Analysis, Design, Development, and Evaluation
Source: Own Illustration

As described in the previous paragraph, the analysis is about better understanding, goals and needs of users and the application that is gamified. Additionally, I have presented ways to evaluate the success of a gamification concept in the beginning of this section. Thus, in the following I focus on the design and development phase. Referring to the design of gamification concepts, most of the methods are not very precise about how to select gamification elements in relation to user needs and how to design them. However, most methods indicate that the first step is the selection of the adequate elements followed by the design of the elements (Deterding 2015; Morschheuser et al. 2018; Werbach/Hunter 2012). Furthermore, most methods just shortly present or list different kinds of elements that exist but do not consider how they can be designed.

Because all methods just present a list of gamification elements or do not even indicate which elements can be used, I summarized the elements based on the insights gained from the study presented in section 4. Similar to the observation made in section 4, there are still inconsistencies about which elements are gamification elements that are used as building blocks for a gamification concept (see section 4 about elements) and which are dynamics or motivational components. In addition, some methods even categorize social networks as gamification elements. Although cooperation is an important dimension when designing gamification concepts, it should be questioned if social networks are gamification elements or if they are simply classified as systems that increase cooperation. To provide an overview about which elements can be used for the selection and how they can be designed, I identified the elements that were used in the methods (in some methods elements are just briefly described by giving general examples or the method usage is not demonstrate which makes it impossible to identify the gamification elements that were used). Figure 35 summarizes all elements I could identify. An overview about the elements of each method is given in Appendix E.12.

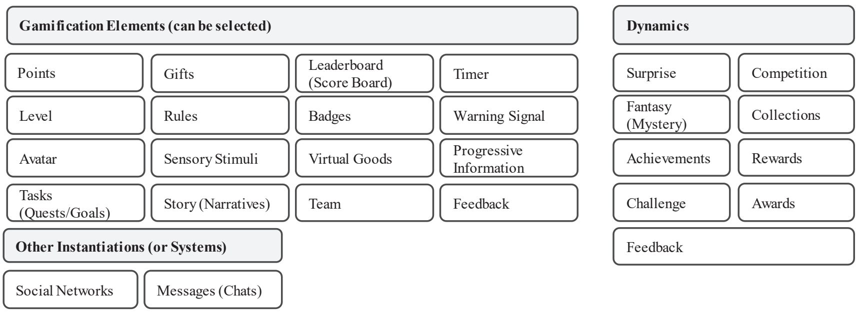


Figure 35: Gamification Elements and Designs
Source: Own Illustration

The right selection and combination of gamification elements seems to be very important to better address the needs and interests of a target group. If an element is selected, the design can be changed and varied. Most often elements are selected in the design phase or in the development phase (Deterding 2015; Klapztein/Cipolla 2016). A selection and design of elements in the design phase seems to be very important when users differ in their needs and behavior and when different kinds of elements are used for a system. Therefore, workshops can be used to find the right gamification design for a target group (Deterding 2015). Otherwise, theories such as self-determination can be used or researchers and practitioners can refer to player types such as the one from Bartle or Yee (Klapztein/Cipolla 2016; Gears/Braun 2013). However, addressing player types should be made very carefully (Deterding 2015). Playing a game is different to, for example, learning something. Therefore, it should be determined if the behavior and the structure of player types is appropriate for a specific context and if users are at some point acting such as players in a game. Otherwise, the effects of designed gamification elements might not be long-lasting because users cannot identify with the game concept and the elements and, thus, do not feel attached by the elements. If player types are part of a concept, it should be carefully analyzed if and how users can identify themselves with the characteristics of different player types such as explorers or killers (Deterding 2015).

Referring to SDT three different aspects are important: autonomy, relatedness, competence (Deci/Ryan 2000). All of them address basic human needs. Autonomy is about letting users decide about their actions by giving them space and possibilities in their decisions (Deci/Ryan 2000). Competence is about signalizing that someone has developed his competences and that he can see a progress in working (Deci/Ryan 2000). Finally, relatedness is about socially interacting with other individuals (Deci/Ryan 2000). Transferring self-determination to the selection and design of gamification elements delivers different examples. To address autonomy, a user avatar can be used, a leaderboard can be used to address competence and missions can be used for the need of relatedness. To design avatars, different components of an avatar should be considered such as his hair, clothes, or the shape (Eckardt/Grogorick/Robra-Bissantz 2018). A user can thus decide about the components of an avatar which addresses his need for autonomy. A task can be designed in different ways, for example by letting users work together or by giving a task to a user that requires chatting with another user (Aparicio et al. 2012). To address competence a leaderboard can be used. It has to be considered if clear names are to be displayed, how many positions the leaderboard should have, or if for example only the first rankings are to be shown.

If player types are used a similar logic can be referred to. Explorers for example love to run around and to explore everything in a system (Bartle 1996; Yee 2006). This can be rewarded with points or completing missions. However, it has to be determined when points are awarded such as what exactly a user has to do to complete a mission. It should be carefully decided on how to select and design the integrated gamification elements. This should be made in line with an analysis of users which makes it easier to match the right elements to the needs of users.

The selected and designed elements have to be transferred into a system. A system should always be a part of a gamification concept (Iivari/Iivari 2011). If a new system is developed in line with a gamification concept, it has to be guaranteed that the overall system design is adequate for users. At this stage, no information is available about the user's reaction towards a system in general. Therefore, user participation seems to be very important to identify the right gamification concept and to design an adequate system. Otherwise, the focus of the development is about creating a fitting gamification concept for a group of users for a system that is already established and that just needs a motivational concept to keep users working with the system. Figure 36 summarizes the implications about how to consider users in the development process of the gamification concept.

Implications for User Participation:
- Users can be involved in all four phases: analysis, design, development, evaluation.
- Users should be considered at least in the analysis and evaluation phase.
- For the analysis phase users can be considered by conducting interviews or by using questionnaires.
- In the design phase users can be involved by using for example workshops. A participation in this phase is optional.
- In the development phase users can be involved by playtesting's or prototyping's otherwise the prototype is developed without users.
- An evaluation requires the involvement of users by for example using interviews or observations.
- If a serious game is constructed participation should be considered in all phases.
- Gamification elements should be selected based on the needs of users.
- After selecting elements they should be design in the way that they are appealing to users.
- For the selection and design of elements users can be involved or theories (such as SDT) can be used.
- It should be carefully considered if using player types is the right way to categorize users.
- The system that is gamified should be considered for both ways: developing a gamification concept in line with a new system or developing a concept for an existing system.

Figure 36: Summary User Participation
Source: Own Illustration

Summarizing the aspects of user participation, it is important to figure out how and if users can and should be considered for the analysis, design, development, and evaluation phase. Their participation seems to be most valuable at the beginning and end of the gamification concept development. However, depending on what is developed (gamification concept or serious game) and on the development phase of the system it should be carefully decided how and where to involve users.

8.4.5 Stakeholders

In a last step, I analyze which of the four stakeholders are important in which phase of the gamification concept development phase and which of the stakeholders are important to make a gamification concept more user-centered by using a method. Along with the four phases of the overall development process, I figured out how often the different stakeholders were considered and how they were considered.

A summary is presented in Figure 37 and a detailed overview about each method and how they address stakeholders is given in Appendix E.8 - Appendix E.11.

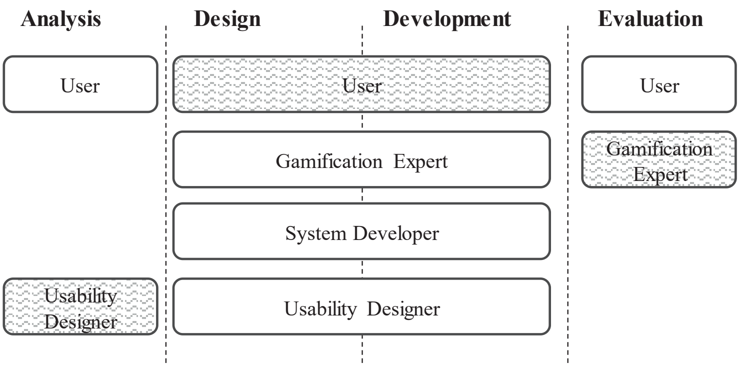


Figure 37: Stakeholders and their Involvement along the Development Process
Source: Own Illustration

First, users are a part of all methods which seems to be logical. Users are using a gamification concept in the end and they are the ones that are motivated and that work with a gamified system. However, it varies at which point they are considered. Overall, considering users seems to be very important in the beginning and end of a gamification concept and likewise in a method. The middle part of designing and developing a gamification concept can be done without a user and the insights gained in the analysis phase are transferred into a gamification concept, the effects of which are measured in the end by asking users again (Erenli 2013; Colteli et al. 2014; Brito/Vieira/Duran 2015). However, transferring a user's ideas and thoughts into a gamification concept might not be as easy as it seems to be. Maybe a user realizes that he does not like his first thoughts about a gamification concept. A consideration of users in all phases might be valuable when it is difficult to predict how users react and behave and also when it is difficult to cluster them into different groups of users. In addition, such a consideration might be valuable for complex gamification concepts or for the development of a complete system in line with a gamification concept. Considering users in all phases is described in detail in most of the methods. An overview is given in the section about user participation.

Regarding the consideration of gamification experts, I found out that most often their support is valuable in the design and development of a gamification concept (Erenli 2013; Korhonen et al. 2017). Of course, gamification experts have detailed knowledge about each gamification element and about how to design them. Therefore, it is easier for them to transfer the needs of a user into a gamification concept by selecting and adapting the right gamification element. If users are not part of the design and development phase, they might be even more important because they have a deeper understanding about each element and they understand how, for example, a need for autonomy could be addressed by changing the design of a specific element. Otherwise, when considering them in line with a user, they can assist them in selecting the right elements and by giving information to them about how each element works (Mozgaleva et al. 2018). Gamification experts can also be used to evaluate the developed gamification concept (Aparicio et al. 2012). However, considering users in a user-centered approach is most important to judge about the effects of a created gamification concept. Gamification experts might in addition help to further improve a gamification concept based on the feedback that is given by a user. They can be considered by expert interviews or in workshops to collaborate with users (Deterding 2015; Mozgaleva et al. 2018; Korhonen et al. 2017). System developers and usability designers are mostly used in the design and development phase (Eckardt/Grogorick/Robra-Bissantz 2018; Moreta/Gamboa/Palacios 2016). In addition, usability designers could support in the analysis phase. Both are important to guarantee that the users' needs and their ideas about a gamification concept are transferred into a system in the right way. Usability designers can also care about the general design of a system, make sure that a gamification concept has the intended effects, and avoid that it is not used because the system itself has a weak design. In all methods, nothing is said about how to involve both stakeholders. However, similar to the gamification experts they might be considered by participating in a workshop or by working together with them in a prototyping session. Figure 38 summarizes the implications about the involvement of different stakeholders and about when and how to consider them.

Implications for Involvement of Stakeholders:
- Users should be considered in the analysis and evaluation phase.
- Users can be considered in the design and development phase – this is valuable if a new system is developed in line with a gamification concept.
- Gamification experts are important for the design and development of the game concept because they can assist in finding the best element and design that fits to the needs of users.
- Gamification experts can also be involved in the evaluation phase by letting them decide about the quality of a developed gamification concept.
- System developers are important in the design and development phase. In the design phase the learn more about the overall concept that and get a better understanding that they can use for the development phase.
- Usability designers are important for the design and development phase because they can assist in transferring the gamification concept to a system and at the same time they help to avoid that a gamification concept has no effects because of a weak system design.
- Usability designers can be considered in the analysis phase to get a better understanding how to develop a gamification concept that has a motivating design for a group of users.

Figure 38: **Summary Stakeholders**
Source: Own Illustration

8.5 Discussion and Contribution

To answer *RQ5*, this study presents the results of a systematic literature review about gamification methods. *RQ5* is used to give general implications about how to consider users in the development process of a gamification concepts and in addition to identify gaps for future research, which is helpful to derive areas for future research for this thesis (see section 9.3). Nevertheless, by analyzing existing methods in gamification, I was able to give detailed insights about the meaning of user-centered gamification concepts. These insights help to get away from so-called one-size-fits-all solutions. To this end, discussion of the results follows under the headings of propositions that provide implications for areas of future research

8.5.1 Discussion

Gamification is described as the usage of gamification elements with the intention to change the behavior of users (Deterding et al. 2011a; Hamari/Koivisto/Sarsa 2014). Therefore, many studies that develop gamification concepts have the intention to change the usage behavior, for example by increasing a learner's learning outcomes. Gamification does not always lead to positive motivating effects; instead, there are also negative or no effects of gamification on the behavior of users (Christy/Fox 2014; Attali/Areli-Attali 2015; McDaniel/Lindgren/Friskics 2012). Most of all, when acting more user-centered, developed gamification concepts are based on the needs of users. Needs can for example be considered for gamification concepts by referring to SDT (such as some of the methods did) (Deci/Ryan 2000). SDT primarily focusses on psychological needs – namely the innate needs for competence, relatedness, and autonomy (Deci/Ryan 2000). Thus, it can be assumed that a gamification design that is developed on the basis of user needs changes the psychological outcomes and is more likely to result in satisfaction and enjoyment. However, psychological outcomes do not directly translate into behavioural outcomes. This is supported by the results of studies showing gamification itself having no direct effects on the behavior of users (Super et al. 2019) because the behavior is influenced by different factors such as the general usability of an IS that is gamified. Summarizing, a deeper understanding about how psychological outcomes and behavioural outcomes in gamification are related is needed, by getting a more detailed understanding about the needs of users and about how they differ and by understanding what drives their behavior. Thus, I posit:

Proposition 1: Gamification concepts should start by addressing the users' needs and changing the user's psychological outcomes. The impact on behavioural outcomes is indirect and should be empirically evaluated.

Most often gamification concepts are handled as one-size-fits-all solutions. The methods I analyze present different ways of developing a more individualized gamification concept based on the needs and interests of users. Besides referring to theories, a common way of developing individual gamification concepts is to refer to player types. However, it should be carefully considered if player types are the best solution of developing individual gamification concepts (Deterding 2015). To better understand the needs of users, it is important to make a detailed analysis to find out if and how users differ in their attitude or the way they work and behave. Having the same gamification design for one group of users might result in different individual effects. Whereas some users might be satisfied with the design, others might not be interested at all, because their interests and needs are not reflected. But it is not only important to understand the users' attitude and behavior. It is also important to better understand how they work, which helps to better demonstrate the meaning (Thiebes/Lins/Basten 2014) of a gamification concept. Badges that are used to motivate call-center agents, for example, are connected to training modules to learn conversations (Liu/Santhanam/Webster 2017), and thus are connected to the agents work and at the same time support the badges meaning. Based on their needs designs for each group of learners should be developed. Such an understanding is useful to develop a gamification design that is accepted by a group of users. Overall, I posit:

Proposition 2: A gamification concept that considers the users attitude, behavior, and the tasks they work on, is more likely to be accepted by users of an IS.

In gamification development, four different phases should be considered: analysis, design, development, evaluation. The results of this study indicate that user most often participate in the beginning and the end of the development process. Therefore, users and their needs are analyzed in the first step and, in the last step; they give feedback to the gamification design that was developed based on their needs. However, participation is possible along the complete development process. Only involving users in the beginning might be risky because the developed gamification design might not reflect what users had in mind. If users are not involved in the design and development phase, a redesign of the developed concept should be considered (Iivari/Iivari 2011). The developed gamification design should be adapted based on the feedback that is given by the users in the evaluation phase. In sum, letting users participate in all steps of the design a gamification concept can support user motivation (Deterding 2015) and I posit:

Proposition 3: Letting users at least participate in the analysis, evaluation, and redesign phase of the development process motivates the usage of a gamified IS.

Each gamification design element has a different meaning and characteristic (section 4) and research as of yet has not determined the different characteristics of each element and needs to do so to better understand which elements users prefer and which not (Seaborn/Fels 2015). This kind of game design element analysis becomes even more important in the development process of a gamification concept because the long-term effects of gamification are still not fully understood (de-Marcos/Garcia-Lopez/Garcia-Cabot 2016; Hamari/Koivisto/Sarsa 2014). Therefore, I assume that gamification design elements have to be better connected to the needs of users by delivering a better description of their individual characteristics and by considering their individual effects. By randomly selecting and combining gamification elements and by ignoring their individual characteristics, it becomes difficult to adapt gamification concepts to the needs of users. Such random selection and combination oftentimes result in so-called one-size-fits-all solutions that do not consider that users can differ in their behavior and their motivational structures (Santhanam/Liu/Milton-Shen 2016). An example can be given in relation to digital learning where performance and mastery learners exist. Whereas mastery learners' goals are directed to a higher purpose, performance learners' goals are directly correlated to an outcome being, for example, better than other learners

(Hakulinen/Auvinen 2014). An element with competitive characteristics would work for performance learners, but not for mastery ones. Thus, I posit:

Proposition 4: Gamification elements should be selected in line with the needs of users by considering the elements' individual characteristics, such as competition or cooperation which can determine the reaction and behavior of users towards a gamification concept.

Acting more user-centered is not only about considering users in the development process of an IS or a gamification concept. It is about working with different stakeholders that are important for the artifact that is developed (Gulliksen et al. 2003). Besides considering users, it is important to consider gamification experts that are familiar with each gamification element that exists (Morschheuser et al. 2018). Gamification experts can support in identifying the best gamification elements for a specific group of users. Furthermore, gamification is a design process because it is not just about selecting and combining gamification elements. Rather, it is about designing a gamified experience for users to increase their engagement in using an IS (Hamari/Koivisto/Sarsa 2014; Schmidt-Kraepelin et al. 2018). Therefore, usability designers that support the development process with their experience about how to design an artefact are important. They are also important because they can guarantee that the overall system design is adequate whenever a system is newly developed in line with a gamification design. Otherwise, positive effects that can result from a gamification design might be harmed because of weak system design. Finally, having a gamification design in mind or having it written on a paper is different to seeing it in an IS. Therefore, it is also important to consider system developers that have a better understanding about how the ideas of the users can be transferred into an IS. Overall, all stakeholders have different areas of expertise and each stake-holder can assist in developing a more user-centred gamification design. Therefore, I posit:

Proposition 5: The development process of a gamification design can be better supported by considering users, involving system developers, usability designers, and gamification experts.

8.5.2 Practical and Theoretical Contributions

This study provides theoretical and practical contributions. The results of the study describe the state-of-the-art regarding existing gamification methods and a classification to which degree they are user centered. The results of this study contribute to a type III of theory (Gregor 2006) of predicting, because I summarize the results of my systematic literature review by presenting propositions that can be tested and analyzed in a next step. First, I contribute to gamification and design theory by presenting the role and meaning of user-centered gamification concept designs. This might be valuable to better understand where and how gamification can be designed more user-centered and where not and how to better avoid standardized designs of gamification concepts. Second, I contribute to literature about user-centered designs. Thus, I can better explain how user needs can be better addressed by different kinds of gamification elements. Finally, I can give implications about areas of future research. Each of the areas that I present opens new possibilities of contributing to theory such as the role and meaning of psychological effects of gamification and their relation to the users' usage behavior. Practical implications can be given to system developers, gamification concept developers, and researchers that have to design gamification concepts for their research studies. With this study, I provide a detailed overview about how to act more user-centered in terms of addressing user needs, in how to let them participate in the development process, and about when and how to involve different kinds of stakeholders.

8.6 Limitations and Future Research

Although I believe that the results and implications of my gamification method analysis provide a useful foundation about how to act more user-centered when developing gamification concepts, this study is not without limitations. The results are grounded on a systematic literature review. Future research should try to analyze if a systematic development of gamification concepts is the most appropriate way of designing user-centered gamification concepts. This development processes could also be connected to design science research aspects (Gregor/Hevner 2013). The insights of these study can be further used to create a design theory (section 3.6.1). Such a design theory can be connected to the development of a novel user-centered gamification method that supports designers of gamification concepts in creating individualized and adapted gamification concepts. In addition, I did focus on different contexts in detail. Most of the methods I identified were developed in the area of learning. Future research should try to isolate context differences regarding the usage of gamification. Finally, in this study, I describe a method as the stepwise development of gamification concepts. However, studies might exist that use a systematic development process but do not present their work as method. Therefore, future research should try to isolate differences in the development process of gamification concepts.

The goal of this section was twofold. First, I wanted to identify existing methods that are used to develop gamification concepts to learn from them about how to design more user-centered gamification concepts and to generalize the findings of my previous research studies by supporting designers in getting away from one-size-fits-all gamification concepts. Second, I wanted to give implications for areas of future research. The results of this study reveal that several methods exist. By summarizing the key aspects of each method, I can give implications about how to act more user-centered when developing gamification concepts by considering different stakeholders, by analyzing the meaning of user participation, and by getting a better understanding of how user needs are handled in gamification. Future research should concentrate on getting a better understanding about how users differ in their needs and how needs can be better connected to the characteristics of gamification elements. In addition, it should be evaluated how and if a gamification concept can be improved by considering different stakeholders.

9 Summary of Contributions and Areas for Future Research

To this end, I take a look at the three research challenges of my dissertation and how my study implications contributed to solving these challenges from both a theoretical as well as practical perspective. To address the first challenge of my dissertation, I developed a taxonomy that is used to get a better understanding about the function and characteristics of gamification elements. The second challenge was addressed by three empirical studies that support researchers and practitioners in getting a better understanding about the design of gamification concepts in digital learning. Finally, I present the results of a systematic literature review to get a better understanding about the process of designing gamification concepts. In addition, I present three streams for future research.

9.1 Theoretical Contributions of the Dissertation

For the theoretical contributions I refer to the work of David Whetten (1989) by presenting what was analyzed why it was analyzed and how it was analyzed. Figure 39 presents a summary of all contributions this dissertation provides.

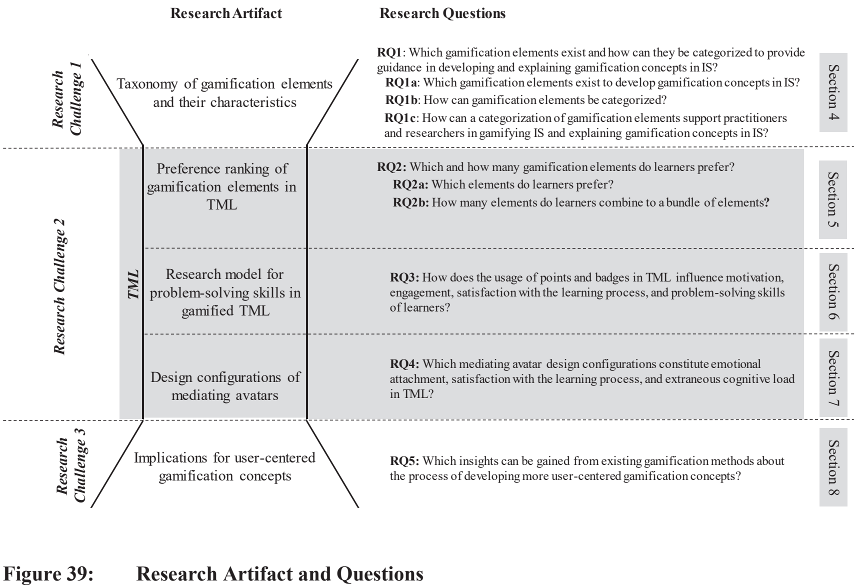


Figure 39: Research Artifact and Questions
Source: Own Illustration

I will use the insight about what, why, and how in relation to Doty and Glicks (1994) work on criteria's about theories. A theory supports the development of constructs, describes the relationship between constructs which must be falsifiable (Doty/Glick 1994). In addition, to support theory development, utility should be demonstrated (Corley/Gioia 2011). All four components are part of the work of Gregor (2006), who presents different types of theory. A type I theory simply summarizes literature without describing any relationships or without a deeper analysis (Gregor 2006). A theory type II supports in not only understanding what is, it informs readers about how, why, when, and where something is of relevance (Gregor 2006). Having a type III kind of theory is about saying what is and will be and delivers testable propositions without a well-developed jurisdiction (Gregor 2006). A type IV theory somehow combines type I, II, and III theory and exceeds it by having testable propositions and causal relationships (Gregor 2006). Such a theory "gives statements of relationship between constructs stated in such a form that they can be tested empirically" (Gregor 2006, 620). Finally, a type V theory of design and action informs readers about how to do something by presenting a new method or technique (Gregor 2006).

9.1.1 The Categorization of Gamification Elements

To this day, there is no shared understanding about how to classify and characterize gamification elements (Liu/Santhanam/Webster 2017). Table 48 summarizes the theoretical contributions of the first research study I present in section 4.

Question	Answer
What?	***Research questions:*** ***RQ1***: Which gamification elements exist and how can they be categorized to provide guidance in developing and explaining gamification concepts in IS? ***RQ1a***: Which gamification elements exist to develop gamification concepts in IS? ***RQ1b***: How can gamification elements be categorized? ***RQ1c***: How can a categorization of gamification elements support practitioners and researchers in gamifying IS and explaining gamification concepts in IS?
How?	A taxonomy was developed that consolidates the state-of-the-art of gamification literature about the functionality and characteristic of gamification elements. To support utility, the taxonomy further guides developers when developing and interpreting gamification concepts.
Why?	Shared understanding about gamification elements, their characteristics, relationships to other elements and their overall usefulness.
Theory Type	Type IV – Explanation and prediction – By presenting measurable dimensions and characteristics it is possible to test the effectiveness of developed gamification concepts.

Table 48: Summary theoretical Contributions Section 4
Source: Own Illustration

This study provides different kinds of theoretical contributions starting with a contribution to gamification literature. One outcome of this study is a taxonomy. The taxonomy that is presented in section 4 describes dimensions and characteristics of gamification element. These dimensions can be used to measure the success of gamification concepts under the light of different viewpoints (such as testing the competitiveness of a gamification concept or the degree of cooperation). The elements' characteristics can help to derive gamification concepts and support in interpreting the results of empirical studies that are made with specific elements. In addition, with this study I present a two staged, taxonomy-based approach to gamify ISs. Therefore, with the developed taxonomy I contribute to a better understanding about the process of developing a gamification concept. This supports the idea that gamification is about designing a gaming experience rather than just selecting and combining elements.

9.1.2 Gamification and the Role of User Preferences

The second study of this dissertation was used to get a first understanding about how users in learning react towards gamification elements. I conducted a preference analysis with different gamification elements. This analysis delivered a ranking of gamification elements, ranging from the most preferred to the least preferred element. In addition, this study was used to get a better understanding about the combination of elements. Table 49 summarizes the key insights of the study I present in section 5.

Question	Answer
What?	***Research questions:*** ***RQ2:*** Which and how many gamification elements do learners prefer? ***RQ2a:*** Which elements do learners prefer? ***RQ2b:*** How many elements do learners combine to a bundle of elements?
How?	A preference analysis (BWS) was used to identify which elements learners prefer. In addition, a combination analysis presents which and how many elements learners like to combine for their gamification concept.
Why?	To get a better understanding which and how many elements learners prefer and to identify which elements need to be analyzed in more detail to make them more appealing in the context of learning.
Type of Theory	Type II theory of explaining – because I can explain which gamification elements users of learning applications prefer and which not. I use the results of my taxonomy to interpret the ranking positions of each gamification element.

Table 49: Summary theoretical Contributions Section 5
Source: Own Illustration

This study contributes to theory by delivering a better understanding of user preferences in gamified learning applications. Additionally, it delivers a better understanding about how to analyze users and their needs, which is not limited to gamification. Such a preference analysis has been successfully used in other contexts such as health (Cafazzo et al. 2012) or marketing (Allenby et al. 2005). As described in section 8, an analysis phase is important to understand users and their needs and interests. With a broader view on preference analyses, this study contributes to a better understanding about how to involve a group of users in the analysis phase of a user centered IS development process. In addition, this study contributes to different streams of literature such as research about competition in learning. Each element that was analyzed in this study has specific characteristics (section 4). Each characteristic helps to better understand the logic behind each gamification element. This study gives insights about how learners experience elements in gamification. This helps to better understand the logic behind gamification such as the fact that competition (instantiated by a leaderboard) might not work as a one-size-fits-all solution in learning (Santhanam/Liu/Milton-Shen 2016). This is similar to the number of gamification elements that should be combined as a bundle in an IS.

9.1.3 Gamification and its Effects on Problem-solving Outcomes

The third study of this dissertation presents the results of another empirical study. In this study, I used badges (least preferred elements in learning – see section 5) in combination with points to support learners in their learning progress. This study provides a research model that delivers important theoretical contributions (see Table 50 for a summary).

Question	Answer
What?	***Research question:*** ***RQ3:*** How does the usage of points and badges in TML influence motivation, engagement, satisfaction with the learning process, and problem-solving skills of learners?
How?	By constructing a research model with relevant constructs that influence problem-solving skills. A SEM was used to analyze the constructs relationships.
Why?	To identify which constructs, determine problem-solving skills in gamification and learning. To get an understanding how engagement in learning constitutes and about how to design badges and points in learning.
Type of Theory	Type IV of explaining and predicting - because I present and test a research model with hypotheses.

Table 50: Summary theoretical Contributions Section 6
Source: Own Illustration

This study provides several theoretical contributions. First, I refer to different streams of literature such as literature about motivation, engagement, and satisfaction (affective learning outcome – see section 2.2). Although gamification has no direct effect on problem-solving skills, it is important to create an engaging and motivating learning experience. It should be critically discussed if gamification is the only way to achieve such engaging end motivating effects. However, engagement, intrinsic motivation, and satisfaction with the learning process are of relevance in learning. With this study, I contribute to learning theory by presenting key constructs that determine positive effects on problem-solving skills. In addition, this study helps to contribute to gamification theory by getting a better understanding about the impacts of gamification on engagement, satisfaction with the learning process, and intrinsic motivation. Most studies that I have analyzed have the aim to influence and change use behavior with gamification. However, gamification might not initially support usage outcomes (such as problem-solving skills) but has a mediating function. Therefore, this study contributes to a better understanding of which constructs constitute usage behavior and need to be considered when constructing a motivating, engaging, and satisfying learning experiences. Finally, referring to the usage of badges in points in learning, I can give design recommendations about what to consider when using gamification elements in TML.

9.1.4 Designing Mediating Avatar

The last empirical study of this dissertation presents an analysis of mediating avatars in learning.

Question	Answer
What?	***Research question:*** ***RQ4***: Which mediating avatar design configurations constitute emotional attachment, satisfaction with the learning process, and extraneous cognitive load in TML?
How?	Dependent variables and configurations were derived that are relevant for designing avatars in learning. QCA was used to analyze the data.
Why?	To understand which design configurations of avatar in learning matter in relation to emotional attachment, satisfaction, and extraneous cognitive load.
Type of Theory	Type IV of explanation and predication - because I can predict which kind of avatar configurations have an impact on emotional attachment, satisfaction with the learning process, and extraneous cognitive load.

Table 51: Summary theoretical Contributions Section 7
Source: Own Illustration

The BWS study results (section 5) highlighted that mediating avatars are not preferred in the context of learning. Thus, in section 7, an analysis of avatar configurations is presented the theoretical contributions of which are explained in Table 51. For this study, I refer to the theories of self-expansion and cognitive load. In addition, I provide a more detailed understanding of motivation, emotions, and interaction in learning. The study theoretically contributes to gamification and design theory by highlighting factors that are important when constructing mediating avatars that are used for learning purposes. It should be carefully considered how to design any kind of learning material (when we judge about mediating avatars as learning material). Learners seem to differ in how they react towards avatars. Besides their experience, it is also important to consider different behaviors that result from demographic data. Thus, we should widen the theoretical understanding of constructing learning materials. Again, this study supports the idea that an analysis phase is important when we design learning materials (such as mediating avatars that interact with a learner). This study theoretically contributes to gamification theory because it presents a better understanding about configurations that are necessary when designing avatars in learning. Research studies have already highlighted that more needs to be learned about preferred and less preferred elements in gamification to allow for a more detailed analysis of each element (Seaborn/Fels 2015). Having this in mind, the study I present in section 7 supports researchers in finding ways to better understand which design configurations of gamification elements (mediating avatar) constitute emotional attachment, satisfaction with the learning process, and extraneous cognitive load.

9.1.5 The Meaning of User-centered Gamification Concepts

The last study presented in section 8 summarizes work of existing studies to give recommendations about how to act more user-centered when creating gamification concepts, to get away from standardized gamification concept designs which is besides learning relevant for all other areas. Table 52 presents a short summary of the theoretical contributions.

Question	Answer
What?	***Research question:*** ***RQ5***: Which insights can be gained from existing gamification methods about the process of developing more user-centered gamification concepts?
How?	By analyzing existing gamification methods to better understand how they address the needs and interests of users (or a specific context). The methods were derived from a systematic literature review.
Why?	To give general implications about what to do when considering users in the construction of a gamification concept and to better understand the process of developing gamification concepts.
Type of Theory	Type III of prediction - because I summarize the results of a systematic literature review to formulate testable propositions.

Table 52: Summary theoretical Contributions Section 8
Source: Own Illustration

This study provides theoretical contributions to research about the development of methods and about the process of developing a user-centered gamification concept. First, a better understanding about what user-centeredness in gamification is is provided in this study. When constructing user-centered gamification concepts, several steps need to be considered (analysis of user needs, design of gamification concepts, development of concept, evaluation of concept, redesign).

Gamification itself delivers several possibilities of element combinations and adaptions in combination with differences that result from the target group for which a gamification concept is developed. The study results contribute to gamification theory by demonstrating how to proceed when constructing a gamification concept. It demonstrates which steps are necessary, what to care about and how to proceed in each phase with regard to the needs and interests of users. Lastly, the study presented in section 8, presents propositions that can be used from other researchers in getting a deeper understanding about the role and meaning of user-centeredness in gamification.

9.2 Practical Contributions of the Dissertation

Related to the theoretical contributions of this dissertation are the practical contributions that are explained in the following. I can give five practical contributions for each of the studies I present in this dissertation.

9.2.1 Taxonomy of Gamification Elements and their Characteristics

The study presented in section 4 summarizes existing gamification elements and presents a list of all elements and additional terms of gamification elements. Therefore, practitioners have an overview about which elements they can use to gamify their ISs. In addition, the taxonomy provides two different practical contributions. First, practitioners can construct new gamification concepts by using the developed taxonomy. By referring to the characteristics that need to be addressed in a gamification concept, practitioners can identify which gamification elements are most suitable for a specific context or group of users. Second, the taxonomy supports in getting a better understanding about existing gamification concepts and their overall logic. Practitioners can get a better understanding about a game logic by deriving which elements are used that address which kind of characteristics. In addition, practitioners have the possibility to enhance existing gamification concepts. By presenting two different case studies I demonstrate the utility of the developed taxonomy and give implications to practitioners about what to consider when constructing gamification concepts.

9.2.2 Ranking of Preferred Gamification Elements

The second practical contribution results from the study presented in section 5. I deliver a ranking of preferred elements in the context of learning. Thus, practitioners are guided by selecting the most preferred gamification elements for their learning applications. In addition, the study provides insights about the combination of gamification elements. The study results reveal that four elements should be used in a bundle of elements. Thus, the study provides not only implications about which elements to use in the learning context, is also presents how many elements should be combined to a bundle of elements

9.2.3 Research Model to Explain Effects of Gamification

Section 6 presents a research model that analyzes the impact of points and badges on engagement, intrinsic motivation, extrinsic motivation, satisfaction with the learning process, engagement, and problem-solving skills. Practical implications can be given about the design of online trainings with points and badges. Practitioners should consider that a rewarding system supports learners along the learning process. Thus, rewards should not be given in combination with activities that are connected to the success or failure of a learner. Instead practitioners should focus on rewarding the progress a learner makes. In this study, I provide a research model that can also be used to analyze other gamification elements that are used in learning. In summary, practitioners can use the results presented in section 6 to design motivating and engaging online trainings by using points and badges. In addition, practitioners should keep in mind that engagement is an important construct to influence problem-solving skills.

9.2.4 Mediating Avatar Design Configurations

The fourth practical contributions that results from section 7 is about mediating avatars that are used for learning purposes. When designing mediating avatars for learning applications, it is important to consider different design configurations. Mediating avatars in learning should be interactive and familiar. They should be embedded in an online training that is motivating and that supports the learner's aesthetic experience. Mediating avatars should be handled as part of learning material that is presented to users. Designers of learning materials or online learnings should also care about different user characteristics. Experienced learners might profit more from a different mediating avatar than unexperienced learners. Furthermore, females might differ in their reaction towards a mediating avatar in contrast to males. As presented in section 6, emotional attachment, satisfaction with the learning process, and extraneous cognitive load should be considered when using mediating avatars in learning. These constructs might also matter for designing online learning materials. Practitioners should try to get a better understanding about the target group for which a mediating avatar is used to identify and implement different avatar design configurations for an online training.

9.2.5 Propositions about the Development of User-centered Gamification Concepts

The last practical contribution can be given about user-centered gamification concepts. This implication is part of the results presented in section 8. Users should participate in the development process of a gamification concept. First of all, when developing a gamification concept, the target group and context should be analyzed in detail. This analysis is necessary to understand whether or not gamification is useful for an application. In addition, an analysis (such as the preference analysis I made in section 5) helps practitioners to get a deeper understanding about what users need and want and about how the system works that should be gamified. The analysis phase is followed by a design phase. In this design phase gamification elements become relevant. It is important to identify the best gamification elements that address the needs of users and best fit to a context and its activities. Afterwards, a development phase is used to transfer the gamification concept to an IS. Typically, prototyping can be used as an instrument to find out if the concept was transferred in an IS in the right way. An evaluation then reveals how well a gamification concept fits the needs and interests of users. Typically, a redesign follows to make some refinements on the concepts based on the recommendations given in the evaluation. In conclusion, practical contributions can be given about when and how to consider users in the gamification concept development phase. The concept development is not only limited to the consideration of users. Other stakeholders such as system developers or usability designers who can guarantee that a developed gamification concept is transferred in an IS in the right way should be considered in addition so that a gamification does not fail due to other restrictions that result from an insufficient system design.

Although this dissertation provides several theoretical and practical contributions, some limitations result from each study that at the same time provide implications for future research. Directions for future research are presented in the following and last section of this dissertation.

9.3 Directions for Future Research

This dissertation is based on the results of five different research studies. In conclusion, there are some streams for future research. In this section, I present five different areas for future research. Two of them result from technological changes. The other three research directions can be assigned to different aspects along the development process I presented in section 8. To discuss these future research directions, I refer to three guiding questions:

1. ***What*** is gamification and what is it not? (section 9.3.1)
2. ***Why*** is gamification necessary? (section 9.3.2)
3. ***How*** can we bring gamification to the next level of game design? (section 9.3.3)

An overview about the different areas for future research in relation the construction of a gamification concept is presented in Figure 40.

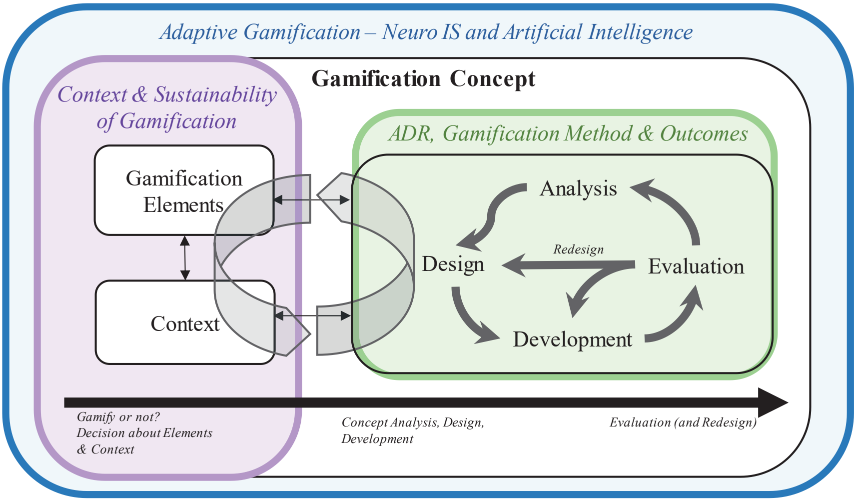


Figure 40: **Overview about Areas for Future Research**
Source: Own Illustration

9.3.1 Gamification Context and the Sustainability of Gamification

The first idea for future research refers to the question: "*What is gamification and what is it not?*"

The first study I presented in section 4 highlights that there are still some inconsistencies about gamification, its elements, and general meaning. Future research should discuss in more detail what gamification is and what it is not. More precisely, gamification is not limited to the use of gamification elements only. Some other streams of research such as the concept of digital nudging have started to develop that are closely connected to gamification. Similar to gamification which has its origin in games, nudging has its origins in offline settings endorsed by behavioral economics. A nudge is defined as "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler/Sunstein 2009, 6). In IS research, nudging has become more and more relevant and has led to the concept of digital nudging (Lembcke et al. 2019; Hummel/Maedche 2019). More decisions are made online where digital nudging can support individuals in guiding them in a certain direction (Kroll/Stieglitz 2019). Similar to gamification, digital nudging is present in many different areas such as privacy, crowdfunding, or e-commerce (Lembcke et al. 2019). Originally, digital nudging has been defined as "the use of user-interface design elements to guide people's behavior in digital choice environments" (Weinmann/Schneider/Vom Brocke 2016, 433). Some overlaps can be seen when comparing digital nudging with gamification. Both refer to elements and are used with the intention to change user behavior. However, the results of my empirical studies indicate that gamification not directly influences behavior, it rather supports psychological constructs such as motivation, engagement, or emotions (Super et al. 2019). In addition, there is empirical support for only small effects of gamification on behavioral learning outcomes (Sailer/Homner 2019). Nudging might be more into influencing the user’s behavior. Therefore, future research should try to better understand the relationships of gamification, and nudging elements. As such, it may be fruitful to investigate how users interact with gamification elements (as well as with nudging elements) and behave differently when gamification elements (or nudging elements) are present in non-game contexts (i.e., serious games) as opposed to when they are playing real games (i.e., hedonic systems).

Moreover, future endeavors may move beyond the current focus on gamification elements and need to consider “game functionalities,” which are understood as providing more features to a certain IS design. The application of gamification elements requires more than mere employment. Instead, it is crucial to understand the game logic behind such employment for gamification elements and thus IS to realize their full potential.

In addition, gamification is not limited to gamification elements such as leaderboards. Competition and cooperation are well known constructs that have been used before the existence of gamification. Both cooperation as well as competition can be transferred to gamification by using elements such as a leaderboard or virtual goods that reward users for their cooperative behavior (Thiebes/Lins/Basten 2014; Santhanam/Liu/Milton-Shen 2016; Schöbel/Söllner 2016). IS can also be connected to social networks, which is often referred to as gamification but by definition, using social networks (Boticki et al. 2015) is not necessarily related to using a game-like element. It might be an "entertaining" function in a non-entertainment-based IS. In summary, future research should analyze in more detail what gamification is by identifying its relationships to other areas such as nudging. Therefore, more detailed analyses are necessary that try to better understand dynamics that are used in gamification such as cooperation or competition (Werbach/Hunter 2012).

9.3.2 Action Design Research for Developing Gamification Concepts

The second idea for future research is guided by the question: "W*hy is gamification necessary?"*

In section 8, I present the results of a systematic literature review about methods that can be used to gamify an IS. Although several methods exist to guide researchers and practitioners in developing gamification concepts, research still needs to understand how to make gamification concepts more meaningful to IS users. In his work Deterding (2015), argues that existing methods need to be further improved to better support the development process of gamification concepts. All study results I present in this dissertation can be used to derive a new method to gamify IS. Such a methods should not only cover static development approaches, rather adaptive ones that allow for a continuous adaption of gamification concepts (see section 9.3.3 for more details). Having a novel method that better supports the development process of gamification concepts might be useful not only to better guide the development process, rather it supports to get a better understanding the effects that are caused by gamification.

Another important aspect that needs to be payed more attention to are the outcomes of gamification. This can be observed when looking at the results of section 6 and 7. In section 6, no direct effects of gamification could be identified. In section 7, I was able to demonstrate that aspects such as emotional attachment or satisfaction with the learning process (section 2.2 for more details) are important in relation to gamification element designs. Gamification outcomes help us to better understand why we need gamification. Games are fun and enjoyable, but the goal of gamification is much more than entertaining users (Schmidt-Kraepelin et al. 2018). Gamification research seems to suffer from a shortage of theoretically sound and realistic outcome measures (Seaborn/Fels 2015). As a result, it is difficult to establish the success of gamification elements as a whole. With a pragmatic view, I take the position that game or gamification designers cannot define desirable outcomes as gamification is a means to an end where that end should be defined by the stakeholders of the process that is gamified. For example, in an education setting, the expected gamification outcomes should be defined by content and pedagogy experts rather than game or gamification designers. Meanwhile, it is also true that the process of game playing has certain characteristics that need to be present if desirable gamification outcomes are to be achieved among these are increased user motivation (in the subject domain) and engagement (or flow) (Suh/Wagner/Liu 2015; Suh et al. 2017). Current gamification research models cover these variables; however, this is typically done via self-report scales. I advocate the use of direct measures of these psychological variables so that more reliable outcomes can be achieved – support can be found when looking at the results of the study I present in section 7.

In line with this, it is important to consider not only short-term studies. Future research should adapt longitudinal approaches or meta analyses to measure the long-term influence of gamification in combination with experiments to measure if potential benefits are maintained, diminished, or amplified. The experimental view is important in terms of future research. Research on gamification has sometimes revealed inconclusive results on the effectiveness of different gamification elements and nonsignificant results can be hard to publish. Research that has focused on short-term studies and gamification theories related to context-effects are still scarce. An action research approach (ADR) could be appropriate to achieve this (Sein et al. 2011). Thus, future research could cover these aspects by developing an artifact in line with a gamification concept by referring to the concept of user-centeredness (where we have analysis, design, development, evaluation, redesign – see section 8 for more details) and by making a long-term analysis to better understand why gamification is necessary and to better demonstrate the effects that result from gamification.

9.3.3 Artificial Intelligence and Neuro IS in Gamification – Creation of Adaptive Gamification Concepts[10]

Lastly, the third aspect for future research focusses on the question: "*How can we bring gamification to the next level of game design?*"

This dissertation was used to better understand how gamification can be adapted to specific contexts (such as learning) or to a group of users. In line with the results of the studies presented in this dissertation, a general topic that needs to be addressed is the understanding and customization of gamification design for different contexts, in which different user groups have different needs and expectations of gamification. Understanding the current circumstances and settings can facilitate effective user engagement and better understanding of gamification use (Denny 2013; Wang 2015). This is also related to the context-awareness perspective of gamification design, where key context components should be captured and integrated to gamification in order to motivate and activate positive user actions in the right situations. Such a customization can happen by referring to artificial intelligence (AI) that has been established in other areas such as product configurations (Salvador/Forza 2004). Up until now, gamification research is led by a rather static view. The experiments that were used in this dissertation (as well as the preference analysis in section 5) compare static treatments, e.g., experimental variations of game design elements, with respect to certain outcomes such as learning outcomes, engagement etc. An AI gamification concept design might be relevant and necessary due to two different observations. First, motivation might change over time and during system use. For example, the conditions of users change in health applications (illnesses are cured, come back, etc.) or in learning applications, the current state of knowledge changes over time (learners get more experienced in the topic of interest) and they simply have other interests regarding their goal orientation (Baranik/Barron/Finney 2007). Thus, the motivation to keep users interested might change and that should be reflected when considering the logic of gamification. Second, gamification elements could wear off over time when they do not meet the specific (and changing) motivational affordances or when they simply annoy the users over time. A comparable effect is known in the domain of education when it comes to the effectiveness of scaffolds during the learning process (Delen/Liew/Willson 2014). Here we know that learners need certain scaffolds in the beginning of the learning process, but these scaffolds need to alter or even be removed as the learner progresses. Therefore,

[10] Part of this study are currently under review at CAIS and present the results of a panel workshop on gamification designs. I thank all workshop participants for their contributions and ideas.

future gamification research needs to focus on the on-going adaption of the underlying game design logic and related design efforts. AI or machine learning could be utilized to analyze the data collected to adapt gamification deployment of in IS over time. Most systems that we use nowadays collect data that could be used for on-going gamification efforts (under consideration of ethical issues). So far, a more user-specific view on the adaptation of gamification measures is scarce in research (Böckle et al. 2018).

Such observations can also be connected to Neuro IS. Neuro IS can be used to better understand how gamification and its elements relate to neuro- and biophysiological processes (such as skin conductance response, heart rate etc.). An implicit association test (Greenwald/McGhee/Schwartz 1998) or the approach avoidance task (Rinck/Becker 2007) could be used to disclose preferred gamification elements for an individual user and their effects on relevant dependent variables. They could also be used to identify the best time to change or vary gamification elements. Therefore, it could be observed how users react towards specific elements (e.g., does learning performance decrease because of too much fun or does physical or mental stress occur) alongside the role of cognitive load while using gamification elements (e.g., at what part is a game no longer fun / when is it fun and finding an optimal interval).

Both AI and Neuro IS can be embedded in an overall design science approach. A suitable approach could be to refer to Peffers et al. (2007) design science methodology (see section 3.6 about DSR). His approach can be used to derive requirements for adaptive gamification concepts in a first step. In a second step, adaptive gamification concepts can be developed and designed by using AI or Neuro IS in combination with an IS that needs to be gamified. Lastly, an evaluation and redesign follow that support the continuous adaption of gamified IS.

References

Abdellaoui, M.; Bleichrodt, H.; Paraschiv, C. (2007): Loss aversion under prospect theory - A parameter-free measurement. In: Management science, Vol. 53 (2007) No. 10, pp. 1659–1674.

Agarwal, R.; Karahanna, E. (2000): Time Flies When You're Having Fun - Cognitive Absorption and Beliefs About Information Technology Usage. In: MIS Quarterly, Vol. 24 (2000) No. 4, pp. 665–694.

Alavi, M.; Leidner, D. (1999): Knowledge management systems: issues, challenges, and benefits. In: Communications of the AIS, Vol. 12 (1999), pp. 1–37.

Alavi, M.; Leidner, D. E. (2001): Research commentary: Technology-mediated learning—A call for greater depth and breadth of research. In: Information Systems Research, Vol. 12 (2001) No. 1, pp. 1–10.

Alavi, M.; Wheeler, B. C.; Valacich, J. S. (1995): Using IT to reengineer business education: An exploratory investigation of collaborative telelearning. In: MIS-Quarterly, Vol. 19 (1995) No. 3, pp. 293–312.

Alcivar, I.; Abad, A. G. (2016): Design and evaluation of a gamified system for ERP training. In: Computers in Human Behavior, Vol. 58 (2016), pp. 109–118.

Allenby, G.; Fennell, G.; Huber, J.; Eagle, T.; Gilbride, T.; Horsky, D.; Kim, J.; Lenk, P.; Johnson, R.; Ofek, E. (2005): Adjusting choice models to better predict market behavior. In: Marketing Letters, Vol. 16 (2005) 3-4 , pp. 197–208.

Anderson, L. W.; Krathwohl, D. R. (2016): A Taxonomy for Learning, Teaching and Assesing - A Revision of Bloom’s Taxonomy. LongmanPublishing, New York. 2016.

Anderson, L. W.; Krathwohl, D. R.; Airasian, P. W.; Cruikshank, K. A.; Mayer, R. E.; Pintrich, P. R.; Raths, J.; Wittrock, M. C. (2001): A taxonomy for learning, teaching, and assessing - A revision of Bloom’s taxonomy of educational objectives, abridged edition. In: White Plains, NY: Longman (2001).

Aparicio, A. F.; Gutiérrez Vela, F. L.; Gonzáles Sánchez, J. L.; Isla Montes, J. L. (2012): Analysis and application of gamification. In: Proceedings of the 13th International Conference on Interacción Persona-Ordenador (2012), pp. 1–2.

Aparicio, M.; Tiago, O.; Bacao, F.; Painho, M. (2019): Gamification: A Key Determinant of Massive Open Online Course (MOOC) Success. In: Information and Management, Vol. 56 (2019) No. 1, pp. 39–54.

Arbaugh, J. B. (2000): How classroom environment and student engagement affect learning in Internet-based MBA courses. In: Business Communication Quarterly, Vol. 63 (2000) No. 4, pp. 9–26.

Aron, A.; Steele, J. L.; Kashdan, T. B.; Perez, M. (2006): When similars do not attract: Tests of a prediction from the self-expansion model. In: Personal Relationships, Vol. 13 (2006) No. 4, pp. 387–396.

Artino, A. R. (2008): Cognitive Load Theory and the Role of Learner Experience: An Abbreviated Review for Educational Practitioners. In: Association for the Advancement of Computing In Education Journal, Vol. 16 (2008) No. 4, pp. 425–439.

Ašeriškis, D.; Damaševičius, R. (2014): Gamification patterns for gamification applications. In: Procedia Computer Science, Vol. 39 (2014), pp. 83–90.

Attali, Y.; Areli-Attali, M. (2015): Gamification in assessment - Do points affect test performance. In: Computers & Education, Vol. 83 (2015), pp. 57–63.

Ayres, P.; Youssef, A. (2008): Investigating the influence of transitory information and motivation during instructional animations. In: International Society of the Learning Sciences (2008), pp. 68–75.

Babin, B. J.; Hair, J. F.; Boles, J. S. (2008): Publishing research in marketing journals using structural equation modeling. In: Journal of Marketing Theory and Practice, Vol. 16 (2008) No. 4, pp. 279–286.

Bacon, D. R. (2003): A comparison of approaches to importance-performance analysis. In: International Journal of Market Research, Vol. 45 (2003) No. 1.

Baek, E.-O.; Cagiltay, K.; Boling, E.; Frick, T. (2008): User-centered design and development. In: Handbook of research on educational communications and technology (2008) No. 1, pp. 660–668.

Bagozzi, R. P.; Yi, Y. (1988): On the evaluation of structural equation models. In: Journal of the academy of marketing science, Vol. 16 (1988) No. 1, pp. 74–94.

Bailey, K. D. (1994): Typologies and Taxonomies - An Introduction to Classification Techniques. Sage Publications, Thousand Oaks 1994.

Bandura, A.; Jourden, F. J. (1991): Self-Regulatory Mechanisms Governing the Impact of Social Comparison on Complex Decision Making. In: Journal of Personality and Social Psychology, Vol. 60 (1991) No. 6, pp. 941–951.

Baranik, L. E.; Barron, K. E.; Finney, S. J. (2007): Measuring goal orientation in a work domain: Construct validity evidence for the 2×2 framework. In: Educational and Psychological Measurement, Vol. 67 (2007) No. 4, pp. 697–718.

Bartle, R. (1996): Hearts, clubs, diamonds, spades - Players who suit MUDs. In: Journal of MUD research, Vol. 1 (1996) No. 1, pp. 19–46.

Baskerville, R.; Baiyere, A.; Gregor, S.; Hevner, A.; Rossi, M. (2018): Design Science Research: Finding a Balance between Artifact and Theory. In: Journal of the Association for Information Systems (JAIS), Vol. 19 (2018) No. 5, pp. 358–376.

Baskerville, R.; Kaul, M.; Storey, V. C. (2015): Genres of Inquiry in Design-Science Research: Justification and Evaluation of Knowledge Production. In: MIS Quarterly, Vol. 39 (2015) No. 3, pp. 541–564.

Bedwell, W. L.; Pavlas, D.; Heyne, K.; Lazzara, E. H.; Salas, E. (2012): Toward a Taxonomy Linking Game Attributes to Learning - An Empirical Study. In: Simulation & Gaming, Vol. 43 (2012) No. 6, pp. 729–760.

Behfar, K.; Okhuysen, G. A. (2018): Perspective—Discovery Within Validation Logic: Deliberately Surfacing, Complementing, and Substituting Abductive Reasoning in Hypothetico-Deductive Inquiry. In: Organization Science, Vol. 29 (2018) No. 2, pp. 323–340.

Beierlein, C.; Kovaleva, A.; Kemper, C. J.; Rammstedt, B. (2012): Ein Messinstrument zur Erfassung subjectiver Kompetenzerwartung: Allgemeine Selbstwirksamkeits Kurzskala (ASKU). In: GESIS Working Papers (2012) No. 17, pp. 1–24.

Bertels, H. M. J. (2018): You've Been Framed! The Effect of Opportunity and Prosocial Framing on the Novelty and Usefulness of Student Solutions. In: Journal of Management Education, Vol. 42 (2018) No. 5, pp. 650–689.

Bhattacherjee, A. (2012): Social Science Research: Principles, Methods, and Practices. 2012.

Bigelow, J. D. (2004): Using problem-based learning to develop skills in solving unstructured problems. In: Journal of Management Education, Vol. 28 (2004) No. 5, pp. 591–609.

Bista, S. K.; Nepal, S.; Paris, C.; Colineau, N. (2014): Gamification for online communities - A case study for delivering government services. In: International Journal of Cooperative Information Systems, Vol. 23 (2014) No. 2, pp. 1–25.

Blohm, I.; Leimeister, J. M. (2013): Gamification: Design of IT-based enhancing services for motivational support and behavioral change. In: Business & Information Systems Engineering (BISE), Vol. 5 (2013) No. 4, pp. 275–278.

Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W. H.; Krathwohl, D. R. (1956): Taxonomy of educational objectives, handbook I - The cognitive domain. New York: David McKay Co Inc 1956.

Böckle, M.; Micheel, I.; Bick, M.; Novak, J. (2018): A design framework for adaptive gamification applications. In: Hawaii International Conference on System Science (HICSS) (2018), pp. 1227–1236.

Bollen, K. A. (2002): Latent variables in psychology and the social sciences. In: Annual review of psychology, Vol. 53 (2002) No. 1, pp. 605–634.

Bostrom, R.; Olfman, L.; Sein, M. (1990): The Importance of Learning Style in End-User Training. In: MIS-Quarterly, Vol. 14 (1990) No. 1, pp. 101–119.

Boticki, I.; Baksa, J.; Seow, P.; Looi, C.-K. (2015): Usage of a mobile social learning platform with virtual badges in primary school. In: Computers & Education, Vol. 86 (2015), pp. 120–136.

Bradley, E. H.; Curry, L. A.; Devers, K. J. (2007): Qualitative data analysis for health services research - Developing taxonomy, themes, and theory. In: Health services research, Vol. 42 (2007) No. 4, pp. 1758–1772.

Brinkkemper, S. (1996): Method engineering - Engineering of information systems development methods and tools. In: Information and Software Technology, Vol. 38 (1996) No. 4, pp. 275–280.

Brito, J.; Vieira, V.; Duran, A. (2015): Towards a Framework for Gamification Design on Crowdsourcing Systems - The G.A.M.E. Approach. In: 2015 12th International Conference on Information Technology - New Generations (ITNG) - 13 - 15 April 2015, Las Vegas, Nevada, USA. Hrsg: Latifi, S. IEEE, Piscataway, NJ 2015, pp. 445–450.

Brown, K. G. (2005): An examination of the structure and nomological network of trainee reactions - A closer look at" smile sheets". In: Journal of Applied Psychology, Vol. 90 (2005) No. 5, pp. 991.

Brown, S. (2009): Discovering the Importance of Play through Personal Histories and Brain Images - An Interview with Stuart L. Brown. In: American Journal of Play, Vol. 1 (2009) No. 4, pp. 399–412.

Buckley, P.; Doyle, E. (2017): Individualising gamification - An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market. In: Computers & Education, Vol. 106 (2017), pp. 43–55.

Bughin, J.; Hazan, E.; Lund, S.; Dählström, P.; Wiesinger, A.; Subramaniam, A.: Skill shift: Automation and the future of the workforce. In:

https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce,accessed on10.04.2019.

Bui, A.; Veit, D. (2015): The Effects of Gamification on Driver Behavior: An Example from a Free Float Carsharing Service. In: Twenty-Third European Conference on Information Systems (ECIS) (2015), pp. 1–14.

Burgers, C.; Eden, A.; van Engelenburg, M. D.; Buningh, S. (2015): How feedback boosts motivation in play in a brain-training game. In: Computers in Human Behavior, Vol. 48 (2015), pp. 94–103.

Burke, B. (2012): Gamification: Engagement Strategies for Business and IT. In: Gartner Inc. (2012).

Burke, B. (2014): Gamify: How Gamification motivates people to do extraordinary things. Bibliomotion. 1. Aufl., Routledge, New York 2014.

Cafazzo, J. A.; Casselman, M.; Hamming, N.; Katzman, D. K.; Palmert, M. R. (2012): Design of an mHealth app for the self-management of adolescent type 1 diabetes: a pilot study. In: Journal of medical Internet research, Vol. 14 (2012) No. 3.

Cavaco, I. N.; Sousa Barreto, L. de; **Monteiro, A.; Rousy, D.; Silva, C. (2016):** Gamification Aspects in Detail - Collectanea of Studies to Renew Traditional Education. In: Revista Eletrônica Argentina-Brasil de Tecnologias da Informação e da Comunicação, Vol. 1 (2016) No. 4.

Ceipidor, U. B.; Medaglia, C. M.; Perrone, A.; Marsico, M. de; **Di Romano, G. (2009):** A museum mobile game for children using QR-codes. In: Proceedings of the 8th international conference on interaction design and children (2009), pp. 282–283.

Chenail, R. J. (2011): Interviewing the investigator: Strategies for addressing instrumentation and researcher bias concerns in qualitative research. In: The qualitative report, Vol. 16 (2011) No. 1, pp. 255–262.

Cheong, C.; Cheong, F.; Filippou, J. (2013): Quick Quiz: A Gamified Approach for Enhancing Learning. In: Pacific Asia Conference on Information Systems (PACIS) (2013).

Chin, W. W. (1998): The partial least squares approach to structural equation modeling. In: Modern methods for business research, Vol. 295 (1998) No. 2, pp. 295–336.

Chini, J. J.; Straub, C. L.; Thomas, K. H. (2016): Learning from avatars - Learning assistants practice physics pedagogy in a classroom simulator. In: Physical Review Physics Education Research, Vol. 12 (2016) No. 1, pp. 10117.

Christy, K. R.; Fox, J. (2014): Leaderboards in a virtual classroom - A test of stereotype threat and social comparison explanations for women's math performance. In: Computers & Education, Vol. 78 (2014), pp. 66–77.

Christy, K. R.; Fox, J. (2016): Transportability and presence as predictors of avatar identification within narrative video games. In: Cyberpsychology, Behavior, and Social Networking, Vol. 19 (2016) No. 4, pp. 283–287.

Chua, W. F. (1986): Radical Developments in Accounting Thought. In: The Accounting Review, Vol. 61 (1986) No. 4, pp. 601–632.

Clark, R. E.; Choi, S. (2005): Five design principles for experiments on the effects of animated pedagogical agents. In: Journal of Educational Computing Research, Vol. 32 (2005) No. 3, pp. 209–225.

Cohen, J. (1988): Statistical power analysis for the behavioural sciences. Routledge, New York 1988.

Cohen, S. H. (2003): Maximum Difference Scaling: Improved Measures of Importance and Preferences for Segmentation. In: Sawtooth Research Paper Series (2003), pp. 1–17.

Collins, J. A.; Fauser, B. (2005): Balancing the strengths of systematic and narrative reviews. In: Human Reproduction Update, Vol. 11 (2005) No. 2, pp. 103–104.

Colteli, O.; Grandi, X.; Tosca, R.; Latorre, P.; Sánchez, J. S.; Lizán, L. V.; Ros-Bernal, F.; Martínez-Cadenas, C. (2014): Designing serious games for learning support in medicine studies - A specific method to elicit and formalize requirements. In: Frontiers in Education Conference (FIE) (2014).

Cooper, A. (2004): The inmates are running the asylum: Why high-tech products drive us crazy and how to restore the sanity. Sams Indianapolis 2004.

Cooper, H. M. (1988): Organizing knowledge syntheses: A taxonomy of literature reviews. In: Knowledge in Society, Vol. 1 (1988) No. 1, pp. 104–126.

Corley, K. G.; Gioia, D. A. (2011): Building Theory about Theory Building - What Constitutes a Theoretical Contribution. In: Academy of management review, Vol. 36 (2011) No. 1, pp. 12–32.

Creswell, J. W.; Creswell, J. D. (2017): Research design: Qualitative, quantitative, and mixed methods approaches. Sage Publications, Thousand Oaks 2017.

Cruz, C.; Hanus, M. D.; Fox, J. (2017): The need to achieve: Players' perceptions and uses of extrinsic meta-game reward systems for video game consoles. In: Computers in Human Behavior, Vol. 71 (2017), pp. 516–524.

da Rocha Seixas, L.; Gomes, A. S.; de Melo Filho, I. J. (2016): Effectiveness of gamification in the engagement of students. In: Computers in Human Behavior, Vol. 58 (2016), pp. 48–63.

Davis, K.; Singh, S. (2015): Digital badges in afterschool learning - Documenting the perspectives and experiences of students and educators. In: Computers & Education, Vol. 88 (2015), pp. 72–83.

Deci, E. L.; Ryan, R. M. (1993): Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik. In: Zeitschrift für Pädagogik, Vol. 39 (1993) No. 2, pp. 223–238.

Deci, E. L.; Ryan, R. M. (2000): The "What" and "Why" of Goal Pursuits - Human Needs and the Self-Determination of Behavior. In: Psychological Inquiry, Vol. 11 (2000) No. 4, pp. 227–268.

Deci, E. L.; Ryan, R. M.; Gagne, M.; Leone, D. R.; Usunov, J.; Kornazheva, B. P. (2001): Need Satisfaction, Motivation, and Well-Being in the Work Organizations of a Former Eastern Bloc Country: A Cross-Cultural Study of Self-Determination. In: Personality and Social Psychology Bulletin, Vol. 27 (2001) No. 8, pp. 930–942.

Deci, E. L.; Vallerand, R. J.; Pelletier, L. G.; Ryan, R. M. (1991): Motivation and Education - The Self-Determination Perspective. In: Educational Psychology, Vol. 26 (1991) 3&4 , pp. 325–346.

Delen, E.; Liew, J.; Willson, V. (2014): Effects of interactivity and instructional scaffolding on learning - Self-regulation in online video-based environments. In: Computers & Education, Vol. 78 (2014), pp. 312–320.

de-Marcos, L.; Domínguez, A.; Saenz-de-Navarrete, J.; Páges, C. (2014): An empirical study of comparing gamification and social networking on e-learning. In: Computers & Education, Vol. 75 (2014), pp. 82–91.

de-Marcos, L.; Garcia-Lopez, E.; Garcia-Cabot, A. (2016): On the Effectiveness of Game-like and Social Approaches in Learning: Comparing Educational Gaming, Gamification & Social Networking. In: Computers & Education, Vol. 95 (2016), pp. 99–113.

Denny, P. (2013): The effect of virtual achievements on student engagement. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (2013), pp. 763–772.

Depura, K.; Garg, M. (2012): Application of online gamification to new hire onboarding. In: Services in Emerging Markets (2012), pp. 153–156.

Derrick, D. C.; Jenkins, J. L.; Nunamaker Jr, J. F. (2011): Design principles for special purpose, embodied, conversational intelligence with environmental sensors (SPECIES) agents. In: AIS Transactions on Human-Computer Interaction, Vol. 3 (2011) No. 2, pp. 62–81.

Desanctis, G.; Fayard, A.-L.; Roach, M.; Jiang, L. (2003): Learning in Online Forums. In: European Management Journal, Vol. 21 (2003) No. 5, pp. 565–577.

Deterding, S. (2015): The lens of intrinsic skill atoms - A method for gameful design. In: Human–Computer Interaction, Vol. 30 (2015) 3-4 , pp. 294–335.

Deterding, S.; Dixon, D.; Khaled, R.; Nacke, L. (2011a): From game design elements to gamefulness - Defining gamification. In: MindTrek (2011), pp. 9–15.

Deterding, S.; Sicart, M.; Nacke, L.; O'Hara, K.; Dixon, D. (2011b): Gamification: Using Game Design Elements in Non-Gaming Contexts. In: Human Factors in Computing Systems (2011), pp. 2425–2428.

Ding, L.; Kim, C.; Orey, M. (2017): Studies of student engagement in gamified online discussions. In: Computers & Education, Vol. 115 (2017), pp. 126–142.

Dobeco, I. (2016): E-Learning Market Trends and Forecast 2017-2021. (2016), pp. 1–50.

Domínguez, A.; Saenz-de-Navarrete, J.; de-Marcos, L.; Fernández-Sanz, L.; Páges, C.; Martínez-Herráiz, J.-J. (2013): Gamifying learning experiences - Practical implications and outcomes. In: Computers & Education, Vol. 63 (2013), pp. 380–392.

Doty, H. D.; Glick, W. H. (1994): Typologies as a unique form of theory building - Towards improved understanding and modeling. In: Academy of management review, Vol. 19 (1994) No. 2, pp. 230–251.

Duffy, T. M.; Cunningham, D. J. (2001): Constructivism - Implications for the Design and Delivery of Instruction. In: Handbook of Research for Educational Communications and Technology. Hrsg: Jonassen, D. H. Erlbaum Associates 2001, pp. 170–198.

Eccles, J. S.; Wigfield, A. (1995): In the mind of the achiever: The structure of adolescents' academic achievement related-beliefs and self-perceptions. In: Personality and Social Psychology Bulletin, Vol. 21 (1995) No. 3, pp. 215–225.

Eckardt, L.; Grogorick, S.; Robra-Bissantz, S. (2018): Play to Learn: Conducting a Playtest Session for Improving an Educational Game. In: Americas Conference on Information Systems, New Orleans (2018), pp. 1–10.

Eom, S. B. (2014): Understanding e-learners' satisfaction with learning management systems. In: Bulletin of the IEEE Technical Committee on Learning Technology, Vol. 16 (2014) 2/3 , pp. 10–13.

Erenli, K. (2013): Gamify Your Teaching - Using Location-Based Games for Educational Purposes. In: International Journal of Advanced Corporate Learning (iJAC), Vol. 6 (2013) No. 2, pp. 22–27.

Ernst, S.-J.; Janson, A.; Söllner, M.; Leimeister, J. M. (2016): It's about Understanding Each Other's Culture – Improving the Outcomes of Mobile Learning by Avoiding Culture Conflicts. In: International Conference on Information Systems (ICIS), Dublin, Ireland (2016).

Eseryel, D.; Law, V.; Ifenthaler, D.; Ge, X.; Miller, R. (2014): An investigation of the interrelationships between motivation, engagement, and complex problem solving in game-based learning. In: Journal of Educational Technology & Society, Vol. 17 (2014) No. 1, pp. 42–53.

Euler, H.; Mandl, H. (1983): Emotionspsychologie - Ein Handbuch in Schlüsselbegriffen. Urban & Schwarzenberg, München 1983.

Faghihi, U.; Brautigam, A.; Jorgenson, K.; Martin, D.; Brown, A.; Measures, E.; Maldonado-Bouchard, S. (2014): How Gamification Applies for Educational Purpose Specially with College Algebra. In: Procedia Computer Science, Vol. 41 (2014), pp. 182–187.

Farjoun, M.; Ansell, C.; Boin, A. (2015): Perspective Pragmatism in Organization Studies - Meeting the Challenge of a Dynamic and Complex World. In: Organizational Science, Vol. 26 (2015) No. 6, pp. 1553–1804.

Felder, R. M.; Brent, R. (2005): Understanding student differences. In: Journal of engineering education, Vol. 94 (2005) No. 1, pp. 57–72.

Ferguson, J. M.; DeFelice, A. E. (2010): Length of online course and student satisfaction, perceived learning, and academic performance. In: The International Review of Research in Open and Distributed Learning, Vol. 11 (2010) No. 2, pp. 73–84.

Fernandes, J.; Duarte, D.; Ribeiro, C.; Farinha, C.; Madeiras Pereira, J.; Mira da Silva, M. (2012): iThink - A game-based approach towards improving collaboration and participation in requirement elicitation. In: Procedia Computer Science, Vol. 15 (2012), pp. 66–77.

Filsecker, M.; Hickey, D. T. (2014): A multilevel analysis of the effects of external rewards on elementary students' motivation, engagement and learning in an educational game. In: Computers & Education, Vol. 75 (2014), pp. 136–148.

Fink, A. (2010): Conducting Research Literature Reviews - From the Internet to Paper. Sage, Thousand Oaks 2010.

Finn, A.; Louviere, J. J. (1992): Determining the Appropriate Response to Evidence of Public Concern - The Case of Food Safety. In: Journal of Public Policy & Marketing, Vol. 11 (1992) No. 1, pp. 12–25.

Fishbein, M.; Ajzen, I. (1975): Belief, attitude, intention and behavior - An introduction to theory and research. In: Journal of Business Venturing (1975), pp. 177–189.

Fisher, C. D. (2003): Why do lay people believe that satisfaction and performance are correlated? Possible sources of a commonsense theory. In: Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior, Vol. 24 (2003) No. 6, pp. 753–777.

Fiss, P. C. (2011): Building better causal theories: A fuzzy set approach to typologies in organization research. In: Academy of Management Journal, Vol. 54 (2011) No. 2, pp. 393–420.

Fleming, N.: Gamification:Is it game over? In: http://www.bbc.com/future/story/20121204-can-gaming-transform-your-life,accessed on17.11.2019.

Flick, U. (2018): An introduction to qualitative research. Sage, Los Angeles 2018.

Flynn, T. N.; Louviere, J. J.; Peters, T. J.; Coast, J. (2007): Best-worst scaling: What it can do for health care research and how to do it. In: Journal of Health Economics, Vol. 26 (2007) No. 1, pp. 171–189.

Fogel, G.: Will 80% of gamification projects fail? Giving credit to Gartner's 2012 gamification forecast. In: http://www.gameffective.com/gamification-basics/will-80-of-gamification-projects-fail/,accessed on17.11.2019.

Fornell, C.; Larcker, D. F. (1981): Evaluating structural equation models with unobservable variables and measurement error. In: Journal of Marketing research, Vol. 18 (1981) No. 1, pp. 39–50.

Frischmann, B. (2009): Zum Begriff der Anerkennung. In: Soziale Passagen, Vol. 1 (2009) No. 2, pp. 145–161.

Garaus, C.; Furtmüller, G.; Güttel, W. H. (2016): The hidden power of small rewards - The effects of insufficient external rewards on autonomous motivation to learn. In: Academy of Management Learning & Education, Vol. 15 (2016) No. 1, pp. 45–59.

García, F.; Pedreira, O.; Piattini, M.; Cerdeira-Pena, A.; Penabad, M. (2017): A framework for gamification in software engineering. In: Journal of Systems and Software, Vol. 132 (2017), pp. 21–40.

Gartner, I.: Gartner Says by 2014, 80 Percent of Current Gamified Applications Will Fail to Meet Business Objectives Primarily Due to Poor Design. In: http://www.gartner.com/newsroom/id/2251015,accessed on17.11.2019.

Gears, D.; Braun, K. (2013): Gamification in business - Designing motivating solutions to problem situations. In: Proceedings of the CHI 2013 Gamification Workshop (2013).

Geisser, S. (1975): The predictive sample reuse method with applications. In: Journal of the American Statistical Association, Vol. 70 (1975) No. 350, pp. 320–328.

Glass, R. L.; Vessey, I. (1995): Contemporary application-domain taxonomies. In: IEEE Software, Vol. 12 (1995) No. 4, pp. 63–76.

Glesne, C.; Peshkin, A. (1991): Becoming qualitative researchers. Longman, New York 1991.

Gnauk, B.; Dannecker, L.; Hahmann, M. (2012): Leveraging gamification in demand dispatch systems. In: Proceedings of the 2012 Joint EDBT/ICDT Workshops (2012), pp. 103–110.

Goldkuhl, G. (2012): Pragmatism vs interpretivism in qualitative information systems research. In: European Conference on Information Systems, Vol. 21 (2012), pp. 135–146.

Gonzalez, C. S. G.; Carreno, A. M. (2014): Methodological proposal for gamification in the computer engineering teaching. In: 2014 International Symposium on Computers in Education (SIIE) - 12 - 14 Nov. 2014, Logroño, La Rioja, Spain. Hrsg: Sierra-Rodrígues, J.-L. IEEE, Piscataway, NJ 2014, pp. 29–34.

Greckhamer, T.; Misangyi, V. F.; Elms, H.; Lacey, R. (2008): Using qualitative comparative analysis in strategic management research: An examination of combinations of industry, corporate, and business-unit effects. In: Organizational Research Methods, Vol. 11 (2008) No. 4, pp. 695–726.

Greckhamer, T.; Misangyi, V. F.; Fiss, P. C. (2013): The two QCAs: From a small-N to a large-N set theoretic approach. In: Configurational theory and methods in organizational research. Hrsg: Fiss, P. C.; Cambré, B.; Marx, A. Emerald Group Publishing 2013, pp. 49–75.

Green, P. E.; Srinivasan, V. (1990): Conjoint analysis in marketing: new developments with implications for research and practice. In: The Journal of Marketing (1990), pp. 3–19.

Greenberg, B. S.; Sherry, J.; Lachlan, K.; Lucas, K.; Holmstrom, A. (2010): Orientations to video games among gender and age groups. In: Simulation & Gaming, Vol. 41 (2010) No. 2, pp. 238–259.

Greenwald, A. G.; McGhee, D. E.; Schwartz, J. L. K. (1998): Measuring individual differences in implicit cognition: the implicit association test. In: Journal of Personality and Social Psychology, Vol. 74 (1998) No. 6, pp. 1464–1480.

Gregor, S. (2006): The nature of theory in information systems. In: MIS Quarterly, Vol. 30 (2006) No. 3, pp. 611–642.

Gregor, S.; Hevner, A. R. (2013): Positioning and presenting design science research for maximum impact. In: MIS Quarterly, Vol. 37 (2013) No. 2, pp. 337–355.

Gregor, S.; Jones, D. (2007): The anatomy of a design theory. In: Journal of the Association for Information Systems, Vol. 8 (2007) No. 5, pp. 312–335.

Grover, V.; Lyytinen, K.; Srinivasan, A.; Tan, B. C. Y. (2008): Contributing to rigorous and forward thinking explanatory theory. In: Journal of the Association for Information System, Vol. 9 (2008) No. 2, pp. 40–47.

Gubrium, J. F.; Holstein, J. A. (1997): The new language of qualitative method. Oxford University Press on Demand 1997.

Gulliksen, J.; Göransson, B.; Boivie, I.; Blomkvist, S.; Persson, J.; Cajander, Å. (2003): Key principles for user-centred systems design. In: Behaviour and Information Technology, Vol. 22 (2003) No. 6, pp. 397–409.

Gupta, S. (2006): Longitudinal investigation of collaborative e-learning in an end-user training context. University of Georgia 2006.

Gupta, S.; Bostrom, R. (2013): Research Note—An Investigation of the Appropriation of Technology-Mediated Training Methods Incorporating Enactive and Collaborative Learning. In: Information Systems Research, Vol. 24 (2013) No. 2, pp. 454–469.

Gupta, S.; Bostrom, R. P. (2009): Technology-mediated learning: A comprehensive theoretical model. In: Journal of the Association for Information Systems, Vol. 10 (2009) No. 9, pp. 686–714.

Gupta, S.; Bostrom, R. P.; Huber, M. (2010): End-user training methods - What we know, need to know. In: ACM SIGMIS Database: the DATABASE for Advances in Information Systems, Vol. 41 (2010) No. 4, pp. 9–39.

Haaranen, L.; Ihantola, P.; Hakulinen, L.; Korhonen, A. (2014): How (not) to introduce badges to online exercises. In: Proceedings of the 45th ACM technical symposium on Computer science education (2014), pp. 33–38.

Hailikari, T.; Katajavuori, L.; Lindblom-Ylanne, S. (2008): The relevance of prior knowledge in learning and instructional design. In: American journal of pharmaceutical education, Vol. 72 (2008) No. 5, pp. 113.

Hair, J. F.; Black, W. C.; Babin, B. J.; Anderson, R. E. (2010): Multivariate Data Analysis. A Global Perspective. Pearson, New Jersey 2010.

Hair, J. F.; Hult, G. T. M.; Ringle, C. M.; Sarstedt, M. (2014a): A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications, Piscataway, NJ 2014.

Hair, J. F.; Sarstedt, M.; Hopkins, L.; Kuppelwieser, V. G. (2014b): Partial least squares structural equation modeling (PLS-SEM) An emerging tool in business research. In: European Business Review, Vol. 26 (2014) No. 2, pp. 106–121.

Hakulinen, L.; Auvinen, T. (2014): The effect of gamification on students with different achievement goal orientations. In: International conference on teaching and learning in computing and engineering (IEEE) (2014), pp. 9–16.

Hallifax, S.; Serna, A.; Marty, J.-C.; Lavoué, G.; Lavoué, E. (2019): Factors to Consider for Tailored Gamification. In: Proceedings of the Annual Symposium on Computer-Human Interaction in Play (2019), pp. 559–572.

Hamari, J. (2013): Transforming homo economicus into homo ludens - A field experiment on gamification in a utilitarian peer-to-peer trading service. In: Electronic Commerce Research and Applications, Vol. 12 (2013) No. 4, pp. 236–245.

Hamari, J.; Koivisto, J. (2015): "Working out for likes" - An empirical study on social influence in exercise gamification. In: Computers in Human Behavior, Vol. 50 (2015), pp. 333–347.

Hamari, J.; Koivisto, J.; Sarsa, H. (2014): Does Gamification Work? - A Literature Review of Empirical Studies on Gamification. In: Hawaii International Conference on System Science (HICSS) (2014), pp. 3025–3034.

Hamari, J.; Shernoff, D. J.; Rowe, E.; Coller, B.; Asbell-Clarke, J.; Edwards, T. (2016): Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. In: Computers in Human Behavior, Vol. 54 (2016), pp. 170–179.

Hambrick, D. C. (1984): Taxonomic approaches to studying strategy - Some conceptual and methodological issues. In: Journal of Management, Vol. 10 (1984) No. 1, pp. 27–41.

Hamzah, W. A. F. W.; Ali, N. H.; Saman, M. Y. M.; Yusoff, M. H.; Yacob, A. (2014): Enhancement of the ARCS model for gamification of learning. In: International Conference on User Science and Engineering (i-USEr) (2014), pp. 287–291.

Hannafin, M. J.; Kim, M. C.; Kim, H. (2004): Reconciling research, theory, and practice in web-based teaching and learning: The case for grounded design. In: Journal of Computing in Higher Education, Vol. 15 (2004) No. 2, pp. 3–20.

Hanus, M. D.; Fox, J. (2015): Assessing the effects of gamification in the classroom - A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort and, academic performance. In: Computers & Education, Vol. 80 (2015), pp. 152–161.

Hattie, J.; Timperley, H. (2007): The power of feedback. In: Review of educational research, Vol. 77 (2007) No. 1, pp. 81–112.

Hazan, C.; Zeifman, D. (2008): Pair bonds as attachments. In: Handbook of attachment: Theory, research, and clinical applications. Hrsg: Cassidy, J.; Shaver, P. R. Guilford Press, New York 2008, pp. 336–354.

Hein, R.: How to Use Gamification to Engage Employees. In: https://www.cio.com/article/2453330/careers-staffing/how-to-use-gamification-to-engage-employees.html,accessed on17.11.2019.

Helms, R.; Barneveld, R.; Dalpiaz, F. (2015): A Method for the Design of Gamified Trainings. In: Pacific Asia Conference on Information Systems (PACIS) (2015).

Henrie, C. R.; Halverson, L. R.; Graham, C. R. (2015): Measuring student engagement in technology-mediated learning - A review. In: Computers & Education, Vol. 90 (2015), pp. 36–53.

Henseler, J.; Ringle, C. M.; Sinkovics, R. R. (2009): The use of partial least squares path modeling in international marketing. In: New challenges to international marketing. Hrsg: Sinkovics, R.; Ghauri, P. Emerald Group Publishing Limited 2009, pp. 277–319.

Hess, T. J.; McNab, A. L.; Basoglu, K. A. (2014): Reliability Generalization of Perceived Ease of Use, Perceived Usefulness, and Behavioral Intentions. In: MIS Quarterly, Vol. 38 (2014) No. 1, pp. 1–28.
Hevner, A. R.; March, S. T.; Park, J.; Ram, S. (2004): Design science in information systems research. In: MIS Quarterly, Vol. 28 (2004) No. 1, pp. 75–105.
Hew, K. F.; Huang, B.; Chu, K. W. S.; Chiu, D. K. W. (2016): Engaging Asian students through game mechanics: Findings from two experiment studies. In: Computers & Education, Vol. 92 (2016), pp. 221–236.
Hiltbrand, T.; Burke, M. (2011): How Gamification Will Change Business Intelligence. In: Business Intelligence Journal, Vol. 16 (2011) No. 2, pp. 8–16.
Hirsch, E. D. (1967): Validity in interpretation. Yale University Press 1967.
Ho, P.-C.; Chung, S.-M.; Tsai, M.-H. (2006): A Case Study of Game Design for E-Learning.doc. (2006), pp. 453–462.
Hoffner, C.; Buchanan, M. (2005): Young adults' wishful identification with television characters: The role of perceived similarity and character attributes. In: Media Psychology, Vol. 7 (2005) No. 4, pp. 325–351.
Horton, W. (2011): E-learning by design. John Wiley & Sons 2011.
Hrbackova, K.; Suchankova, E. (2016): Self-Determination Approach to Understanding of Motivation in Students of Helping Professions. In: Procedia-Social and Behavioral Sciences, Vol. 217 (2016), pp. 688–696.
Hui, W.; Hu, P.-H.; Clark, T. H. K.; Tam, K. Y.; Milton, J. (2008): Technology-assisted learning - A longitudinal field study of knowledge category, learning effectiveness and satisfaction in language learning. In: Journal of Computer Assisted Learning, Vol. 24 (2008) No. 3, pp. 245–259.
Huizinga, J. (1949): Homo Ludens. The Beacon Press, Boston 1949.
Hulland, J. (1999): Use of partial least squares (PLS) in strategic management research - A review of four recent studies. In: Strategic management journal, Vol. 20 (1999) No. 2, pp. 195–204.
Human-centered design processes for interactive systems. In: https://www.iso.org/standard/21197.html.
Hummel, D.; Maedche, A. (2019): How effective is nudging? A quantitative review on the effect sizes and limits of empirical nudging studies. In: Journal of Behavioral and Experimental Economics, Vol. 80 (2019), pp. 47–58.

Hunicke, R.; LeBlanc, M.; Zubek, R. (2004): MDA - A formal approach to game design and game research. Vol. 4 (2004) No. 1, pp. 1–5.

Ibánez, M.-B.; Di-Serio, Á.; Delgado-Kloos, C. (2014): Gamification for Engaging Computer Science Students in Learning Activities - A Case Study. In: IEEE Transactions on Learning Technologies, Vol. 7 (2014) No. 3, pp. 291–301.

Iivari, J.; Iivari, N. (2011): Varieties of user-centredness - An analysis of four systems development methods. In: Information Systems Journal, Vol. 21 (2011) No. 2, pp. 125–153.

Jang, H. (2008): Supporting students' motivation, engagement, and learning during an uninteresting activity. In: Journal of Educational Psychology, Vol. 100 (2008) No. 4, pp. 798–811.

Jang, H.; Reeve, J.; Kim, J. E. (2012): Longitudinal Test of Self-Determination Theory's Motivation Mediation Model in a Naturally Occurring Classroom Context. In: Journal of Economic Psychology, Vol. 4 (2012) No. 104, pp. 1175–1188.

Jia, Y.; Xu, B.; Karanam, Y.; Voida, S. (2016): Personality-targeted gamification - A survey study on personality traits and motivational affordances. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (2016), pp. 2001–2013.

Jonassen, D. H. (1991): Objectivism versus constructivism: Do we need a new philosophical paradigm? In: Educational technology research and development, Vol. 39 (1991) No. 3, pp. 5–14.

Jonassen, D. H. (2000): Toward a design theory of problem solving. In: Educational technology research and development, Vol. 48 (2000) No. 4, pp. 63–85.

Kang, D.; Santhanam, R. (2003): A longitudinal field study of training practices in collaboration application environement. In: Journal of Management Information Systems, Vol. 20 (2003) No. 3, pp. 257–281.

Kapp, K. M. (2012): The gamification of learning and instruction: game-based methods and strategies for training and education. John Wiley & Sons 2012.

Keller, J. M. (1987): Development and use of the ARCS model of instructional design. In: Journal of instructional development, Vol. 10 (1987) No. 3, pp. 2.

Kettanurak, V.; Ramamurthy, K.; Haseman, W. D. (2001): User attitude as a mediator of learning performance improvement in an interactive multimedia environment: an empirical investigation of the degree of interactivity and learning

styles. In: International Journal of human-computer studies, Vol. 54 (2001) No. 4, pp. 541–583.
Khaleel, F.; Ashaari, N.; Tengku, T. (2017): Methodology for Developing Gamification-Based Learning Programming Language Framework. (2017).
Khan, A.; Ahmad, F. H.; Malik, M. M. (2017): Use of digital game based learning and gamification in secondary school science - The effect on student engagement, learning and gender difference. In: Education and Information Technologies, Vol. 22 (2017) No. 6, pp. 2767–2804.
Kim, Y. J.; Baker, J.; Song, J. (2007): An Exploratory Study of Social Factors Influencing Virtual Community Members' Satisfaction with Avatars. In: Communications of the Association for Information Systems, Vol. 20 (2007), pp. 567–593.
Kirkley, S.; Tomblin, S.; Kirkley, J. (2005): Instructional Design Authoring Support for the Development of Serious Games and Mixed Reality Training. In: Interservice/Industry Training, Simulation, and Education Conference (2005).
Kitchenham, B.; Bereton, P. O.; Budgen, D.; Turner, M.; Bailey, J.; Linkman, S. (2009): Systematic literature reviews in software engineering — a systematic literature review. In: Information and Software Technology, Vol. 51 (2009) No. 1, pp. 7–15.
Klapztein, S.; Cipolla, C. (2016): From Game Design to Service Design. In: Simulation & Gaming, Vol. 47 (2016) No. 5, pp. 566–598.
Kogut, B.; Ragin, C. (2006): Exploring complexity when diversity is limited: Institutional complementarity in theories of rule of law and national systems revisited. In: European Management Review, Vol. 3 (2006) No. 1, pp. 44–59.
Korhonen, T.; Halonen, R.; Ravelin, T.; Kemppainen, J.; Koskela, K. (2017): A Multidisciplinary Approach To Serious Game Development In The Health Sector. In: Mediterranean Conference on Information Systems (MCIS) (2017).
Krathwohl, D. R. (2002): A revision of Bloom's taxonomy - An overview. In: Theory into practice, Vol. 41 (2002) No. 4, pp. 212–218.
Kroll, T.; Stieglitz, S. (2019): Digital nudging and privacy: improving decisions about self-disclosure in social networks. In: Behaviour & Information Technology (2019), pp. 1–19.
Kuo, F.-R.; Hwang, G.-J.; Lee, C.-C. (2012): A hybrid approach to promoting students' web-based problem-solving competence and learning attitude. In: Computers & Education, Vol. 58 (2012) No. 1, pp. 351–364.

Kuo, M.-S.; Chuang, T.-Y. (2016): How gamification motivates visits and engagement for online academic dissemination–An empirical study. In: Computers in Human Behavior, Vol. 55 (2016), pp. 16–27.

Kuvaas, B.; Buch, R.; Weibel, A.; Dysik, A.; Nerstad, C. G. L. (2017): Do intrinsic and extrinsic motivation realte differently to employee outcomes? In: Journal of Economic Psychology, Vol. 61 (2017), pp. 244–258.

Landers, R. N. (2015): Developing a Theory of Gamified Learning - Linking Serious Games and Gamification of Learning. In: Simulation & Gaming, Vol. 45 (2015) No. 6, pp. 752–768.

Lansing, J.; Schneider, S.; Sunyaev, A. (2013): Cloud Service Certification - Measuring Consumers' Preferences For Assurances. In: European Conference on Information Systems (2013).

Leavy, P. (2017): Research Design - Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches. The Guilford Press, New York 2017.

LeDoux, J. (2003): Synaptic self - How our brains become who we are. Penguin Press, New York 2003.

Lee, J. A.; Soutar, G.; Louviere, J. J. (2008): The best–worst scaling approach: An alternative to Schwartz's values survey. In: Journal of personality assessment, Vol. 90 (2008) No. 4, pp. 335–347.

Lee, J. A.; Soutar, G. N.; Louviere, J. (2007): Measuring values using best-worst scaling: The LOV example. In: Psychology & Marketing, Vol. 24 (2007) No. 12, pp. 1043–1058.

Lee, J. J.; Ceyhan, P.; Jordan-Cooley, W.; Sung, W. (2013): GREENIFY - A Real-World Action Game for Climate Change Education. In: Simulation & Gaming, Vol. 44 (2013) 2-3 , pp. 349–365.

Lee, K. C.; Kwon, S. (2008): A cognitive map-driven avatar design recommendation DSS and its empirical validity. In: Decision Support Systems, Vol. 45 (2008) No. 3, pp. 461–472.

Lee, S. J.; Srinivasan, S.; Trail, T.; Lewis, D.; Lopez, S. (2011): Examining the relationship among student perception of support, course satisfaction, and learning outcomes in online learning. In: The Internet and Higher Education, Vol. 14 (2011) No. 3, pp. 158–163.

Leidner, D.; Jarvenpaa, S. (1995): The Use of Information Technology to Enhance Management School Education - A Theoretical View. In: MIS-Quarterly, Vol. 19 (1995) No. 3, pp. 265–291.

Leidner, D. E. (2016): Review and Theory Symbiosis - An Introspective Retrospective. In: Journal of the Association for Information Systems, Vol. 19 (2016) No. 6, pp. 552–567.

Leimeister, J. M.; Huber, M.; Bretschneider, U.; Krcmar, H. (2009): Leveraging crowdsourcing: activation-supporting components for IT-based ideas competition. In: Journal of Management Information Systems, Vol. 26 (2009) No. 1, pp. 197–224.

Lembcke, T.-B.; Engelbrecht, N.; Brendel, A. B.; Herrenkind, B.; Kolbe, L. M. (2019): Towards a Unified Understanding of Digital Nudging by Addressing its Analog Roots. In: Pacific Asia Conference on Information Systems (PACIS) (2019).

Li, W.; Grossman, T.; Fitzmaurice, G. (2012): GamiCAD: a gamified tutorial system for first time autocad users. In: Proceedings of the 25th annual ACM symposium on User interface software and technology (2012), pp. 103–112.

Lin, L.; Atkinson, R. K.; Christopherson, R. M.; Joseph, S. S.; Harrison, C. J. (2013): Animated agents and learning: Does the type of verbal feedback they provide matter? In: Computers & Education, Vol. 67 (2013), pp. 239–249.

Lincoln, Y. S. (2007): Naturalistic inquiry. In: The Blackwell Encyclopedia of Sociology (2007).

Lincoln, Y. S.; Guba, E. G. (1985): Naturalistic Inquiry. Sage Publications, Beverly Hills 1985.

Liu, D.; Li, X.; Santhanam, R. (2013): Digital Games and Beyond - What Happens When Players Compete. In: MIS Quarterly, Vol. 327 (2013) No. 1, pp. 111–124.

Liu, D.; Santhanam, R.; Webster, J. (2017): Towards meaningful engagement - A framework for design and research of gamified information systems. In: MIS Quarterly, Vol. 41 (2017) No. 4, pp. 1011–1034.

Lohmöller, J.-B.; Wold, H. (1980): Three-mode path models with latent variables and partial least squares (PLS) parameter estimation. In: European Meeting of the Psychometric Society, Groningen, Netherlands (1980).

Lou, Y.; Abrami, P.; d'Apollonia, S. (2001): Small Group and Individual Learning with TechnologyA Meta Analysis. In: Review of educational research, Vol. 71 (2001) No. 3, pp. 449–521.

Louviere, J. J.; Lings, I.; Islam, T.; Gudergan, S.; Flynn, T. (2013): An introduction to the application of (case 1) best-worst scaling in marketing research. In: International Journal of Research in Marketing, Vol. 30 (2013), pp. 292–303.

Mao, J.-Y.; Vredenburg, K.; Smith, P. W.; Carey, T. (2005): The state of user-centered design practice. In: Communications of the ACM, Vol. 48 (2005) No. 3, pp. 105–109.

Marantz Henig, R. (2008): Taking Play Seriously. In: The New York Times Magazine, Vol. 2008 (2008).

Marchand, G. C.; Gutierrez, A. P. (2012): The role of emotion in the learning process: Comparisons between online and face-to-face learning settings. In: The Internet and Higher Education, Vol. 15 (2012) No. 3, pp. 150–160.

Marczewski, A. C. (2015): Even Ninja Monkeys Like to Play - Gamification, Game Thinking and Motivational Design. CreateSpace Independent Publishing Platform 2015.

Marley, A. A. J.; Louviere, J. J. (2005): Some probabilistic models of best, worst, and best–worst choices. In: Journal of Mathematical Psychology, Vol. 49 (2005) No. 6, pp. 464–480.

Marques, R.; Goncalo, C.; Mira da Silva, M.; Goncalves, D.; Goncalves, P. (2018): Improving Scrum Adoption with Gamification. In: Americas Conference on Information Systems, New Orleans (2018), pp. 1–10.

Mattingly, B. A.; Lewandowski, G. (2013): The power of one: Benefits of individual self-expansion. In: The Journal of Positive Psychology, Vol. 8 (2013) No. 1, pp. 12–22.

Matzner, M.; Hoffen, M. von; **Heide, T.; Plenter, F.; Chasin, F. (2015):** A Method for Measuring User Preferences in Information Systems Design Choices. (2015).

Maurer, T. J. (2001): Career-relevant learning and development, worker age, and beliefs about self-efficacy for development. In: Journal of Management, Vol. 27 (2001) No. 2, pp. 123–140.

Mayer, R. E. (2019): Computer Games in Education. In: Annual review of psychology, Vol. 70 (2019), pp. 531–549.

Mayer, R. E.; Moreno, R. (2003): Nine ways to reduce cognitive load in multimedia learning. In: Educational Psychologist, Vol. 38 (2003) No. 1, pp. 43–52.

Mayring, P. (2014): Qualitative content analysis - Theoretical foundation, basic procedures and software solution. 2014.

McDaniel, R.; Lindgren, R.; Friskics, J. (2012): Using badges for shaping interactions in online learning environments. In: Professional Communication Conference (IPCC) (2012), pp. 1–4.

McDougall, W. (1923): An outline of psychology. Methuen and Co., London 1923.

McKernan, B.; Mikeal Martey, R.; Stromer-Galley, J.; Kenski, K.; Clegg, B. A.; Folkestad, J. E.; Rhodes, M. G.; Shaw, A.; Saulnier, E. T.; Strzalkowski, T. (2015): We don't need no stinkin'badges - The impact of reward features and feeling rewarded in educational games. In: Computers in Human Behavior, Vol. 45 (2015), pp. 299–306.

Means, B.; Toyama, Y.; Murphy, R.; Bakia, M.; Jones, K. (2009): Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. In: US Department of Education (2009).

Meermann, S. D.: JetBlue Badges gamification marketing fails to take off. In: https://www.webinknow.com/2013/07/jetblue-badges-gamification-marketing-fails-to-take-off.html,accessed on17.11.2019.

Mekler, E. D.; Brühlmann, F.; Tuch, A. N.; Opwis, K. (2017): Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. In: Computers in Human Behavior, Vol. 71 (2017), pp. 525–534.

Melero, J.; Hernándes-Leo, D.; Manatunga, K. (2015): Group-based mobile learning - Do group size and sharing mobile devices matter? In: Computers in Human Behavior, Vol. 44 (2015), pp. 377–385.

Merriam, S. B.; Grenier, R. S. (2019): Qualitative Research in Practice: Examples for Discussion and Analysis. John Wiley & Sons, Newark 2019.

Mertens, W.; Pugliese, A.; Recker, J. (2017): Quantitative data analysis - A Comparison for Accounting and Information Systems Research. Springer 2017.

Mettler, T.; Eurich, M.; Winter, R. (2014): On the Use of Experiments in Design Science Research: A Proposition of an Evaluation Framewok. In: Communications of the Association for Information Systems, Vol. 34 (2014) No. 10, pp. 223–240.

Mettler, T.; Pinto, R. (2015): Serious Games as a Means for Scientific Knowledge Transfer—A Case From Engineering Management Education. In: IEEE Transactions on Engineering Management, Vol. 62 (2015) No. 2, pp. 256–265.

Mijangos, C. C.; Ramírez, I. A. M.; Osorio, A. V. (2017): SofIAX: Developing and Evaluating a Bespoke Educational Software. In: Latin American Conference on Human Computer Interaction (2017), pp. 1–4.

Miles, M. B.; Huberman, A. M.; Huberman, M. A.; Huberman, M. (1994): Qualitative data analysis: An expanded sourcebook. Sage 1994.

Mlinar, M.; Weppel, S. (2015): A Level Up on Gaming. In: Chief Learning Officer (2015), pp. 34–48.

Moreta, L. L.; Gamboa, A. C.; Palacios, M. G. (2016): Implementing a Gamified application for a Risk Management course. In: Ecuador Technical Chapters Meeting (ETCM) (2016).

Morschheuser, B.; Hassan, L.; Werder, K.; Hamari, J. (2018): How to design gamification? - A method for engineering gamified software. In: Information and Software Technology, Vol. 95 (2018), pp. 219–237.

Mowrer, R. R.; Klein, S. B. (2001): Handbook of contemporary learning theories. Lawrence Erlbaum Associates, Inc., Publishers, Mahwah 2001.

Mozgaleva, P.; Zamyatina, O.; Mozgaleva, A.; da-Costa, P. (2018): A methodology for gamifying of the educational process. In: IEEE Global Engineering Education Conference (2018), pp. 289–297.

Mull, I.; Wyss, J.; Moon, E.; Lee, S.-E. (2015): An exploratory study of using 3D avatars as online salespeople. In: Journal of Fashion Marketing and Management: An International Journal, Vol. 19 (2015) No. 2, pp. 154–168.

Mummendey, H. D. (1990): Psychologie der Selbstdarstellung. Göttingen 1990.

Nebel, S.; Beege, M.; Schneider, S.; Rey, G. D. (2016): The higher the score, the higher the learning outcome? Heterogeneous impacts of leaderboards and choice within educational videogames. In: Computers in Human Behavior, Vol. 65 (2016), pp. 391–401.

Newmann, F. M. (1992): Student engagement and achievement in American secondary schools. ERIC 1992.

Nickerson, R. C.; Varshney, U.; Muntermann, J. (2013): A method for taxonomy development and its application in information systems. In: European Journal of Information Systems, Vol. 22 (2013), pp. 336–359.

Nike: Nike+ Run Club App. In: https://www.nike.com/us/en_us/c/nike-plus/running-app-gps,accessed on17.11.2019.

Nitzl, C.; Roldan, J. L.; Cepeda, G. (2016): Mediation analysis in partial least squares path modeling. In: Industrial Management and Data Systems (2016) No. 116, pp. 1846–1864.

Noels, K. A. (2001): New orientations in language learning motivation - Towards a model of intrinsic, extrinsic, and integrative orientations and motivation. In: Motivation and second language acquisition, Vol. 23 (2001), pp. 43–68.

Okoli, C. (2015): The View from Giants' Shoulders: Developing Theory with Theory-Mining Systematic Literature Reviews. In: Working Paper Series (2015).

Orlikowski, W. J.; Baroudi, J. J. (1991): Studying Information Technology in Organizations: Research Approaches and Assumptions. In: Information Systems Research, Vol. 2 (1991) No. 1, pp. 1–28.

Orme, B. (2005): Accuracy of HB Estimation in MaxDiff Experiments. In: Sawtooth Research Paper Series (2005), pp. 1–7.

Osipov, I. V.; Nikulchev, E.; Volinsky, A. A.; Prasikova, A. Y. (2015): Study of gamification effectiveness in online e-learning systems. In: International Journal of advanced computer science and applications, Vol. 6 (2015) No. 2, pp. 71–77.

Osterwalder, A.; Pigneur, Y.; Bernarda, G.; Smith, A. (2014): Value proposition design - How to create products and services customers want. John Wiley & Sons 2014.

Paas, F.; Renkl, A.; Sweller, J. (2003): Cognitive Load Theory and Instructional Design: Recent Developments. In: Educational Psychologist, Vol. 38 (2003) No. 1, pp. 1–4.

Pandey, A.: Top 6 Benefits of Gamification in eLearning. In: https://elearningindustry.com/top-6-benefits-of-gamification-in-elearning,accessed on17.11.2019.

Paravizo, E.; Chaim, O. C.; Braatz, D.; Muschard, B.; Rozenfeld, H. (2018): Exploring gamification to support manufacturing education on industry 4.0 as an enabler for innovation and sustainability. In: Procedia Manufacturing, Vol. 21 (2018), pp. 438–445.

Passos, E. B.; Medeiros, D. B.; Neto, P. A. S.; Clua, E. W. G. (2011): Turning Real-World Software Development into a Game. In: Proceedings of SBGames (2011), pp. 260–269.

Pedro, L.; Santos, C.; Aresta, M.; Almeida, S. (2015): Peer-supported badge attribution in a collaborative learning platform - A SAPO campus case. In: Computers in Human Behavior, Vol. 51 (2015), pp. 562–567.

Peffers, K.; Tuunanen, T.; Rothenberger, M. A.; Chatterjee, S. (2007): A Design Science Research Methodology for Information Systems Research. In: Journal of Management Information Systems, Vol. 24 (2007) No. 3, pp. 45–77.

Peham, M.; Breitfuss, G.; Michalczuk, R. (2014): The "ecoGator" App: Gamification for Enhanced Energy Efficiency in Europe. In: Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality. ACM (2014), pp. 179–183.

Pérez-Marín, D.; Pascual-Nieto, I. (2013): An exploratory study on how children interact with pedagogic conversational agents. In: Behaviour & Information Technology, Vol. 32 (2013) No. 9, pp. 955–964.

Perry, B. (2015): Gamifying French Language Learning - a case study examining a quest-based, augmented reality mobile learning-tool. In: Procedia Computer Science, Vol. 174 (2015), pp. 2308–2315.

Peters, J. L.; Sutton, A. J.; Jones, D. R.; Abrams, K. R.; Rushton, L. (2006): Comparison of two methods to detect publication bias in meta-analysis. In: Jama, Vol. 295 (2006) No. 6, pp. 676–680.

Petrelli, D.; Beaulieu, M.; Sanderson, M.; Demetriou, G.; Herring, P.; Hansen, P. (2004): Observing users, designing clarity - A case study on the user-centered design of a cross-language information retrieval system. In: Journal of the American Society for Information Science and Technology, Vol. 55 (2004) No. 10, pp. 923–934.

Petri, M. (2010): Motivationspsychologie und Personalentwicklung - Eine Kohärenzbetrachtung von motivationspsychologischen Inhaltstheorien und kongruenten Personalentwicklungszielen. Meidenbauer, München 2010.

Pfeuffer, N.; Benlian, A.; Gimpel, H.; Hinz, O. (2019): Anthropomorphic Information Systems. In: Business & Information Systems Engineering (2019), pp. 1–11.

Piccoli, G.; Rami, A.; Blake, I. (2001): Web-based Virtual Learning Environments - A Research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skills Training. In: MIS Quarterly, Vol. 25 (2001) No. 4, pp. 401–426.

Pike, G. R.; Kuh, G. D.; McCormick, A. C.; Ethington, C. A.; Smart, J. C. (2011): If and when money matters - The relationships among educational expenditures, student engagement and students' learning outcomes. In: Research in Higher Education, Vol. 52 (2011) No. 1, pp. 81–106.

Pintrich, P. R. (2003): A motivational science perspective on the role of student motivation in learning and teaching context. In: Journal of Educational Psychology, Vol. 95 (2003) No. 4, pp. 667–689.

Pintrich, P. R.; de-Groot, E. V. (1990): Motivational and self-regulated learning components of classroom academic performance. In: Journal of Educational Psychology, Vol. 82 (1990) No. 1, pp. 33–40.

Pintrich, P. T.; Smith, D. A. F.; Garcia, T.; McKeachie, W. J. (1991): A Manual for the Use of the Motivated Strategies Learning Questionnair. The Regents of The University of Michigan, Michigan 1991.

Podsakoff, P. M.; MacKenzie, S. B.; Lee, J.-Y.; Podsakoff, N. P. (2003): Common method biases in behavioral research - A critical review of the literature and recommended remedies. In: Journal of Applied Psychology, Vol. 88 (2003) No. 5, pp. 879–903.

Poggenpoel, M.; Myburgh, C. (2003): The researcher as research instrument in educational research: A possible threat to trustworthiness?(A: research_instrument). In: Education, Vol. 124 (2003) No. 2, pp. 418–423.

Poole, S. M.; Desanctis, G. (1992): Microlevel structuration in computer-supported group decision making. In: Human Communication Research, Vol. 19 (1992) No. 1, pp. 5–49.

Poonam, D. C. (1997): Intrinsic motivation and academic achievement: What does their relationship imply for the classroom teacher? In: Remedial and special education, Vol. 18 (1997) No. 1, pp. 12–19.

Purao, S.; Baldwin, C. Y.; Hevner, A. R.; Storey, V. C.; Pries-Heje, J. (2008): The Sciences of Design: Observations on an Emerging Field. In: Communications of the Association for Information Systems, Vol. 23 (2008) No. 29, pp. 523–546.

Putka, D. J.; Le, H.; McCloy, R. A.; Diaz, T. (2008): Ill-structured measurement designs in organizational research: Implications for estimating interrater reliability. In: Journal of Applied Psychology, Vol. 93 (2008) No. 5, pp. 959–981.

Ragin, C. C. (2000): Fuzzy-set social science. University of Chicago Press 2000.

Ragin, C. C. (2009): Qualitative comparative analysis using fuzzy sets (fsQCA). In: Configurational comparative methods: Qualitative comparative analysis (QCA) and related techniques, Vol. 51 (2009), pp. 87–121.

Recker, J. C. (2013): Scientific Research in Information Systems - A Beginner's Guide. Springer, Berlin, Heidelberg 2013.

Redding, S. G.; Michael, N. (1983): The role of “face” in the organizational perceptions of Chinese managers. In: International Studies of Management & Organization, Vol. 13 (1983) No. 3, pp. 92–123.

Reed, W. A. (2014): User-centered design - A guide to ROI with ISO 9241-210. In: Texology Science (2014).

Reeves, T. C. (1998): The impact of media and technology in schools. The Bertelsmann Foundation, Georgia 1998.

Reschly, A. L.; Christenson, S. L. (2012): Jingle, jangle, and conceptual haziness - Evolution and future directions of the engagement construct. In: Handbook of research on student engagement. Springer 2012, pp. 3–19.

Rinck, M.; Becker, E. S. (2007): Approach and avoidance in fear of spiders. In: Journal of behavior therapy and experimental psychiatry, Vol. 38 (2007) No. 2, pp. 105–120.

Robey, D.; Boudreau, M.-C.; Rose, G. M. (2000): Information Technology and Organizational Learning: Review and Assessment of Research. In: Accounting, Management, and Information Technologies, Vol. 10 (2000) No. 2, pp. 125–155.

Robson, K.; Plangger, K.; Kietzmann, J. H.; McCarthy, I.; Pitt, L. (2015): Is it all a game? - Understanding the principles of gamification. In: Business Horizons, Vol. 58 (2015) No. 4, pp. 411–420.

Rodrigues, L. F.; Costa, C. J.; Oliveira, A. (2016): Gamification - A framework for designing software in e-banking. In: Computers in Human Behavior, Vol. 62 (2016), pp. 620–634.

Rothschild, M. K. (2008): The instructional design of an educational game - Form and function in JUMP. In: Specialist, Instructional Design (2008).

Rowe, F. (2014): What literature review is not: diversity, boundaries and recommendations. In: European Journal of Information Systems, Vol. 23 (2014) No. 3, pp. 241–255.

Rubin, B.; Fernandes, R.; Avgerinou, M. D.; Moore, J. (2010): The effect of learning management systems on student and faculty outcomes. In: The Internet and Higher Education, Vol. 13 (2010) 1-2 , pp. 82–83.

Ryan, R. M.; Deci, E. L. (2000): Intrinsic and extrinsic motivations - Classic definitions and new directions. In: Contemporary educational psychology, Vol. 25 (2000) No. 1, pp. 54–67.

Sailer, M.; Homner, L. (2019): The Gamification of Learning: a Meta-analysis. In: Educational Psychology Review (2019), pp. 1–36.

Salen, K.; Zimmerman, E. (2004): Rules of Play - Game design fundamentals. MIT Press, Massachusetts 2004.

Salvador, F.; Forza, C. (2004): Configuring products to address the customization-responsiveness squeeze: A survey of management issues and opportunities. In: International journal of production economics, Vol. 91 (2004) No. 3, pp. 273–291.

Santhanam, R.; Liu, D.; Milton-Shen, W.-C. (2016): Research Note-Gamification of Technology-Mediated Training - Not All Competitions are the Same. In: Information Systems Research, Vol. 27 (2016) No. 2, pp. 453–465.

Sarker, S.; Xiao, X.; Beaulieu, T.; Lee, A. S. (2018): Learning from First-Generation Qualitative Approaches in the IS Discipline: An Evolutionary View and Some Implications for Authors and Evaluators (PART 1/2). In: Journal of the Association for Information Systems, Vol. 19 (2018) No. 9, pp. 752–774.

Sarstedt, M.; Ringle, C. M.; Hair, J. F. (2017): Partial Least Squares Structural Equation Modeling. In: Handbook of Market Research. Hrsg: Homburg, C.; Klarmann, M.; Vomberg, A. Springer, Heidelberg 2017, pp. 1–40.

Saunders, M.; Lewis, P.; Thornhill, A. (2016): Research Methods for Business Students. 7. Aufl., Pearson, Harlow 2016.

Scaife, M.; Rogers, Y. (2001): Informing the design of a virtual environment to support learning in children. In: International Journal of human-computer studies, Vol. 55 (2001) No. 2, pp. 115–143.

Scheiner, C. W.; Witt, M. (2013): The Backbone of Gamification-a Theoretical Consideration of Play and Game Mechanics. In: GI-Jahrestagung (2013), pp. 2372–2386.

Schlagenhaufer, C.; Amberg, M. (2015): A Descriptive Literature Review and Classification Framework for Gamification in Information Systems. In: European Conference on Information Systems (ECIS) (2015).

Schmidt-Kraepelin, M.; Thiebes, S.; Tran, M. C.; Sunyaev, A. (2018): What's in the Game? Developing a Taxonomy of Gamification Concepts for Health Apps. In: Hawaii International Conference on System Science (HICSS) (2018), pp. 1217–1226.

Schneider, C. Q.; Wagemann, C. (2012): Set-theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis. Cambridge University Press, Cambridge 2012.

Schöbel, S.; Janson, A. (2018): Is it all about Having Fun? - Developing a Taxonomy to Gamify Information Systems. In: European Conference on Information Systems (ECIS) (2018).

Schöbel, S.; Lehmann, K.; Oeste-Reiß, Sarah, Söllner, Matthias (**2016): **StaySmart – Individuelles und kompetenzorientiertes E-Learning im Zeitalter des demografischen Wandels. In: e-Learning Fachtagung Informatik (DeLFI) (2016).

Schöbel, S.; Söllner, M. (2016): How to Gamify Information Systems - Adapting Gamification to Individual User Preferences. In: European Conference on Information Systems (ECIS), Istanbul, Turkey (2016).

Schöbel, S.; Söllner, M.; Leimeister, J. M. (2016): The Agony of Choice – Analyzing User Preferences regarding Gamification Elements in Learning Management Systems. In: International Conference on Information Systems (ICIS), Dublin, Ireland (2016).

Schultze, U.; Avital, M. (2011): Designing interviews to generate rich data for information systems research. In: Information and Organization, Vol. 21 (2011) No. 1, pp. 1–16.

Schunk, D. H. (2012): Learning theories - An educational perspective. Pearson, Boston 2012.

Schwandt, T. A. (1998): Constructivists, Interpretivists Approaches to Human Inquiry. In: The Landscape of Qualitative Research: Theories and Issues. Hrsg: Denzin, N. K.; Lincoln, Y. S. Sage Publications, Thousand Oaks 1998, pp. 221–259.

Schwandt, T. A. (2001): Qualitative inquiry: A dictionary of terms. Sage, Thousand Oaks 2001.

Schwarz, A.; Mehta, M.; Johnson, N.; Chin, W. W. (2007): Understanding frameworks and reviews: a commentary to assist us in moving our field forward by analyzing our past. In: ACM SIGMIS Database: the DATABASE for Advances in Information Systems, Vol. 38 (2007) No. 3, pp. 29–50.

Schweizer, T. (2014): Epistemology: The nature and validation of anthrophological knowledge. In: Handbook of methods in cultural anthropology. Hrsg: Bernard, H. R.; Gravlee, C. C. Rowman & Littlefield 2014, pp. 39–87.

Scott, M.; Pereira, L.; Oakley, I. (2014): Show me or tell me - Designing avatars for feedback. In: Interacting with computers, Vol. 27 (2014) No. 4, pp. 458–469.

Seaborn, K.; Fels, D. I. (2015): Gamification in theory and action: A survey. In: International Journal of human-computer studies, Vol. 74 (2015), pp. 14–31.

Sein, M.; Henfridsson, O.; Purao, S.; Rossi, M.; Lindgren, R. (2011): Action design research. In: Management Information Systems Quarterly, Vol. 35 (2011) No. 1, pp. 37–56.

Severin, F.; Schmidtke, J.; Mühlbacher, A.; Rogowski, W. H. (2013): Eliciting preferences for priority setting in genetic testing: a pilot study comparing best-worst scaling and discrete-choice experiment. In: European Journal of Human Genetics, Vol. 21 (2013) No. 11, pp. 1202–1208.

Shadish, W. R.; Cook, T. D.; Campbell, D. T. (2002): Experimental and quasi-experimental designs for generalized causal inference. Boston: Houghton Mifflin, Boston 2002.

Shah, R.; Goldstein, S. M. (2006): Use of structural equation modeling in operations management research: Looking back and forward. In: Journal of Operations management, Vol. 24 (2006) No. 2, pp. 148–169.

Shen, W.-C. M.; Liu, D.; Santhanam, R.; Evans, D. A. (2016): Gamified Technology-Mediated Learning: The Role of Individual Differences. In: Pacific Asia Conference on Information Systems (PACIS) (2016).

Shenton, A. K. (2004): Strategies for ensuring trustworthiness in qualitative research projects. In: Education for information, Vol. 22 (2004) No. 2, pp. 63–75.

Shute, V. J. (2008): Focus on formative feedback. In: Review of educational research, Vol. 78 (2008) No. 1, pp. 153–189.

Shute, V. J.; D'Mello, S.; Baker, R.; Cho, K.; Bosch, N.; Ocumpaugh, J.; Ventura, M.; Almeda, V. (2015): Modeling how incoming knowledge, persistence, affective states, and in-game progress influence student learning from an educational game. In: Computers & Education, Vol. 86 (2015), pp. 224–235.

Sicart, M. (2014): Play matters. MIT Press 2014.

Simoes, J.; Díaz Redondo, R.; Fernández Vilas, A. (2013): A social gamification framework for K-6 learning platform. In: Computers in Human Behavior, Vol. 29 (2013) No. 2, pp. 345–353.

Simon, H. A. (1988): The Science of Design: Creating the Artificial. In: MIT Press, Vol. 4 (1988) 1/2 , pp. 67–82.

Simon, H. A. (1996): The Sciences of the Artificial. 3. Aufl., MIT Press, Boston 1996.

Smith, G. F. (2005): Problem-based learning - Can it improve managerial thinking? In: Journal of Management Education, Vol. 29 (2005) No. 2, pp. 357–378.

Steed, A.; Pan, Y.; Zisch, F.; Steptoe, W. (2016): The impact of a self-avatar on cognitive load in immersive virtual reality. In: IEEE Virtual Reality (VR) (2016), pp. 67–76.

Stephenson, W. (1935): Correlating persons instead of tests. In: Journal of Personality, Vol. 4 (1935) No. 1, pp. 17–24.

Stone, M. (1974): Cross-validatory choice and assessment of statistical predictions. In: Journal of the royal statistical society. Series B (Methodological), Vol. 36 (1974) No. 2, pp. 111–147.

Straub, D.; Boudreau, M.-C.; Gefen, D. (2004): Validation guidelines for IS positivist research. In: Communications of the Association for Information Systems, Vol. 13 (2004) No. 1, pp. 380–427.

Suh, A.; Cheung, C. M. K.; Ahuja, M.; Wagner, C. (2017): Gamification in the Workplace - The Central Role of the Aesthetic Experience. In: Journal of Management Information Systems, Vol. 34 (2017) No. 1, pp. 268–305.

Suh, A.; Wagner, C.; Liu, L. (2015): The Effects of Game Dynamics on User Engagement in Gamified Systems. In: Hawaii International Conference on System Sciences (HICCS) (2015), pp. 672–681.

Suh, K.-S.; Kim, H.; Suh, E. K. (2011): What if your Avatar looks like you? Dual Congruity Perspectives for Avatar User. In: MIS Quarterly, Vol. 35 (2011) No. 3, pp. 711–729.

Sun, H.; Ping, Z. (2006): The role of moderating factors in user technology acceptance. In: International Journal of human-computer studies, Vol. 64 (2006) No. 2, pp. 53–78.

Sunyaev, A.; Hansen, M.; Krcmar, H. (2009): Method engineering - A formal description. In: Information Systems Development. Springer 2009, pp. 645–654.

Supendi, K.; Prihatmanto, A. S. (2015): Design and implementation of the assesment of publik officers web base with gamification method. In: Proceedings of the 2015 4th International Conference on Interactive Digital Media (ICIDM) - 1-5 December 2015, Bandung, Indonesia. IEEE, Piscataway, NJ 2015, pp. 1–6.

Super, J.; Keller, R. H.; Betts, T. K.; Roach Humphreys, J. (2019): Simulation Games: Learning Goal Orientations and Norms for Knowledge Sharing. In: Academy of Management Proceedings (2019) No. 1.

Sweller, J. (1994): Cognitive load theory, learning difficulty, and instructional design. In: Learning and Instruction, Vol. 4 (1994) No. 4, pp. 295–312.

Symon, G. (1998): The work of IT system developers in context - An organizational case study. In: Human–Computer Interaction, Vol. 13 (1998) No. 1, pp. 37–71.

Tellegen, A. (1982): Brief manual for the multidimensional personality questionnaire. In: Unpublished manuscript, University of Minnesota, Minneapolis (1982), 1031-1010.

Thaler, R. H.; Sunstein, C. R. (2009): Nudge: Improving decisions about health, wealth, and happiness. Penguin 2009.

Thiebes, S.; Lins, S.; Basten, D. (2014): Gamifying Information Systems - A Synthesis of Gamification Mechanics and Dynamics. In: European Conference on Information Systems (ECIS) (2014).

Thomson, M.; MacInnis, D. J.; Park, C. W. (2005): The ties that bind: Measuring the strength of consumers' emotional attachments to brands. In: Journal of consumer psychology, Vol. 15 (2005) No. 1, pp. 77–91.

Thurstone, L. L. (1927): A Law of Comparative Judgement. In: Psychological Review (1927) No. 4, pp. 273–286.

Toda, A. M.; do Carmo, R. S.; Mesquita, M. A. A.; da Silva, A. L.; Brancher, J. D. (2014): A gamified online system to aid in math lessons of junior and middle high students. In: IEEE International Conference on Computer and Information Technology (2014), pp. 616–621.

Tondello, G. F.; Orji, R.; Nacke, L. E. (2017): Recommender Systems for Personalized Gamification. In: UMAP'17 - Proceedings of the 25th ACM Conference on User Modeling, Adaptation, and Personalization: July 9-12, 2017, Bratislava, Slovakia. Hrsg: Bielikova, M.; Herder, E.; Cena, F.; Desmarais, M. ACM Assocation for Computing Machinery, New York, NY, USA 2017, pp. 425–430.

Urh, M.; Vukovic, G.; Jereb, E. (2015): The model for introduction of gamification into e-learning in higher education. In: Procedia-Social and Behavioral Sciences, Vol. 197 (2015), pp. 388–397.

Usman, M.; Britto, R.; Börstler, J.; Mendes, E. (2017): Taxonomies in software engineering - A Systematic mapping study and a revised taxonomy development method. In: Information and Software Technology, Vol. 85 (2017), pp. 43–59.

van der Rhee, B.; Verma, R.; Plaschka, G. R.; Kickul, J. R. (2007): Technology readiness, learning goals, and eLearning - Searching for synergy. In: Decision Sciences Journal of Innovative Education, Vol. 5 (2007) No. 1, pp. 127–149.

Van Gerven, P. W. M.; **Paas,, F. G. W. C.; Van Merrienboer,, J. J. G.; Schmidt, H. G. (2002):** Cognitive load theory and aging: effects of worked examples on training efficiency. In: Learning and Instruction, Vol. 12 (2002) No. 1, pp. 87–105.

van Merriënboer, J. J. G.; Sweller, J. (2005): Cognitive Load Theory and Complex Learning - Recent Developments and Future Directions. In: Educational Psychology Review, Vol. 17 (2005) No. 2, pp. 147–177.

Venable, J. (2006): The role of theory and theorising in design science research. In: International Conference on Design Science in Information Systems and Technology (DESRIST) (2006), pp. 1–18.

Venable, J.; Pries-Heje, J.; Baskerville, R. (2012): A comprehensive framework for evaluation in design science research. In: International Conference on Design Science Research in Information Systems (2012), pp. 423–438.

Venkatesh, V. (2000): Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. In: Information Systems Research, Vol. 11 (2000) No. 4, pp. 342–365.

Venkatesh, V.; Morris, M. G. (2000): Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. In: MIS Quarterly, Vol. 24 (2000) No. 1, pp. 115–139.

Vom Brocke, J.; Simons, A.; Riemer, K.; Niehaves, B.; Plattfaut, R.; Cleven, A. (2015): Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in Information Systems Research. In: Communications of the Association for Information Systems, Vol. 37 (2015) No. 9, pp. 205–244.

Walls, J. G.; Widmeyer, G. R.; El Sawy, O. A. (1992): Building an Information System Design Theory for Vigilant EIS. In: Information Systems Research, Vol. 3 (1992) No. 1, pp. 36–59.

Walsham, G. (1995): Interpretive case studies in IS research: nature and method. In: European Journal of Information Systems, Vol. 4 (1995) No. 2, pp. 74–81.

Walsham, G. (2006): Doing interpretive research. In: European Journal of Information Systems (EJIS), Vol. 15 (2006) No. 3, pp. 320–330.

Walsham, G.; Sahay, S. (1999): GIS for district-level administration in India: problems and opportunities. In: Management Information Systems Quarterly, Vol. 23 (1999) No. 1, pp. 39–66.

Wang, I. A. (2015): The wear out effect of a game-based student response system. In: Computers & Education, Vol. 82 (2015), pp. 217–227.

Watson, S.; Sutton, J. M. (2012): An examination of the effectiveness of case method teaching online - Does the technology matter? In: Journal of Management Education, Vol. 36 (2012) No. 6, pp. 802–821.

Weber, R. (2003): Editor's Comments: Theoretically Speaking. In: MIS-Quarterly, Vol. 27 (2003) No. 3, pp. iii–xii.

Weber, R. (2004): Editors Comment: The Rhetoric of Positvism Versus Interpretivism: A Personal View. In: MIS-Quarterly, Vol. 28 (2004) No. 1, pp. iii–xii.

Webster, J.; Watson, R. T. (2002): Analyzing the Past to Prepare for the Future - Writing a Literature Review. In: MIS Quarterly, Vol. 26 (2002) No. 2, pp. 13–23.

Weinmann, M.; Schneider, C.; Vom Brocke, J. (2016): Digital nudging. In: Business & Information Systems Engineering, Vol. 58 (2016) No. 6, pp. 433–436.

Weiser, P.; Bucher, D.; Cellina, F.; de-Luca, V. (2015): A taxonomy of motivational affordances for meaningful gamified and persuasive technologies. (2015).

Werbach, K.; Hunter, D. (2012): For the win - How game thinking can revolutionize your business. Wharton Digital Press 2012.

Whetten, D. A. (1989): What Constitutes a Theoretical Contribution? In: Academy of management review, Vol. 14 (1989) No. 4, pp. 490–495.

Wilson, K. A.; Bedwell, W. L.; Lazzara, E. H.; Salas, E.; Burke, C. S.; Estock, J. L.; Orvis, K. L.; Conkey, C. (2009): Relationships between game attributes and learning outcomes: Review and research proposals. In: Simulation & Gaming, Vol. 40 (2009) No. 2, pp. 217–266.

Winn, W.; Snyder, D. (2001): Cognitive Perspectives in Psychology. In: Handbook of Research for Educational Communications and Technology. Hrsg: Jonassen, D. H. Erlbaum Associates 2001, pp. 112–142.

Witmer, B. G.; Singer, M. J. (1998): Measuring presence in virtual environments: A presence questionnaire. In: Presence: Teleoperators and virtual environments, Vol. 7 (1998) No. 3, pp. 225–240.

Wolf, T.; Weiger, W. H.; Hammerschmidt, M. (2018): Gamified Digital Services - How Gameful Experiences Drive Continued Service Usage. In: Hawaii International Conference on System Sciences (HICSS) (2018).

YanFi; **Udjaja, Y.; Sari, A. C. (2017):** A Gamification Interactive Typing for Primary School Visually Impaired Children in Indonesia. In: Procedia Computer Science, Vol. 116 (2017), pp. 638–644.

Yee, N. (2006): Motivations for play in online games. In: CyberPsychology & behavior, Vol. 9 (2006) No. 6, pp. 772–775.

Yilmaz, K. (2013): Comparison of Quantitative and Qualitative Research Traditions: epistemological, theoretical, and methodological differences. In: European Journal of Education, Vol. 48 (2013) No. 2, pp. 311–325.

Yin, R. K. (2003): Case Study Research - Design and Methods. Sage Publications, Thousand Oaks 2003.

Yohannis, R. A.; Prabowo, Y. D.; Waworuntu, A. (2014): Defining Gamification - From lexical meaning and process viewpoint towards a gameful reality. In: International Conference on Information Technology Systems and Innovation (ICITSI) (2014), pp. 284–289.

Yoo, Y.; Kanawattanachai, P.; Citurs, A. (2002): Forging into the wired wilderness - A case study of a technology-mediated distributed discussion-based class. In: Journal of Management Education, Vol. 26 (2002) No. 2, pp. 139–163.

Zin, N. A. M.; Jaafar, A.; Yue, W. S. (2009): Digital game-based learning (DGBL) model and development methodology for teaching history. In: WSEAS transactions on computers, Vol. 8 (2009) No. 2, pp. 322–333.

Zyda, M. (2005): From visual simulation to virtual reality to games. In: Computer Society, Vol. 38 (2005) No. 9, pp. 25–32.

Appendix

Appendix A Appendices for Study presented in Section 4

Appendix A.1 Definition of Elements

Element	Definition
Badge	A badge is a visual icon that signifies an achievement a user accomplishes while working on an activity and/or an action in an IS.
Collection System	Collection systems are used to measure a user's progress and performance when working on activities and/or actions in an IS. Therefore, a numeric value is added to an overall score.
Feedback	Feedback provides users with information about how well they have performed, and helps to keep users aware of their progress and failure when working on activities and/or actions in an information system. Feedback is therefore content related and informs users about why they might have failed in working on an activity and/or task.
Mediating Avatar	A mediating avatar guides users while they use an information system, and provides feedback on their performance and IS outcomes. Mediating avatars are created by the system designer with a specific goal.
Leaderboard	On a leaderboard, a user can compare their own performance with the performance of other users. A user's performance is often presented as a ranking.
Level	A level shows a user's progress in working on system activities or actions and displays their experience through different level positions. Levels are cumulative, thus a higher level can be reached by completing previous levels.
One-Time Narratives	One-time narratives are used to tell a story and generally embed every action or activity in an IS.
Processing Narratives	Processing narratives that tell an ongoing story according to all a user's actions or activities in an IS.
Point	A point is a numerical unit that is obtained for completing an activity and/or action in an IS.
Progress Bar	A progress bar is used to indicate the user's progress when working on activities and/or actions in an information system without comparing a user's performance to those of other users, and without challenging them.
Reminder	A reminder is used to visualize the user's past behavior by presenting them with a history of their actions.
User Avatar	A user avatar is used as a visual representation of the user so that their user profile can be personalized in an IS. Representing avatars are typically chosen or created, and are modified by users.
Mission	Missions are achievable steps that users can accomplish while working on actions and/or activities in an IS.
Time Manipulations	Time manipulations are applied regarding the completion of certain activities and actions in an IS using a counter or an hourglass.
Virtual Goods	Virtual goods are assets with a perceived value that can be purchased or traded (e.g., coins).

Appendix A.2 Definition of Dimensions

Dimension	Definition	Example
Reward	Elements that reward users for successfully completing an activity in an information system. They can be either rewarding or documenting: rewarding means that the activity of a user is connected to something, while documenting concerns informing a user about their activity without giving them anything.	A point is awarded to a user for giving the correct answer in a knowledge test (reward). Feedback is given to a user about the correct answer (documenting).
Punishment	Elements that punish users for not successfully completing an activity in an information system. They can be either punishing or neutral. Punishing takes away something from a user that they previously earned. A neutral element informs a user without taking anything away from them.	A badge is taken away from a user because they failed to continue with their activities (punishing). A mediating avatar informs a user about their previous activities in the system (neutral).
Bonus	Elements that are given to users in addition to rewards for completing a series of activities. Such elements can act as bonus elements or not.	A badge is given to a user for the successful completion of 10 successive activities (bonus). A level documents the users overall system progress (no bonus).
Interdependency	Elements that require the existence of other elements. They can be either independent (do not need other elements to work) or dependent (need other elements to work).	A level needs points to document the users' progress in working on activities (dependent). A mediating avatar welcomes a user when they starts working in a system (independent).
Development	Elements that develop over time based on the user's activities in an information system. They can be either developing (showing the overall progress of users over time) or static (show one-time behavior).	A progress bar indicates the progress of users in collecting points (developing). A point informs a user about their success in finishing a activity (static).
User Involvement	Elements that allow for the involvement of users. Some elements are given by the designer (and can be changed or selected by users) while other allow for the partial involvement of users (users can decide about what they would like to pick, or can even decide about specific components).	A user can select components of their user avatar such as their hair or skin color (partial involvement). A designer decides upon those activities for which a user can earn a point (prescribed).
Competition	Elements that involve at least two users who compete against one other to achieve the same goal. Depending on its design elements, these can either be competitive (users compete against other users for being better at an activity), or individual (users do not compete against other users but focus on their own activities to get better in their own activities).	A leaderboard is used to present the efforts of all users in collecting points (competition). A user likes to get into a higher level by completing more activities in a system (individual).
Cooperation	Elements that support the cooperation (working together) between or among users. Depending on its design, cooperation can be possible (an elements supports a user in working with other users), or impossible (the element is focused on the users own activities).	A group of users gets a badge for completing an activity together (cooperation possible). A progress bar shows the users' progress in working on activities (cooperation impossible)
Surprise	Elements that are given to users that they did not expect. Element can be either surprising or regular. Surprising elements are not expected by a user. Regular elements are known.	A user gets an additional badge for working in an information system for more than 30 days (surprise). A user can select the badge they want, and so can work towards listed badges; they receive the badge after completing related activity (regular).
Initial Motivation	Elements that are based either on intrinsic motivation or on extrinsic motivation. Intrinsic motivation is addressed when	Receiving a point concerns getting a desirable outcome and addresses extrinsic motivation. Collecting elements such as points or badges

	something is done without having a desirable outcome; for example, when an element triggers to do something because it is inherently interesting. Extrinsic motivation is addressed when an activity leads to a desirable outcome.	concerns addressing intrinsic emotion. Collection concerns achievements that also address intrinsic motivation.

Appendix A.3 Consolidated Interview Results

Criteria and Interviewee Suggestions (consolidated)		Action Taken
Completeness	Include a dimension that describes surprises (P1).	Addressed as suggested.
	Categorizes rewards into financial and non-financial rewards (P1).	Not addressed, because the taxonomy is used to describe characteristics of gamification elements, not their design possibilities.
	Use feedback and micro feedback instead of just feedback (R2).	Not addressed, because the characteristics that describe feedback are not different for micro feedback.
	Use an absolute and relative leaderboard instead of just a normal leaderboard (P2, P1).	
	Use processing narratives and one-time narratives instead of just normal narratives (R2).	Addressed as suggested.
	Bonusses are not necessary; they are the same as rewards (R3).	Not addressed, because a bonus is an additional reward that is given to users for fulfilling activities outside of the anticipated rewards.
	Use involvement and no involvement instead of partial involvement and no involvement (R3).	Not addressed, because the designer always has some involvement.
	Virtual goods are also collection systems (P3).	Addressed as suggested.
	Include cascading information as a dimension (P3).	Not addressed, because this information is already included in development dimension.
Level of Detail	Levels are rewarding and punishing when someone reaches a higher or lower level (R1).	Not addressed, because points or other items are taken from, or given to users, which changes their level.
	Different assignments of elements to characteristics: • Leaderboard can be cooperative and independent (P2), • Virtual goods can be competitive (P2, R2, R3), • Badges can develop (P2), • User and mediating avatar can develop (P2, R2), • Levels can be competitive and cooperative (P2), • A representing avatar can be cooperative (P2), • User's avatar can be used for competitive purposes (P2, R2), • Collection systems can be cooperative (R2), • Narratives can be cooperative and competitive (P2), • Feedback can be competitive (R3).	I categorized the elements as suggested. I did not categorize level as a competitive element. If users compare their level with others it ends up in a ranking. In addition, a leaderboard is dependent from other elements that are used to as base for comparison with other users.
	Rename: • Tasks to missions (R2), • Time pressure to time manipulation (P2), • Level to user level (R3), • User design to user interaction (R3), • Interacting avatar to mediator (R3), • Representing avatar to user avatar (R3).	Addressed as suggested.
	Separating between intrinsic and extrinsic motivation is difficult because it depends on users (R3, P1, P2).	Not addressed; I refer to the initial motivation caused by the element.
	Just use extrinsic and intrinsic motivation as characteristics of one dimension: motivation (R1, R2).	Addressed as suggested.
	Do not use not extrinsic and not intrinsic (P1, R3).	Addressed as suggested.
	Include a dimension for the idea that a level has to be passed; tasks can be passed and thus are voluntary (P2).	Not addressed; this is already part of the taxonomy (developing and not developing).
Simplicity	Separation of collection systems is not understandable (P2, P1, R1, R2).	Collection system is handled as own element.
	Use collection system as its own element and points badges and goods as a separate elements (P2).	Addressed as suggested.
	Motivation should be a separate dimension (P1, R4).	Addressed as suggested.

<table>
<tr><td rowspan="6">Ease of use</td><td>Presentation of taxonomy is very complex (P1, R1, R4).</td><td>I added dimensions in the first row instead of numbers. Therefore, how the characteristics fit to the dimensions is clearer. I also added two further categories to better explain the dimensions (underlaying game logic and game design)</td></tr>
<tr><td>Include a table with possible element combinations (R1).</td><td>Not addressed because this was not the aim of the taxonomy.</td></tr>
<tr><td>Replace numbers of dimensions with names (R1).</td><td>Addressed as suggested.</td></tr>
<tr><td>Include an example of how to use the taxonomy (R1).</td><td>I present its validation in the last part of this paper.</td></tr>
<tr><td>Combine dimensions such as rewards, punishment, and bonus (R1, R2).</td><td>Not addressed, because of Nickerson et al.'s (2013) guidelines.</td></tr>
<tr><td>Try to avoid yes/no terms in dimensions (R4, P1).</td><td>Addressed based on the new taxonomy visualization.</td></tr>
<tr><td rowspan="3">Elegance</td><td>Consider context characteristics for the next version of the taxonomy (P3).</td><td rowspan="3">Addressed as implication for future research.</td></tr>
<tr><td>Use different gamified information systems or mobile games to develop a next version of the taxonomy (R1).</td></tr>
<tr><td>It would be interesting to see how elements can be used together (R1).</td></tr>
<tr><td rowspan="2">Real World Phenomenon</td><td>Taxonomy is useful to better understand elements (P1, P2, P3, R1, R2, R3, R4).</td><td rowspan="2">-</td></tr>
<tr><td>The taxonomy can assist researchers and practitioners developing a gamification concepts for their information systems (P1, P2, P3, R1, R2, R3, R4). neighbors</td></tr>
</table>

Appendix A.4 Implications for Element Adaptions

Element	Dimension and Characteristic	Implication	Example
Badges	Development – Developing	Developing badges can be used to encourage the progress of users in completing tasks, particularly if tasks comprise several parts.	Bronze, silver, and gold badges.*
	Development – Static	Static badges can be used to reward users each time they have completed a task, and if tasks do not develop.	A user earns a badge for answering quiz questions (Alcivar/Abad 2016).
	Surprise – Surprise	Surprise badges can be used to further support users in continuing with activities because they receive a good they did not expect to receive.	A user gets a new badge that they could not previously see in his badge list.**
	Surprise – Regular	Regular badges can be used as a visual representation of the different activities a user has to complete. They can be seen by a user, for example, in a badge board.	Badges are used to show the users expertise in specific fields (Suh et al. 2017)
Virtual Goods	Interdependency – Dependent	Independent virtual goods can be used if system designers want to control those system activities for which users are rewarded or punished.	User collects goods by completing activities.*
	Interdependency – Independent	Dependent virtual goods can be used if a user's autonomy is to be further addressed by giving them the possibility of selecting goods on their own.	User spends points to earn a good (de-Marcos et al. 2014)
	Surprise – Surprise	Surprising virtual goods can be used to further support users in continuing with their activities because they receive a good that they did not expected to receive.	A user receive a new virtual good that they did not know about before.**
	Surprise – Regular	Regular virtual goods can be used to support a user in completing activities in a system. The user knows about the goods they can earn.	Users get coins for completing activities (Weiser et al. 2015).
Points	Surprise – Surprise	Surprise points can be used to further support users in continuing with their activities because they receive a good that they did not expected to receive.	A user gets additional extra points for an activity that was not previously bound to any points**
	Surprise – Regular	Regular points are given to users for completing activities in a system. The user knows about the points they can earn.	Using points, learners can claim rewards to advance in learning applications (Hamzah et al. 2014).
User Avatar	Development – Developing	A developing user avatar can be used to visualize the overall progress of users in completing activities in a system.	An avatar can acquire new items, such as a new hat.*
	Development – Static	A static user avatar can be used if it does not represent progress and if it interacts with a user without any development.	A user selects a human avatar to represent themselves at the beginning of their system use (Faghihi et al. 2014).
Mediating Avatar	Development – Developing	A developing mediating avatar can be used to visualize the overall progress of users in completing activities in a system.	An avatar can change its expressions based on the user's results in working on activities.*

	Development – Static	A mediating static avatar can be used if it should not represent progress and if it interacts with a user without any development.	A user cooperates with a human avatar that is used as a teacher that assists them during their use of the system (Perry 2015).
*Examples given by interviewees; **Added based on the constitution of elements and the meaning of surprise, this is because these are grounded on a new dimension as recommended by an interviewee.			

Appendix A.5 Classification of Elements used in Gamification

Name	Definition	Assigned Elements	Source
MDA – Mechanics, Dynamic, Aesthetics	***Mechanics** originally defined as: Mechanics describe the particular components of the game, at the level of data representation and algorithms (Hunicke/LeBlanc/Zubek 2004, 2).*		
	Game mechanics cover diverse building blocks for gamifying a core offer.	Documentation of Behavior, Scoring System, Badges, Trophies, Rankings, Ranks, Levels, Reputation Points, Group Tasks, Time Pressure, Tasks Quests, Avatars, Virtual Worlds, Virtual Trades	Blohm and Leimeister (2013, 276)
	The fame is responsible for making the components of it work. They allow the player to have total control of the game levels and with it, guide their actions.	Points, Levels, Challenges, Trophies, Badges/Medals and Accomplishments, Virtual Goods, Classification Table, Ranking, Score Table	Da Rocha et al. (2016, 49)
	This arbitrage is creating a disruption in a variety of business processes, resulting in usage of game mechanics.	Badges, Leaderboard, Levels	Depura and Mohit (2012, 154)*
	Game mechanics are the mechanisms used to ‘‘gamify’’ an activity. As game mechanics are the rules and rewards of the game.	Points, Level, Trophies, Badges, Achievements, Virtual Goods, Leaderboards, Virtual Gifts	Simoes et al. (2013, 347)
	Game mechanics refer to the tools, techniques, and widgets that are the building blocks of a game.	Points, Badges, Levels, Trophies, Virtual Goods, Leaderboard, Virtual Gifts	Suh et al. (2015, 673)
	Mechanics are utilized within a system	Points, Levels, Ranks, Social Features, Positive and Constant Feedback, Intuitive Controls, Optimal Challenge, Cooperative Tasks, Player Profiles	Toda et al. (2014, 617)*
	Elements and rules are known as the mechanics of the game.	Points, Tokens, Badges	Ibanez et al. (2014)
	Refer to components that establish a structured set of goals for performing the desired activities and to issue intangible rewards upon goal accomplishment.	Avatars, Badges, Leaderboards, Performance Graphs, Chats, Friending’s, Points, Progress Notification, Quests, Social Feedback, Teams, User Level, User Profiles	Wolf et al. (2018, 1188)**
	Game mechanics are functional components of a gamified application and provide various actions, behaviors and control mechanisms to enable user interaction.	Point Systems, Leaderboards, Levels, Challenges	Kuo and Chuang (2016, 18)
	Mechanics are the decisions that designers (…) make to specify the goals, the rules, the setting, the context, the types of interactions, (…) and the boundaries of the situation to be gamified. These gamification mechanics are known before the experience starts and they remain constant. In other words, they do not change from one player to the next and they stay the same each time a player engages in the experience.	Setup mechanics (considerations that shape the environment), Rule mechanics (shape the concept or goal of gamification experience), Progression Mechanics (for example scores, levels, progress bars)	Robson et al. (2015, 414)
	Mechanics comprise the functioning components of the game.	Points, Levels, Challenges, Virtual Goods, Leaderboards, Badges, Gifts, Charity	Hamzah et al. (2014, 288)*
	***Dynamics**, originally defined as: Dynamics describe the run-time behavior of the mechanics acting on player inputs and each other’s outputs (Hunicke/LeBlanc/Zubek 2004, 2)*		
	Game dynamics, however, describe the effects of these mechanics on the subjective user experience over time and correspond to specific user motives.	Exploration, Collection, Competition, Acquisition of status, Collaboration, Challenge, Development/Organization	Blohm and Leimeister (2013, 276)
	Dynamics are the interactions of the player with the mechanics.	Reward, Status, Accomplishment/Fulfillment, Self-Expression, Competition	Da Rocha et al. (2016, 49)**

	Game dynamics are the desires and motivations leading to those emotions.	Rewards, Status, Achievement, Self-expression, Competition, Altruism	Simoes et al. (2013, 347)**
	Game dynamics refer to the run-time behavior of a game and its interaction with players.	Reward, Status, Self-expression, Altruism, Achievement, Competition	Suh et al. (2015, 673)
	Dynamics of the game intend to drive players into a flow state.	Time Constraints, Limited Resources, Turns	Ibanez et al. (2014, 292)
	Refer to user perceptions of the benefit creation associated with game mechanics during digital service usage.	Achievement, Challenge, Choice Perception, Competition, Cooperation, Progress, Self-expression, Social Interaction, Status	Wolf et al. (2018, 1189)**
	Game dynamics determine the individual's reactions as a response to using the implemented mechanics.	Not specified.	Kuo and Chuang (2016, 18)
	Gamification dynamics are the types of player behavior that emerge as players partake in the experience. Contrary to mechanics that are set by the designer, the gamification dynamics are produced by how players follow the mechanics chosen by designers.	For example: Cooperation, Competition	Robson et al. (2015, 415)
	The idea behind game dynamics is to make interactions more fun and appealing.	Loyalty Points, Leader Boards, Badges, Progress Bars, Virtual Currencies and On Boarding	Bista (2014, 3)***
	***Aesthetics** originally defined as: Aesthetics describe the desirable emotional responses evoked in the player, when she interacts with the game system (Hunicke/LeBlanc/Zubek 2004, 2).*		
	However, according to their specific design, single mechanics may cause different dynamics that might correspond to different motives.	Intellectual Curiosity, Achievement, Social recognition, Social Exchange, Cognitive Stimulation, Self Determination	Blohm and Leimeister (2013, 276)
	Game aesthetics refer to players' emotional responses when they interact with a game.	Enjoyment	Suh et al. (2015, 673)
	Are designed to trigger emotions that players find pleasant or fun.	Reputation, Achievement, Collect Elements	Ibanez et al. (2014, 292)
	These reactions try to satisfy fundamental needs and desires.	Reward, Self-expression, Altruism or Competition, Achievement, Status.	Kuo and Chuang (2016, 18)
	Gamification emotions are the mental affective states and reactions evoked among individual players when they participate in a gamified experience. Emotions are a product of how players follow the mechanics and then generate dynamics.	For example: excitement, amusement, amazement, surprise, wonder, disappointment, sadness	Robson et al. (2015, 416)
	Human desire fulfilled by gamification	Reward, Status, Altruism, Competition, Achievement, Self-Expression	Bista (2014, 4)
*Dynamics and Aesthetics not specified, **Aesthetics not specified, *** Mechanics not specified			

Name	Definition	Assigned Elements	Source
MDC – Mechanics, Dynamics, Components	***Mechanics** originally defined as: Mechanics are the basic processes that drive the action forward and generate player engagement (Werbach/Hunter 2012, 79).*		
	Mechanics are the means by which dynamics are fulfilled.	Challenges, Random Elements, Cooperation, Feedback, Rewards	Alcivar et al. (2016, 114)
	Game mechanics, in turn, refer to the mechanisms used by designers to reward activities between users.	Rewards, Challenges, Feedback, Competition	Sousa Barreto et al. (2016, 2)
	***Dynamics,** originally defined as: Dynamics are the big-picture aspects of the gamified system that you have to consider and manage but which you can never directly enter into the game (Werbach/Hunter 2012, 78).*		
	Dynamics are tightly related to the business objectives regarding the gamified system.	Constraints and Tradeoffs, Emotions, Progress and Story Telling, Social Interaction	Alcivar et al. (2016, 114)

Name	Definition	Assigned Elements	Source
	Game dynamics are the most abstract game elements.	Emotions, Narrative, Progression, Relationships	Sousa Barreto et al. (2016, 2)
	***Components**, originally defined as: Components are more-specific forms that mechanics or dynamics can take (Werbach/Hunter 2012, 80).*		
	Components are the least abstract and are those tangible elements that let mechanics be completed.	Points, Levels, Achievements, Missions, Badges, Avatars, Leaderboard, Progress Bar, Performance Stars	Alcivar et al. (2016, 114)
	Game components are specific instantiations of game dynamic and mechanics.	Achievements, Badges, Leaderboard, Points	Sousa Barreto et al. (2016, 2)
Name	**Definition**	**Assigned Elements**	**Source**
Motivational Affordances Classification	**General Design Principles**		
	Abstract guidelines for the design process	Offer meaningful Stories, Support User Choices, Provide User Guidance, Personalize Experiences, Respect Stages of Behavior Change	Weiser et al. (2015, 275)
	Mechanics		
	Possible means of interaction between user and system	Feedback, Education, Rewards, Competition, Challenges, Cooperation	
	Elements		
	Building blocks to implement mechanics	-Assignments, Quests, Goals -Achievements, Badges -Leaderboards, Collections -Reminders -Points, Credits, Levels -Virtual Goods -Friends, Team, Groups	
Name	**Definition**	**Assigned Elements**	**Source**
Gamification Taxonomy	**Gamification Objects**		
	Gamification objects are the basic building blocks of a gamified system, which typically include items, characters, scripts, visual assets, and so on.	Virtual Coach (narratives), Rewards (Badges), Pie Charts, Bar Charts, Activity streaming	Liu et al. (2017, 1013)
	Gamification Mechanics		
	Gamification mechanics refer to the rules that govern the interaction between users and game objects	Conferring Rewards (Goals), Giving Kudos, Social Networking, Forming Teams, Providing Cash Incentives	Liu et al. (2017, 1014)

Appendix A.6 Overview of Previous Element Definitions and Descriptions used in Gamification

Elements	Definitions and Descriptions about Elements	Source
Points	From a theoretical perspective, ***points provide feedback*** to the student. […] It can do so through a number of different cognitive processes, including restructuring ***understandings***, ***confirming to students*** that they are correct or incorrect, and/or indicating ***alternative strategies*** to understand particular information.	Attali and Arieli Attali 2015, p. 58
	Using points, learners ***can claim rewards to advance in learning applications***.	Hamzah et al. 2014, p.289
	Employees earn points and have levels ***according to their activities*** (e.g.,creating new documents, correctly answering discussion questions, writing new blogposts, completing project tasks).	Suh et al. 2017, p. 281
	For every task solved, the user gets X points.	Aseriskis and Damasevicius 2014, p. 89
	We represent scores in terms of points that ***members acquire for their activities.*** Points are awarded to the member who takes certain actions within a context. The point rule defines how many points to allocate for a particular action.	Bista et al. 2012, p. 613, 614
	Points or scores are important aspects of gamification, as they ***form the basis of measurement***.	Bista 2014, p.7
	Numeric record of players' performance to date.	Buckley & Doyle 2016, p. 45
	Points ***given by some activities and actions, to mark progress*** and lead to level advance.	Sousa Barreto et al. 2016, p. 3
	The term "***pointsification***" has been suggested as a label for gamification systems that add nothing more than a scoring system to a non-game activity. […] In a points-based gamification system, the ***goal*** of ***scoring*** points is less likely to be relevant to a user if the activity that the points measure is not relevant to that user	Nicholson 2012, p. 1 &2
	The term Gamification itself, its meaningfulness and the question if it is more than just a temporary marketing fad which solely adds a layer of points and levels without further purpose is discussed controversial	Schlaghaufer and Amberg 2015, p. 2
	The amount of points ***depends on how well they perform***.	de Marcos 2016, p. 103
	Users can ***earn different types of points by participation and performance***.	Dey and Eden 2016, p.8
	Digital points or points (for short), refer to tokens that ***can be collected*** by users, which can be ***used as status indicators***, to unlock access to certain content, or ***to spend on virtual goods or gifting***.	Hew 2016, p. 222
	Academy uses points and badges ***to reward progress*** and levels of expertise acquired by learners.	Ibanez et al. 2014, p. 292
	In the points condition, participants earned 100 points for each tag they entered. The current ***score*** was displayed in the upper right corner of the screen	Mekler et al. 2013, p.3
	Individuals ***scored points by performing the activities*** for which they were already financially incentivized – closing deals with customers.	Mollik et al. 2014, p. 21
	The players ***obtain a reward in the form of points*** on the completion of a certain behavior.	Pedreira et al. 2015, p. 163
	The ***extrinsic motivators*** of points and badges of accomplishment will appeal to certain players, while others will be drawn to intrinsic learning motivators.	Perry 2015, p. 2311
	Points are ***basic elements*** of a multitude of games and gamified applications. They are ***typically rewarded for the successful accomplishment*** of specified activities within the gamified environment and they ***serve to numerically represent a player's progress***.	Sailer 2017, p. 373
	Points are ***numerical units indicating progress***.	Seaborn and Fels 2015, p. 20
	Points come in many forms, i.e., scores, XP, and bonus points.	Silpasuwanchai et al. 2016, p. 462
	The student ***can obtain points*** after watching a video and each individual level of completeness of the activity can be displayed using a progress bar.	Simoes et al. 2013, p. 353
	Points are used as one of the game design elements that ***provide granular***	Suh et al. 2015, p. 676

	and timely feedback in a gamified system.	
	Points are the most basic game element in gamified environments; the majority of students' interactions with these systems are rewarded with points.	Santana eta l. 2016, p. 913
	Points and credits are ***numeric forms of rewards a user receives from the system*** (or other users) with the intention to score (rate) behavior. They also implicitly give feedback on user behavior.	Weiser et al. 2015, p. 276
	The teams earned points by ***successfully deciphering the clue,*** traveling to the landmark, and taking a picture of themselves with it.	Keith et al. 2018, p. 215
	Through the collection of points the user should be motivated to reduce the ecological footprint of his or her household.	Peham et al. 2014, p. 181
	When a user logs an activity, the system calculates the point value that the user gains with the exercise. The ***point value*** is adjusted based on applicable details, such as number of repetitions, distance, time, intensity or weights, provided by the user.	Hamari and Koivisto 2015, p. 421
	Points can be used to reward users across multiple dimensions, and different categories of points can be used to drive different behaviors within the same site or application. Points can also be used as status indicators, users can spend them to unlock access to content, or spend them on virtual goods and gifting.	Bunchball 2010, p. 7
	By using ***pointification*** (the four values) and the illustration of trees (***progress*** visualization and immediate ***feedback*** on goal achievement) as game design elements, each drive is gamified.	Bui and Veit 2015, p.6
	In iThink, the blue hat is used by the project manager when a project is set up and the categories to group requirements are defined, this activity is not rewarded with ***point***, since the project manager is not considered a player.	Fernandes et al. 2012, p. 70
	Units that ***measure user performance*** through ***completion of specific tasks***.	Wolf et al. 2018, p. 1188.
Experience Points	Will be a distributed for ***those who complete the tasks and mini-games***.	Toda et al. 2014, p. 620.
Point Systems	Point systems, for instance, are considered as an absolute requirement for all gamified systems and ***to build up a foundation for measuring a user's progress and performance*** in activities with the product.	Gnauk et al. 2012, p. 104.
	So the game's scoring system mapped to the course's gradebook, but offered more extensive measurements and exceeded the course's total points.	Wilson et al. 2015, p. 10
	Points will serve as the ***metric for progress*** and users' will receive them ***depending on the achievements*** they accomplish. The total score will serve ***to rank users*** from top performers to lower ones.	Alcivar & Abad 2016, p. 115.
	Point systems ***reward users for completing actions, whereby a numeric value is added to their overall point total.***	Thiebes et al. 2014, p. 12.
Point Grading System	***Credits/Points*** for reviewing peer's essays.	Aparicio et al. 2018, p.16
Badges	Badges are used to reward learners ***as well as recognize their achievement and accomplishment.***	Hamzah et al. 2014, p. 289.
	Users are motivated to use Foursquare frequently to collect badges.	Arai et al. 2014, p. 40.
	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations.	Deterding et al. 2011, p. 4
	Thus, ***incentives such as badges*** do not only ***comply with the intrinsic motive of collecting*** but also with the extrinsic motive of gaining ***social recognition.***	Blohm and Leimeister 2013, p. 277.
	Badges: the use of ***external rewards*** in the context of such technology-enhanced environments does have a positive effect on learning.	Boticki et al. 2015, p. 121.
	Badges are ***a visual representation of achievements***.	Buckley 2016, p. 45.
	Graphic representations of accomplishments. Like achievements, badges mark user's accomplishments with trophies. Both are instantiations of the game mechanic "Rewards".	Sousa Barreto et al. 2016, p. 3.

	Digital badges and ***trophies*** are a symbolic representation of users' ***achievement***, which enable some users to feel a sense of achievement and ***progress***; they allow other users to feel that they confer on them a unique identity by ***showing their expertise or excellence in specific fields.***	Suh et al. 2017, p. 276
	The initial emergence of virtual achievements, sometimes referred to as badges or trophies, ***awarded to users' for completing certain tasks*** was primarily focused around games	Denny 2013, 763.
	Users' ***can collect badges*** that ***visually indicate their achievements*** as they accomplish specific tasks and missions.	Dey and Eden 2016, p. 8.
	Badges can be defined as optional ***sub-goals*** which are not required for completion of the main task. Badges in gamification have their parallels in the real world, for instance, in the form of boy scout ***badges***, which are awarded for acquiring a new set of skills or mastering certain skill levels.	Haaranen et al. 2014, p. 1
	In other words, ***badges represent a reward and recognition*** for the learner's participation and performance.	Filsecker und Hickey 2014, p. 139.
	Badges serve similar purposes, although they signal progression by being rewarded for the completion of distinct goals. Additionally, to indicate status, ***badges leverage the drive of collecting and may also be appealing in an aesthetic sense***, considering a badge as a trophy-like item to appreciate, simply for the particular success it is representing.	Gnauk et al. 2012, p. 105.
	Badges consist of ***optional rewards and goals*** whose fulfillment ***is stored outside the scope of the core activities of a service***. On a systemic level, a badge comprisea signifying element (the visual and textual cues of the badge), rewards (the earned badge), and the fulfillment of conditions that determine how the badge can be earned.	Hamari 2013, p. 237.
	Achievements are rewarded through badges, for example, for ***completing certain exercises*** or repeating them a given number of times or within a certain timeframe.	Koivisto and Hamari 2014, p. 181.
	Badges refer to tokens that ***appear as icons to signify an individual's achievements.***	Hew et al. 2016, p. 222.
	Badge-based achievements, or trophies, have long been used in commercial video games to alter gameplay behaviors and encourage particular types of interactions within a system. In this way, ***they provide additional feedback information*** that the player can then use to adjust his or her behavior.	McDaniel 2012, p. 1
	Badges ***represent certain achievements*** of the user.	Pedreira 2015, p. 163.
	The ***extrinsic motivators*** of points and badges of accomplishment will appeal to certain players, while others will be drawn to intrinsic learning motivators.	Perry 2015, p. 2311.
	To be able to grasp the degree of commitment to the learning, gained badges are openly displayed. There are three types of badges: one for the number of words (a brooch type badge), one for the number of comments (a green ribbon badge), and one for the number of evaluation points obtained (a red ribbon badge). There are three other color ***levels*** (gold, silver, and bronze); therefore, it is possible to obtain nine badges in total.	Usami et al. 2015, p. 947
	Badges are defined as ***visual representations of achievements and can be earned and collected*** within the gamification environment. They confirm the players' achievements, ***symbolize their merits***, and ***visibly show their accomplishment*** of levels or goals. […] Badges have many functions, serving as goals, if the prerequisites for winning them are known to the player, or as virtual status symbols. In the same way as points, badges also ***provide feedback***, in that they indicate how the players have performed.	Sailer et al. 2017, p. 373.
	Badges are ***visual icons*** signifying achievements.	Seaborn and Fels 2015, p. 20.
	In this scenario they define that badges should reward students for accomplishing certain actions in the system, such as, correctly answering 10 questions in a row.	Santana et al. 2016, p. 913
	Trophies, badges or medals are the ***visible acknowledgment*** that the user has reached new levels and finished challenges.	Da Rocha et al. 2016, p. 50.
	Badges were awarded in two major ways: when players ***achieved certain steps of actions,*** or when players achieved certain ranks or scores.	Silpasuwanchai et al. 2016, p. 460.

	Based on the point system and ***achievements*** history, a leaderboard (global or partially) and badges are provided to players for motivating ***competitiveness***, which eventually results in change of the players' virtual status in their social network or the system.	Liu et al. 2011, p. 2
	Badges are visual artefacts that represent success or achievment in completing specific tasks. Badges can be viewed as ***a tool for developing metacognitive skills*** required to achieve success in formal and informal spaces, giving value to what is being learned, supporting connections and developing strategies for negotiating and shaping the learning environment	Pedro et al. 2015, p. 563.
	Those features, which may include points or attractive badges, aim at ***exerting on each individual the desire to fulfill the needed accomplishments*** to be rewarded through recognition	Moro et al. (2019), p. 88
	One of the keys to making levels and ***challenges*** effective is providing a forum for them to show off their achievements, like a trophy case or user profile page that displays their ***badges***. These have counterparts in the real world as well, as in Scouting merit badges, colored credit cards that indicate high spending limits, or colored frequent flyer cards that indicate member status.	Bunchball 2010, p. 10
	Badges consist of ***optional rewards and goals*** whose fulfilment ***is stored outside the scope of the core activities of a service.***	Hamari 2013, p. 237.
Stamps	While stamps were collected individually by students, we wanted students to encourage each other to participate more fully.	Latupile 2016
Trophies	Trophies, badges, or medals are the visible acknowledgment that the user has reached new levels and concluded challenges.	Da Rocha et al. 2016, p. 50.
	One of the keys to making levels and ***challenges*** effective is providing a forum for them to show off their achievements, like a trophy case or user profile page that displays their ***badges***. These have counterparts in the real world as well, as in Scouting merit badges, colored credit cards that indicate high spending limits, or colored frequent flyer cards that indicate member status.	Bunchball 2010, p. 10
Medals	To increase this feeling, we decided to represent some special achievements as medals, a ***typical representation of excellence***.	Dominguez et al. 2013, p. 383.
	After winning an elimination round, a whimsical medal (e.g., a silly string medal) was awarded to the school by placing a printed depiction of the medal on the FIT Game Display	Jonse et al. 2014, p. 77
	Medals however are automatically awarded to users upon their attainment of significant ***milestones*** defined by the system designers.	Hassan et al. 2019, p. 155.
Badge System	The badges are organized into three categories: “basic”, “standard” and “elite”, roughly corresponding to the difficulty required to earn them. The ***badges were part of a badge system***.	Denny 2013, p. 765
	In educational contexts, the adoption of badging systems emerges ***as a way to recognize and share the knowledge acquired*** and developed in formal and informal contexts, therefore fostering participation and learning in the community.	Pedro et al. 2015, p. 563.
	The current study explores the opportunities and ***challenges*** associated with implementing a digital badge system that awards high school credit for students' participation in a network of afterschool programs serving youth from low income, immigrant backgrounds.	Davis and Singh 2015, p. 74
	One example of ***these extrinsic rewards*** commonly employed in gamification efforts is the badge system. In these systems, ***players are given badges for tasks completed and milestones reached***	Hanus and Fox 2015, p. 154.
List of Medals	Some users may, for example, perceive earning medals important, however they may not click on the **list of medals** they earned to check them out every day and hence use frequency does not reflect user perception of the features	Hassan et al. 2019, p. 160.
Leaderboar d	Users will be able to ***see their progress with respect to other users*** on a leaderboard that shows the top best performers in the system.	Alcivar & Abad 2016, p. 115.
	The leaderboards ***bring pride to the learner*** during the use of learning applications. The leaderboards show the leading scorers of learning applications.	Hamzah et al. 2014, p. 289

	The leaderboard ***creates competition between individual employees*** and allows to ***determine a game winner***, which should be additionally awarded.	Aseriskis and Damasevicius 2014, p. 88
	After the game concluded, the instructor showed a leaderboard that included team performance (e.g., ***rank***).	Kwack et al. 2019, p. 168
	Allow the direct comparison of players' expertise.	Buckley 2016
	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations.	Deterding et al. 2011, p. 4
	While leaderboards are used to illustrate the results of games involving points and badges to a group as a whole, they also enhance the social aspects of IS. Leaderboards ***display participants' names on a list,*** with the individuals typically ***ranked*** in descending order (i.e., with the highest number of points at the top).	Suh et al. 2017, p. 276
	In the leaderboard condition, participants could compare their current ***score*** to four fictitious participants in a leaderboard on the right-hand side of the screen.	Mekler et al. 2013, p. 3
	Associated to the game mechanics "Competition" and "Feedback", allows the visualization of the user's general situation compared to others.	Sousa Barreto et al. 2016, p. 3
	For example, leaderboards, an element inspired by games and one that is strongly advocated by proponents of gamification, display a rank-ordered listing of contestants.	Dissanayake et al. 2019, p. 3
	Systems facilitate one's desire to influence others, or influenced by others.	Jia et al. 2016, p. 2
	Leaderboard showing current rank in class and having student company aliases in the leaderboard so ***students can track the progress*** of specific peers in the class.	Chapman 2017, p. 1323
	A leaderboard is a game design element consisting of a visual display that ***ranks players according to their accomplishments***; when used in an educational setting, it serves as a way for students to directly ***compare their own performance with that of others.***	Christy and Fox 2014, p. 67.
	Finally, a leaderboard was implemented using the number of trophies and badges to rank students. This instrument was designed ***mostly to foster competition between students*** with the aim of motivating participation.	De Marcos 2016, p. 103,
	A leaderboard enables ***users' to compare their own performance*** with others and ***stimulates competition***.	Dey and Eden 2016, p. 8.
	Based on the ***point system*** and achievements history, a leaderboard (global or partially) and ***badges*** are provided to players for motivating competitiveness, which eventually results in change of the players' virtual status in their social network or the system.	Liu et al. 2011, p. 2
	A leaderboard was added for each set of challenges in order ***to encourage friendly competition*** between students and motivate them further.	Fitz-Walter 2012, p. 140.
	Gamification often includes the addition of a global leaderboard, where players' scores on given tasks or earned badges are displayed for all players to see.	Hanus and Fox 2015, p. 154.
	Leaderboards refer to high-score tables that ***indicate an individual's performance compared with other users'***.	Hew 2016, p. 222.
	The leaderboard was used ***to display the ranking of the leaders*** in the gamified learning activity. Students appeared in this area ordered lexicographically by points and by sub-goals achieved.	Ibanez et al. 2014, p. 294.
	Even if leaderboards are included in empirical comparisons they are often part of a larger gamification strategy or ***included in combination with achievements and other competitive mechanics*** which limits the interpretation tremendously.	Nebel 2016, p. 391.
	Leaderboards ***rank players*** according ***to their relative success***, measuring them against a certain success criterion. As such, leaderboards can ***help determine who performs best*** in a certain activity and are thus competitive indicators of progress that ***relate the player's***	Sailer et al. 2017, p. 373.

	own performance to the performance of others.	
	Leaderboards are ***used to rank users*** often providing competitive motivation.	Silpasuwanchai et al. 2016, p. 462.
	Leaderboards are ***used to track and display desired actions***, using competition to drive valuable behavior.	Bunchball, 2010, p. 10
	Another example of gamification is the leaderboard, showing the status of member´s experience points (EP), charity points (CP) and gift points (GP). In our design, a member's experience and charisma points will keep rising with every engagement, while gift points will fall when they are exchanged for rewards. The members' motivation increased with the aid of this leaderboard.	Kuo and Chuang 2015, p. 20.
	Those who received the most points were spotlighted on a leaderboard, accessible from the user's login page.	Thom et al. 2012, p. 2.
	They also indicate ***"how am I doing" against friends*** and against everybody else. In the context of gamification, leaderboards are used to track and display desired actions, using competition to drive valuable behavior.	Bunchball 2010, p. 10
	Leaderboards and collections of rewards are public ***displays of rank and achievement.*** Leaderboards may appeal to our social needs to lead and follow. ***Both leaderboards and collections allow users to compare themselves with others***, as well as self-evaluate performance.	Weiser 2015, p. 277.
Score Board	Scoreboards displayed data that was already available to salespeople through their sales management system, but in a ***public manner*** and with the sorts of graphics typical of sports statistics on television.	Mollik et al. 2014, p. 20.
	The chart is useful ***for the teacher to get feedback*** on how much the class knows about a topic and opens an opportunity ***to explain better the parts where students lack knowledge***.	Wang 2015, p. 218.
Badge Board	The badge board allows ***observing the skills of employees***. In the badge board, the employees are ordered by the ***total number of badges collected***. Each badge represents a skill and has its own level.	Aseriskis and Damasevicius 2014, p. 88.
Ranking	A ranking with the top players is presented to ***all players to increase competitiveness***. The position in the ranking can be defined by points, levels, or number of votes, for example.	Pedreira 2015, p. 163.
	Shows the ***position of users compared to others***. Those are tables, commonly used to ***manage and display the scores*** of users with the objective of using the competition as an incentive to the behavior.	Da Rocha 2016, p. 50.
	Finally, the rankings and missions allow, respectively, the students to ***compete*** with friends and maximize its evolution in the system.	Santana et al. 2016, p. 913
	This feature measures the degree of the learning numerically and is intended for comparison with other students. In this study, learners were ranked by the total ***points*** obtained from the number of words registered, the number of times the learner evaluated the words of others, the number of comments given to other learners, and the evaluated points obtained for these comments.	Usami et al. 2015, p. 947
	Taking in account the obtained points, rankings could show the ***relative performance of each student.***	Simoes et al. 2013, p. 8.
	Will be ***used to show statistics from the community***.	Toda et al. 2014, p. 620
	In our case, we have focused on the ***competitive*** factor, generating a top-10 ranking of the course attendees based on the marks accumulated at that time by all the students.	Enriquez et al. 2019, p. 8.
Line Chart	With a simple top-10 ***ranking*** and with ***line charts*** showing student evolution during the course compared with the rest of the class, we generate a competitive atmosphere to motivate our students and improve their performance.	Enriquez et al. 2019, p. 16,
Virtual Goods	The common way for players to ***create their own identity*** is to use virtual goods, whether they are ***obtained through rewards***, ***received as a gift***, or ***bought directly*** with ***real currency***.	Hamzah et al. 2014, p. 289.
	Virtual goods ***are assets with perceived value*** within the game.	Buckley 2016, p. 45.
	Virtual goods ***are non-physical, intangible objects*** that ***can be purchased*** or ***traded***.	Thiebes et al. 2014, p 13.
	Non-physical and intangible objects that can be ***purchased using*** points the users collect over time. Virtual goods are a good way to incentive them to get more points and they also ***offer the possibility of personalizing something that will reflect their identity***.	Da Rocha 2016, p. 50.
	Virtual goods are ***non-physical objects*** that are purchased for use in	Bunchball 2010, p. 10

	online communities or online games. They ***have no intrinsic value*** and, by definition, are ***intangible***. Virtual goods include such things as ***swords, coins, and potions***, as well as ***digital gifts*** and ***digital clothing*** for avatars and virtual rooms. Virtual goods give your users a place to spend their ***points***, a reason to want to earn, a way to buy each other gifts, and a way to self-express. Virtual goods can also be used as a revenue center, by ***selling users virtual goods*** for real dollars	
	Virtual goods are things ***that have some economic value*** and can be used for ***trading*** or ***displaying status*** and ***rank***. Some virtual goods may even be traded ***for real-world currency***.	Weiser 2015, p. 276.
Gifts	Giving a gift is a ***great acquisition and retention tool***. A gift is a strong motivator if the learner has a community in which the learner seeks to develop relationships.	Hamzah et al. 2014, p. 289.
	The ***provision of aid to other players.***	Buckley 2016, p. 45.
Level	Levels are used for signifying completion of intermediate goals in the learning process. It ***provides feedback to the learners regarding their progress*** with the use of learning applications.	Hamzah et al. 2014, p. 289.
	Levels ***are difficulty moderated based on player expertise***.	Buckley 2016, p. 45.
	Players have ***different challenges in each level*** and they can choose which ones they prefer to complete to get enough points to get to the next level.	de Marcos et al. 2016, p. 103
	Levels typically ***show progress*** in the game. The level may be ***indicated by a numeric value*** or a user's status such as "novice" or "expert".	Dey and Eden 2016, p. 8.
	Additionally the users advance to different level statuses according to their specific activities. […] In addition, different activities allow users to collect points and progress to higher levels: examples include social media activities (sharing, like), scanning (energy label) of household appliances and using the comparison or calculation function of the app.	Peham et al. 2014, p. 181
	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations.	Deterding et al. 2011, p. 4
	Leveling up: as players are done with a task, the game promotes them to higher levels.	Faghihi et al. 2014, p. 183.
	Related to the point-based rewards; the users have a level that increases as they reach a certain number of points.	Pedreira 2015, p. 163.
	Indicates that ***the user accomplished a goal***. The higher the level, the greater is the respect and status. Levels are usually defined as threshold points, in a way users can automatically level up based on their participation.	Da Rocha 2016, p. 50.
	The levels represent the evolution of the knowledge of students in each subject (domain).	Santana et al. 2016, p. 913
	Likewise, levels are used as a game feature in gamification, but how levels are ***perceived depends on the individual users***. One person may view the levels as a ***challenge*** to achieve increasingly difficult tasks, thereby stimulating the person's desire to increase their status	Suh et al. 2017, p. 276.
	Adding tiered levels in a gamified system aims to enhance the gaming aspects because people often desire the challenge of increasing their levels.	Suh et al. 2015, p. 676.
	In the levels condition, participants were presented with a vertical progress bar labeled with "next level" and the corresponding points necessary to reach the indicated level.	Mekler et al. 2013, p. 3
	A level will be acquired as the player accumulates points.	Toda et al. 2014, p. 620.
	By gaining more ***points***, the service enables ***level-ups***. Furthermore, the service enables ***achievements*** for one's actions, along with completing quests with pre-set exercise conditions.	Hamari and Koivisto 2015, p. 423.
	Levels are different classes in frequent-flyer programs, colored belts in martial arts, job titles in industry: an indication that you've reached a milestone, a level of accomplishment in a community and should be afforded a certain amount of respect and status. Levels are often defined as ***point thresholds***, so that users can automatically level up based on their participation, or use levels to indicate ***status*** and ***control*** access to content on the site	Bunchball 2010, p. 9
	Levels can provide challenge, feedback, and reward at the same time.	Weiser 2015, p. 276.
User Levels	User levels ***indicate the proficiency of the player*** in ***the overall gaming experience over time.***	Gnauk et al. 2012, p. 105.

	Representation of the ***current skill levels of users***.	Wolf et al. 2018, p. 1188.
Feedback	Properties of feedback can ***direct attention to the self or to the task*** and ***attention to self has been shown to attenuate*** or even reverse the effects of feedback because it ***interferes with task performance***.	Attali and Arieli Attali 2015, p. 58.
	In this case, the student has selected an incorrect answer (has a red cross next to it), thus, the correct answer is revealed (has a green tick next to it) and the number of points obtained is also shown.	Cheong et al. 2013, p. 6.
	Providing feedback is regarded as one of the most important features in both play and learning.	Dong et al. 2012, p. 2.
	The purpose of the polar bear avatar was to give the player (1) ***immediate feedback*** on real-world and in-game impact and (2) ***embodied feedback*** in a form for which the player could build empathy and a feeling of responsibility	Lee et al. 2013, p. 356.
	Immediate feedback is used to ***keep the player aware of his progress or failures*** in real time.	Passos et al. 2011, p. 3.
	Users will receive feedback to every activity they complete, so that they can evaluate their decisions and ***improve their learning*** throughout the training process.	Alcivar 2016, p. 115.
	To encourage households to become more eco-friendly, specific categories in the "ecoGator" application provide additional ***information*** required for a deeper understanding on how to save energy and lead a sustainable lifestyle. [….] After the user answers a question, the solution is displayed in the form of an explanatory text complemented by a useful tip	Peham et al. 2014, p. 181
	Poor classifications are noted with a warning from the game's antagonist, along with a breakdown of the player's correct and incorrect decisions. This feedback is framed by the created story meaning, but directly reflects the real world scientific meaning of the activity.	Tang and Prestopnik 2016, p. 6
	Providing feedback and designing for optimal ***challenge*** are useful for improving the users performance has been shown from previous studies. [….] Once the game begins, the smartphone camera automatically captures facial images and wirelessly sends them to the server. Smiles are detected by the "AutoSmiley," which was previously loaded on the server. Data is logged and analyzed, and ***feedback*** is provided via smartphone at the end of the game	Hori et al. 2013, p. 207
	In the condition with descriptive feedback, respondents were informed they completed the game either faster (positive feedback condition) or slower (negative feedback condition) than the optimal time.	Burgers et al. 2015, p. 96
	Feedback is included ***to avoid students getting lost or confused*** about what to do and how to do it within the learning environment; it is also important to inform students about the progress they have made.	Ibanez et al. 2012, p. 292
Audible Feedback	Implementing ***sound effects*** and / or ***background music.***	Thiebes et al. 2014, p. 12.
	When a user drops a PET bottle the sensor fires and a ***coin sound*** is played. Simultaneously, the screen will change from poker face to the Japanese emoticon for happy during 1 second.	Berengueres et al. 2013, p.1
Progress Bar	Progress is displayed as a progress bar. The project forest provides the element of scalability to represent the size of different projects.	Aseriskis and Damasevicius 2014, p. 89.
	A bar chart indicates current ***points*** and grades in class.	Chapman 2017
	How the player progresses toward the ***goals*** of the game.	Bedwell et al. 2012, p. 733
	Rating a requirement with stars is a pretty straight-forward action so by rating one requirement 50 ***points*** are given to the player.	Fernandes 2012, p. 70
	Progress bars were used ***to indicate progress***.	Silpasuwanchai et al. 2016, p. 461.
Performanc e Graph	Performance graphs, which are often used in simulation or strategy games, ***provide information about the player's performance*** compared to their preceding performance during a game. Thus, in contrast to leaderboards, ***performance graphs do not compare the player's performance*** to other players, but ***instead evaluate the player's own performance over time***. Unlike the social reference standard of leaderboards, performance graphs are based on an individual reference standard.	Sailer 2017, p. 373.
	Visualizations of ***user-specific statistics based on their activities*** (e.g., diagrams).	Wolf et al. 2018, p. 1188.
Performanc e Stars	Show users progress in answering questions correctly.	Alcivar 2016

Progress Notifi-cations	Indication of the extent to which quests, tasks, or milestones have been completed.	Wolf et al. 2018, p. 1188.
Avatar	Users will be able to choose an avatar ***to personalize their profile*** in the training system.	Alcivar 2016, p. 115.
	A ***visual representation of a player's character***.	Buckley 2016, p. 45.
	In the game, players embody a virtual character […] ***and are asked to help him overcome different challenges*** that require players to master skills and learn how to use different options […].	De Marcos 2016, p. 103
	The polar bear avatars were an emotionally engaging ***visualization of the frequency of a player's actions within the game***.	Lee 2013, p. 356.
	Avatars are ***visual representations of players*** within the game or gamification environment. Usually they are chosen or ***even created by the player.***	Sailer 2017, p. 373.
	Students chose one of two avatars to represent themselves for the duration of the game and made their way from task to task, visiting different parts of the library's website as they progressed.	Smith and Baker 2011, p. 9.
	Images of users, which ***visually represent them*** in the service community.	Wolf et al. 2018, p. 1188.
User Profiles	***Personalized virtual identities*** of users in the service community.	Wolf et al. 2018, p. 1188.
Virtual character	A virtual character (i.e. an avatar) ***represents the employee***.	Thiebes et al. 2014, p. 13.
Roles	Role-playing ***elements of characters***.	Seaborn and Fels 2015, p. 20.
Time Pressure	Time pressure is commonly considered an important and effective aspect of games. Adding time pressure is effective as it establishes clear and challenging goals.	Li 2012, p. 105.
	Creating time pressure on activities, e.g., ***through counters or hourglasses.***	Thiebes et al. 2014, p. 12.
	However, the application tracked the total time elapsed from when someone opened a clue until the application submitted the correct picture of the landmark	Keith et al. 2018, p. 216.
Time Constraints	Some examples of game elements include: time constraints such as doing tests within a time limit and with a particular schedule.	Aparicio et al. 2018, p.12
	Commonly reoccurring parts of the design of a game that concern gameplay	Deterding et al. 2011, p. 4
Time Limit	Time limits were used ***to provide extra pressure and excitement***.	Silpasuwanchai et al. 2016, p. 462.
Deadline	A deadline ***is a specific timeframe*** within which the user is expected to complete a task.	Halan et al. 2010, p. 483.
Time Banking	Users are motivated to earn minutes, pushing the user to periodically assume the role of a teacher.	Osipov et al. 2015, p. 72.
Assignments	Assignments are ***concrete tasks*** a user needs to complete in order to complete a goal.	Weiser 2015, p. 276.
Reminder	Reminder of past behavior of the user, e.g., a ***history of actions.***	Thiebes et al. 2014, p. 12.
	Reminders can have both feedback and educational character. Reminders ***can help users to not relapse to earlier behavior stages*** or to encourage habit formation.	Weiser 2015, p. 277.
Progression	A visual tool that displays the advancement of users and the remaining work to reach a goal. It motivates ***users to accomplish a pre-determined goal***.	Dey and Eden 2016, p. 8.
	Milestones indicate progress.	Seaborn and Fels 2015, p. 20.
Goals	Goals and objectives need to be split into ***achievable steps*** that learners ***could accomplish by using their skills;*** designers should keep students within their flow channel.	Ibanez et al. 2012, p. 292.
	Allow for a monitoring of individual progress by a deadline to perform a ***task***.	Aparicio et al. 2018, p. 16
	Clear goals are important so ***that players understand the task*** which they are trying to complete, so that they will stay engaged with the system.	Li 2012, p. 105.
	Goals of the underlying activity should be adapted as challenges for the user.	Passos et al. 2011
	Goals were met when students consumed at or above a criterion of the 60th percentile of consumption over the last 10 target days	Jones et al. 2014, p. 77

	Rules are the goal makeup of game and establish criteria for how to win. Specific, well-defined rules and guidelines are a necessary component for an effective educational game, as well as ***feedback*** on ***progression*** toward achieving the goals.	Bedwell et al. 2012, p. 733
	The design implication of this is that gamification systems need to either allow different ways for users to ***achieve*** goals so that users can be involved in the ways most meaningful to them or to allow users to set their own goals and achievements.	Nicholson 2012, p. 3
	Clearly defined goals, and information on progress toward those goals, provided to the player.	Landers 2014, p. 756
	Two advertisements of pairs of running shoes were presented that each consisted of a picture along with game-slogans, such as Track your run development, Measure achievements, Challenge friends and Play audio-games while running or Measure jumps and calories.	Bittner 2014, p. 394
	Clear, specific goals allow the individual to perceive goal-***feedback*** discrepancies, which are seen as crucial in triggering greater attention and motivation.	Garris et al. 2002, p. 449
	In order to support user autonomy, goals should be specifiable by the users themselves. Goals show better results on performed behavior when they are both specific and challenging. ***This requires a solid understanding of how the target behavior can be achieved within a particular context***.	Weiser 2015, p. 276.
Tasks	The basic element of our formative game-like activity was a list of formative tasks (quests) that students could solve during the course. Tasks could have several characteristics such as: individual /***teamwork*** (indicates whether the task must be solved individually or in group), ***challenge*** (indicates the task is an invitation to a defiance) or expirable (indicates the task has a deadline to be solved).	Mora et al. 2015, p. 757
Missions	Missions will be ***complimentary and optional*** and can be completed at any time during the training period.	Alcivar 2016, p. 115.
	Finally, the rankings and missions allow, respectively, the students to compete with friends and maximize its evolution in the system.	Santana et al. 2016, p. 913
Quests	Quests ***guide users to perform pre-defined tasks.*** They help inexperienced users to learn how to move forward.	Dey and Eden 2016, p. 8.
	The task the player has to complete is presented as a quest, with additional game elements that makes it more attractive.	Pedreira 2015, p. 163.
	The system then sends students a new Quest reminder with instructions on how to start the learning ***task.***	Su et al. 2015, p. 273
	Predefined objectives that users should reach by performing activities.	Wolf et al. 2018, p. 1188.
Narratives	Makes the experience consistent, giving the sensation of change and progress, referring to types of practices or ideas that gives context according to the objectives.	Sousa Barreto et al. 2016, p. 3.
	Narrative has long been incorporated into game designs as shown in the literature that describes users' greater involvement with a game when it is structured around a ***story.***	Tomaselli et al. 2015, p. 6
	The game narrative tells the story and presents a bigger picture for players to comprehend and move forward. Thus, the meaning of game resides in game narratives.	Tang and Prestopnik 2016, p. 4
	When students met or exceeded the criterion level of consumption, teachers read an episode of the story the next day. Each episode began by congratulating the school on their success and progressed through the narrative, which usually had a cliffhanger ending.	Jones et al. 2014, p. 77
	A narrative is the ***telling of a story*** or account of events or experiences.	Halan 2010, p. 483.
Meaningful Stories/ Stories	Meaningful stories are game design elements ***that do not relate to the player's performance.*** The narrative context in which a gamified application can be embedded contextualizes activities and characters in the game [….].	Sailer 2017, p. 373.
	Systems induce intended emotions via interaction with the system, or promote creation and representation of self identity.	Jia et al. 2016, p. 2
Bonus	These points are later converted into badges and we suggest these are displayed to the individual so that members can reflect on their achievement.	Bista et al. 2012, p. 613.
	Bonus and ***penalty points*** for completing assignments before or after “best if done by” milestones.	Chapman 2017
	Bonuses are rewarded ***for having completed a series of challenges*** or	Thiebes et al. 2014, p. 12

	core functions.	
	Finally, students are rewarded ***with extra bonus scores*** when all the questions for a particular level are correctly answered.	Melero et al. 2015, p. 378.
	Points come in many forms, i.e., scores, XP, and bonus points.	Silpasuwanchai et al. 2016, p. 462.
Competition	Enable people to challenge each other to get the high score at some activity.	Hamzah et al. 2014, p. 289.
	Competition motivates users ***to improve their performance with the goal to outstand others.***	Sousa Barreto et al. 2016, p. 3.
	A key part of game design is having dynamic challenges, which are often facilitated through competition among players of different skill levels in online games.	Liu et al. 2013, p. 112
	A gamification design with competition ***lets players compete with one another*** in a gameful way to enhance learning and engagement.	Santhanam et al. 2016, p. 454.
	Competitions ***enable people to challenge each other*** to achieve ***the highest score*** on an activity.	Suh et al. 2015, p. 676.
	Competitions enable your users to ***challenge each other*** to get the high score at some activity. Once everyone has done the activity, the user with the highest score wins a reward while all the losers get a consolation prize.	Bunchball 2010, p.10
	At the assembly, students were told that (i) several schools in the galaxy want to help the FITs, (ii) the FITs will hold a competition to select the most qualified school, (iii) the competition will involve three elimination rounds, and (iv) the school that wins the final elimination round will help the FITs battle the VAT.	Jones et al. 2014, p. 77
	Competitions ***enable users to challenge each other.***	Thiebes et al. 2014, p. 13.
Competitive Status	[…] and metaphors for the competitive status of gaming, which terms such as "***levels***" or "***ranks***" illustrate.	Treiblmaier et al. 2018, p. 135.
Competitive Process	[…] the competitive process of gaming—terms such as "***team***" or "***winning***" and "***losing***", which clearly indicate a game-like activity regardless of the actual activity itself […]	Treiblmaier et al. 2018, p. 135.
Collections	A group of related badges.	Buckley 2016, p. 45.
Cooperation	Reviewing peers' work and evaluating their performance. Having student work evaluated by their peers in a peer review assignment.	Chapman 2017, p. 1323
	Experience of ***working with other users'***.	Wolf et al. 2018, p. 1189
Collaborati on	The community collaboration game dynamic rallies an ***entire community to work together to solve a riddle, resolve a problem, or overcome a challenge***.	Hiltbrand and Burke 2011, p. 13
Team Building	In a team-building context, TVG provides an accessible medium that teams can use to learn to work together and ***accomplish the goals of team-building activities***. […]. The participants could identify and visit more landmarks by dividing into pairs, so they received rewards for dividing labor, communicating with other team members, and ***collaborating*** with other team members.	Keith et al. 2018, p. 209
Teams	Groups of players collaborating to achieve goals.	Buckley 2016, p.45
	First, the term "team" itself, which refers to a defined group of players working together to achieve a common goal, is an important game component	Kwack et al. 2019, p. 163
	Groups of users that are formed ***to achieve a common goal***.	Wolf et al. 2018, p. 1188
(Social Networking Features)	Social networking features included cheering, commenting, viewing of friends' activity logs on a timeline and a list of the friends a user interacts the most with.	Hassan et al. 2019, p. 155
Loss Aversion	Loss aversion is a game mechanic that influences user behavior not by a reward, ***but by not instituting punishment***.	Thiebes et al. 2014, p. 13
Rewards	In gamification, the main reward mechanism is the system of points or similar ideas (such as miles granted to passengers by airline companies to stimulate their fidelity).	Da Rocha 2016, p. 50.
	Points are used as the basic scoring scheme in a game to indicate progress. Using points, learners ***can claim rewards to advance in learning applications***.	Hamzah et al. 2014, p. 289.
	Rewards ***are tangible, desirable items***.	Seaborn and Fels 2015, p. 20.
	Rewards refers to obtaining points or receiving ***any kind of tangible items,*** which will be at the users' disposal after they follow the pre-	Suh et al. 2015, p. 676.

	designed procedures, and thus are integral to the users' experience of needing satisfaction.	
Award	A particular award is given to the player ***for the completion of a behavior.***	Pedreira 2015, p. 163.
Social Facilitation	Describe an effect where individual users ***achieve better results at simple tasks*** in the presence of other people or when working in groups.	Thiebes et al. 2014, p. 13.
Challenges	Objectives with a greater difficulty level, and generally with more gratifying rewards.	Sousa Barreto et al. 2016, p. 3.
	Thus, individuals may progress through increasingly difficult challenges at ever-higher levels of skill.	Hamari et al. 2016, p. 172
	Challenges ***represent missions*** for people to accomplish and then give rewards for the execution. Trophies, badges or medals are the visible acknowledgment that the user has reached new levels and concluded challenges.	Da Rocha 2016, p. 50.
	Is defined as the amount of incremental effort the system represents for the user compared to an optimal amount in subsequent steps.	Tomaselli et al. 2015, p. 5
	Challenges (aka ***trophies, badges, or achievements***) give people missions to accomplish and then reward them for doing so. Challenges give people ***goals*** and the feeling like they're working toward something. The general approach is to configure challenges based on actions that you're tracking, and reward your users for reaching ***milestones*** with trophies, badges and achievements.	Bunchball 2010, p. 10
	To advance you must solve a series of challenges with goals completed in several steps, such as: find the key to open the door, open the door and eliminate enemies across the room	Tomaselli et al. 2015, p. 8
	Ideal amount of difficulty and improbability of obtaining ***goals***. A challenging game possesses multiple clearly specified goals, progressive difficulty, and informational ambiguity. Challenge also adds fun and ***competition*** by creating barriers between current state and goal state.	Bedwell et al. 2012, p. 732
	Games create challenges, which motivate a user to achieve a specified ***goal*** given uncertain outcomes. […] Alternatively, the challenge may be against certain odds of achieving outcomes based upon the difficulty of the ***task*** or the randomness of the outcomes.	Summers and Young 2016, p. 3
	[….] are challenged by activities that are neither too easy nor too difficult to perform. […] Games should employ progressive difficulty ***levels***, multiple ***goals***, and a certain amount of informational ambiguity to ensure an uncertain outcome.	Garris et al. 2002, p. 450
	According to this theory, the level of challenge and the ***level of skills*** that one possesses also play a role in one's feelings during the experience. If the challenge is perceived as low, a very skilled individual will feel boredom whereas an unskilled individual will remain in a state of apathy.	El-Masri 2015, p. 6
	Challenges are experience of being claimed by a task.	Wolf et al. 2018, p. 1189.
Achieve-ments	Other achievements are: ***completing more levels***, and ***positioning as the best trainee compared to other users***. Users will be awarded points for these achievements.	Alcivar 2016, p. 115.
	Achievements tend to encourage students ***to seek challenges and set goals.***	Hamzah et al. 2014, p. 289.
	Achievements are signified by virtual signifiers, such as badges and trophies.	Suh et al. 2015, p. 676.
	An achievement ***is a reward*** for completing a clear and desirable goal.	Thiebes et al. 2014, p. 12.
	An achievement ***will be acquired by completing specific tasks.***	Toda et al. 2014, p. 620.
	Badges (visual representations of achievements) can serve various psychological functions. They can act as a goal-setting device and thus challenge users to attain a goal and thus the badge.	Weiser 2015, p. 276.
	Challenges (aka ***trophies, badges, or achievements***) give people missions to accomplish and then reward them for doing so. Challenges give people ***goals*** and the feeling like they're working toward something. The general approach is to configure challenges based on actions that you're tracking, and reward your users for reaching ***milestones*** with trophies, badges and achievements.	Bunchball 2010, p. 10
	Some (but not all) people are motivated by a need to achieve, to ***accomplish something difficult through prolonged and repeated efforts***, to work towards ***goals***, and to win. People motivated by ***achievement*** tend to seek out challenges and set moderately difficult (but achievable) goals. Their most satisfying ***reward*** is the recognition of	Bunchball 2010, p. 10

	their achievements.	
	An achievement ***is an experience of reaching own goals.***	Wolf et al. 2018, p. 1189.
Self Expresssion	Self-expression is used to mark themselves as ***having a unique personality to those around them.***	Hamzah et al. 2014, p. 289.
	Self-expression results ***from having a desire to express autonomy***, identity, or originality, or to mark one's personality as unique.	Thiebes et al. 2014, p. 8.
	Many people want and need opportunities to ***express their autonomy and originality,*** to mark themselves as having unique personalities from those around them. This ties into the human desire to show off a sense of style, identity, and personality and to show off an affiliation with a group, or demonstrate a connection with a celebrity of some kind. Using ***virtual goods*** is a common way for players to create their own identity, whether they are earned through rewards, received as gifts, or bought directly with real currency. A person's ***avatar*** can often serve as a rich focal point for expression, and some people update their Facebook profile picture more than once a day	Bunchball 2010, p. 10
	Experience ***of communicating one's own identity*** in the service community.	Wolf et al. 2018, p. 1189.
Altruism	Being ***generous with giving something is a strong motivation to develop an ongoing relationship.***	Hamzah et al. 2014, p. 289.
	In gamification, gifting is an incredibly powerful acquisition and retention mechanic. You ***receive a gift from someone that pulls you into the game,*** and then you're incented to send gifts to all your friends, creating a great acquisition loop. And every time you receive a gift, it pulls you back into the application to redeem it, so it serves as a powerful retention vehicle as well.	Bunchball 2010, p. 10
	In this context, altruism refers to ***virtual gift*** giving with the ***aim of strengthening the relationships between users.***	Thiebes et al. 2014, p. 13.
Status	Experience of ***presenting one's own social rank*** within the service community.	Wolf et al. 2018, p. 1189.
	Conditions where to show status or recognition has been achieved.	Hamzah et al. 2014, p. 289.
	Status refers to levels labeled ***according to their skills or contributions***.	Suh et al. 2015, p. 676.
	Likewise, gamification features can be viewed by reviewers as a ***status achievement*** and online review platforms can develop such features to encourage a desired behavior	Moro et al. (2019), p. 89.
	Humans generally have a need for the esteem ***and respect of others, for status, recognition, fame, prestige, and attention***. Status and esteem presents the normal human desire to be accepted and valued by others. People need to engage themselves to ***gain recognition***, and have an activity or activities that give them a sense of contribution, to feel accepted and self-valued.	Bunchball 2010, p. 10
	Most humans have a ***need for status, recognition, fame, prestige, attention and, ultimately, the esteem and respect of others***.	Vassileva, 2012, p. 183
Ownership	The ownership dynamic represents ***a positive, sustained connection to an entity that leads to a feeling of shared ownership.***	Burke and Hiltbrand 2011, p. 14

Appendix A.7 Dynamics, Motivational Elements, and Implications for Taxonomy

Elements	Definition and Descriptions (quotations)	Implication for Taxonomy	Source
Bonus	These points are later converted into badges and we suggest these are displayed to the individual so that members can reflect on their achievement.	• Badges and Points can be used as bonus. • Points can be used as bonus. • Bonuses are extra rewards given to users.	Bista 2012, p. 613.
	Bonus and ***penalty points*** for completing assignments before or after “best if done by” milestones.		Chapman 2017, p. 1323
	Bonuses are rewarded ***for having completed a series of challenges*** or core functions.		Burke and Hiltbrand 2011
	Finally, students are rewarded ***with extra bonus scores*** when all the questions for a particular level are correctly answered.		Melero et al. 2015, p. 378.
	Points come in many forms, i.e., scores, XP, and bonus points.		Silpasuwanchai et al. 2016, p. 462.
Competition	Enable people to challenge each other to get the high score at some activity.	• Points can be used as competitive element. • Leaderboards can be used as competitive element. • Playing games is about losing or winning (being rewarded or being punished). • Competition can happen against others (with rankings) or against the individual user that uses a level to challenge himself to get into a better level.	Hamzah et al. 2014, p. 289.
	Competition motivates users ***to improve their performance with the goal to outstand others.***		Sousa Barreto et al. 2016, p. 3.
	A key part of game design is having dynamic challenges, which are often facilitated through competition among players of different skill levels in online games.		Liu 2013, p. 112
	A gamification design with competition ***lets players compete with one another*** in a gameful way to enhance learning and engagement.		Santhanam et al. 2016, p. 454.
	On one side, competition arouses participants’ competitive instincts to achieve performance ***goals***, leading to greater interest, excitement, and engagement/involvement […]		Shen et al. 2016, p.2
	Competitions ***enable people to challenge each other*** to achieve ***the highest score*** on an activity.		Suh et al. 2015, p. 676.
	Competitions ***enable users to challenge each other.***		Thiebes et al. 2014, p. 13.
	Gamification is an upcoming method in learning, with ongoing research in its use as motivation or engagement method, for fostering collaboration or engaging by competition.		Knutas et al. 2014, p. 2
	We differentiate between ideas and metaphors that emphasize the competitive process of gaming—terms such as “***team***” or “***winning***” and “***losing***”, which clearly indicate a game-like activity regardless of the actual activity itself—and metaphors for the competitive status of gaming, which terms such as “***levels***” or “***ranks***” illustrate.		Treiblmaier et al. 2018, p. 135.
Collections	A group of related badges.	• Badges can be collected and are part of a collection system.	Buckley 2016, p. 45.
Cooperation	Reviewing peers' work and evaluating their performance. Having student work evaluated by their peers in a peer review assignment.	• Students work can be evaluated by rewarding elements. • Can be increased	Chapman 2017, p. 1323, 1324
	Experience of ***working with other users’***.		Wolf et al. 2018, p. 1189.

		by rewarding cooperative behavior.	
Team Building	Team building is used to let users solves goals together to get more rewards when working with a group.	• Missions can be used as cooperative elements.	Keith et al. 2018, p. 214
Collaboration	The community collaboration game dynamic rallies an ***entire community to work together to solve a riddle, resolve a problem, or overcome a challenge***.	• Missions can focus on cooperative behavior.	Burke and Hiltbrand 2011
	Gamification is an upcoming method in learning, with ongoing research in its use as motivation or engagement method, for fostering collaboration or engaging by competition.		Knutas et al. 2014, p. 2
Teams	Groups of players collaborating to achieve goals.	• Missions can focus on cooperative behavior.	Buckley 2016, p. 45.
	Groups of users that are formed ***to achieve a common goal***.		Wolf et al. 2018, p. 1188.
Loss Aversion	Loss aversion is a game mechanic that influences user behavior not by a reward, ***but by not instituting punishment*** when the targeted goal is not achieve.	• Rewarding elements can also be used as punishing elements.	Thiebes et al. 2014, p. 13.
Rewards	In gamification, the main reward mechanism is the system of points or similar ideas (such as miles granted to passengers by airline companies to stimulate their fidelity).	• Points, Badges, and virtual goods can be desired; thus, they are rewards. • Points are tangible items. • Points are rewards. • Virtual goods are rewards • Leveling up is a reward but to level up, points are needed or other collectable elements. • Achievements are rewards which are typically associated with badges.	Da Rocha 2016, p. 50.
	Points are used as the basic scoring scheme in a game to indicate progress. Using points, learners ***can claim rewards to advance in learning applications***.		Hamzah et al. 2014, p. 289.
	Rewards ***are tangible, desirable items***.		Seaborn and Fels 2015, p. 20.
	The game mechanics offered rewards of value to the students (in this case, ***gold coins***) that had a one-to-one relationship with the rubrics and ***point values*** used to evaluate progress and assign grades in the course. […] Rewards for completing early work, mentoring others and demonstrating leadership exceeded the normal classes' point values, requiring them to be tracked separately in an instrument called The Treasure Hunter's Report		Wilson et al. 2015, p. 9 & 10
	Human beings are motivated by receiving rewards — ***something of value given for some kind of action***. A reward, ***tangible*** or ***intangible***, is presented after the occurrence of an action (i.e., behavior) with the intent to cause the behavior to occur again. With gamification, the primary reward mechanism is through earning ***points*** or the equivalent (like frequent-flyer miles). But obtaining ***virtual goods***, ***leveling up***, and even completing ***achievements*** also satisfy this desire.		Bunchball 2010, p. 10
	Every time the user achieves a small goal, some rewards are given accordingly, which is normally supported by the ***point system*** (score, ***virtual currency***, ***experience point***, etc).		Liu et al. 2011, p. 2
	The main gamification elements implemented in RedCritter Tracker which were in the focus of the study are reward points, badges and a leader board.		von Janta et al. 2017, p. 136
	Regarding the rewards, all of the companies shared a view that to be able to influence behaviour on a longer-term, the rewards should be something tangible and meaningful and not, for example, just "meaningless" virtual ***badges*** or ***trophies***.		Kari et al. 2016, p. 6
	Rewards refers to obtaining points or receiving ***any***		Suh et al.

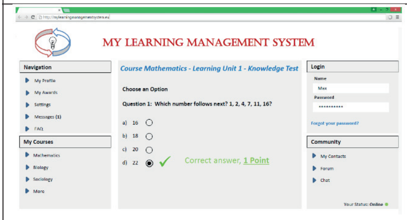
	kind of tangible items, which will be at the users' disposal after they follow the pre-designed procedures, and thus are integral to the users' experience of needing satisfaction.		2015, p. 676.
Award	A particular award is given to the player ***for the completion of a behavior.***	• An award has the same meaning as a reward.	Pedreira 2015, p. 163.
Social Facilitation	Describe an effect where individual users ***achieve better results at simple tasks*** in the presence of other people or when working in groups.	• Missions can be used to increase cooperation.	Thiebes et al. 2014, p. 13.
Challenges	Objectives with a greater difficulty level, and generally with more gratifying rewards.	• Levels are developing and show the progress of users. • Missions have to be accomplished before a user is rewarded with badges. Thus, missions are not rewarding, instead badges are rewarding	Sousa Barreto et al. 2016, p. 3.
	Thus, individuals may progress through increasingly difficult challenges at ever-higher levels of skill.		Hamari et al. 2016, p. 172
	Challenges ***represent missions*** for people to accomplish and then give rewards for the execution. Trophies, badges or medals are the visible acknowledgment that the user has reached new levels and concluded challenges.		Da Rocha 2016, p. 50.
	Challenges are experience of being claimed by a task.		Wolf et al. 2018, p. 1189.
Achievements	Other achievements are: ***completing more levels***, and ***positioning as the best trainee compared to other users***. Users will be awarded points for these achievements.	• Points are used for levels. Thus, users are rewarded with points and levels do not reward. • Badges represent different achievements. • Missions and badges set goals and represent achievements. • Goals (missions) are not rewarding, but if they connected with points, badges, virtual goods, they reward users. • Badges are visual representation of missions. • Quests (or goals/missions) can be completed and each completed quest is another achievement	Alcivar 2016, p. 115.
	Achievements tend to encourage students ***to seek challenges and set goals.***		Hamzah et al. 2014, p. 289.
	Achievements are signified by virtual signifiers, such as badges and trophies.		Suh et al. 2015, p. 676.
	An achievement ***is a reward*** for completing a clear and desirable goal.		Thiebes et al. 2014, p. 12.
	An achievement ***will be acquired by completing specific tasks.***		Toda et al. 2014, p. 620
	Badges (visual representations of achievements) can serve various psychological functions. They can act as a goal-setting device and thus challenge users to attain a goal and thus the badge.		Weiser 2015, p. 276.
	Furthermore, the service enables achievements for one's actions, along with completing ***quests*** with pre-set exercise conditions.		Hamari and Koivisto 2015, p. 423
	An achievement ***is an experience of reaching own goals.***		Wolf et al. 2018, p. 1189.
Self-expresssion	Self-expression is used to mark themselves as ***having a unique personality to those around them.***	• Self-expression is addressed with elements that give users' space to create their own personality.	Hamzah et al. 2014, p. 289.
	Self-expression results ***from having a desire to express autonomy***, identity, or originality, or to mark one's personality as unique.		Thiebes et al. 2014, p. 8
	Experience ***of communicating one's own identity*** in the service community.		Wolf et al. 2018, p. 1189.

Altruism	Being ***generous with giving something is a strong motivation to develop an ongoing relationship.***	• Altruism is related to cooperation. • Virtual goods (virtual gifts) are cooperative based elements.	Hamzah et al. 2014, p. 289.
	In this context, altruism refers to ***virtual gift*** giving with the ***aim of strengthening the relationships between users.***		Thiebes et al. 2014, p. 13.
Status	Experience of ***presenting one's own social rank*** within the service community.	• Leaderboards help to present a status. • All elements that show the progress of a user address his status. • Developing elements show the users' skills. • Status can be earned when users' can compare their results.	Wolf et al. 2018, p. 1189.
	Conditions where to show status or recognition has been achieved.		Hamzah et al. 2014, p. 289.
	Status refers to levels labeled ***according to their skills or contributions***.		Suh et al. 2015, p. 676.
	Most humans have a ***need for status, recognition, fame, prestige, attention and, ultimately, the esteem and respect of others***.		Thiebes et al. 2014, p. 13.
Ownership	The ownership dynamic represents ***a positive, sustained connection to an entity that leads to a feeling of shared ownership.***	• Ownership constitutes by receiving tangible items, hence points, badges, or virtual goods.	Thiebes et al. 2014, p. 13.

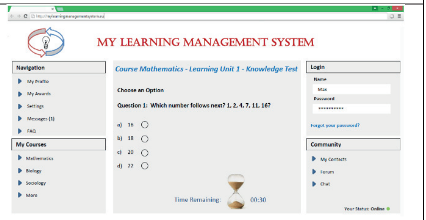
Appendix B Appendices to Study presented in Section 5

Imagine you use a learning management system for your studies, for example Moodle. In the learning management system, you have one course for each university lecture. Each course has different learning units. Despite the documents for the lectures, such as presentations or e-books, videos about different learning contents are included. Furthermore, each learning unit has different knowledge tests to identify the level of knowledge. Hence, each knowledge test refers to one learning unit. All students use the learning management system to learn for their lectures. You have the possibility to interact with your colleagues, and you can contact them as well. In the following, you can see the descriptions of ten different gamification elements, which can be integrated into the learning management system. Please consider the gamification elements described below separate from each other. Read the description of each gamification element carefully.

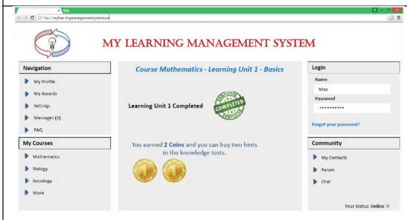
Points: are rewards given for successfully answering knowledge tests. You receive a point for each right answer. They are mostly a part of an overall point score.



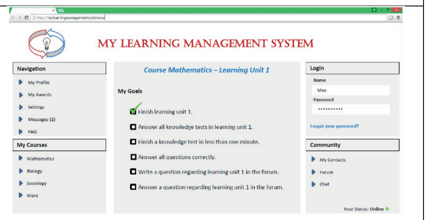
Time Manipulation: when you work on knowledge tests, you are working under pressure and you have to fulfil the task as fast as possible.



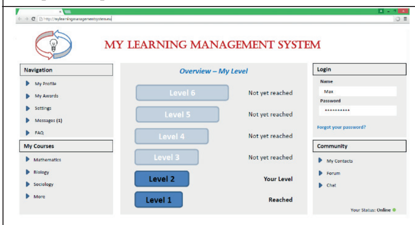
Virtual Goods: you can earn virtual goods (for example, virtual coins) in the system. Coins can be earned by buying, winning, or trading them. Coins can be used for buying hints for the knowledge tests.



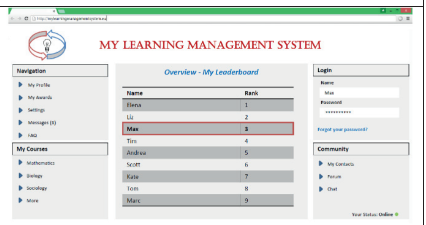
Missions: can be reached by successfully completing a learning unit. Each learning unit has different missions.



Level: indicates your progress in the learning units and knowledge tests. A higher level can only be reached if you are successful in the knowledge tests. The more knowledge tests you complete successfully, the faster you can reach a higher level. For reaching a higher level, you have to complete all previous levels.

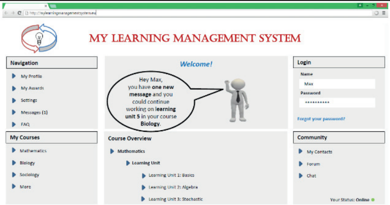
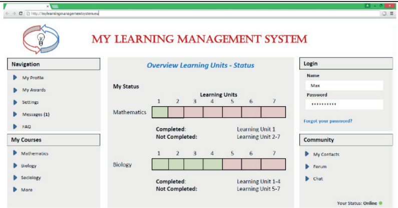
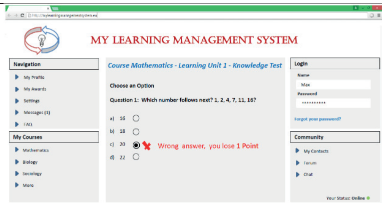


Leaderboard: offers the opportunity to compare your own results with the results of other users. The first rank is the best. By achieving better results in the knowledge tests and the learning units, you can advance into a higher ranking position.



Mediating Avatar: accompanies you during the use of a

Progress Bar: informs you about your current progress in

<table>
<tr><td>system, similar to a kind of tutor. The avatar provides feedback regarding your performance.</td><td>the learning units and knowledge tests. You are always informed about your activities in the system.</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Badges: is an optional reward that is given for fulfilling activities or tasks outside the scope of the core activities, for example, if you give the right answers in all knowledge tests.</td><td>Loss Aversion: influences you not by earning a reward, but by receiving a punishment. You are punished for giving the wrong answers in the knowledge tests, for example, by losing points or badges. Your aim is to avoid this loss.</td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Do you know some or all of the gamification elements described above? *(please select one option)*
☐ Yes ☐ No
Which gamification elements do you already know? *(Please choose the relevant option):*
☐ Missions ☐ Mediating Avatar ☐ Badges ☐ Points ☐ Leaderboard ☐ Progress Bar ☐ Time Manipulation ☐ Virtual Goods ☐ Loss Aversion ☐ Level

Appendix C Appendices to Study presented in Section 6

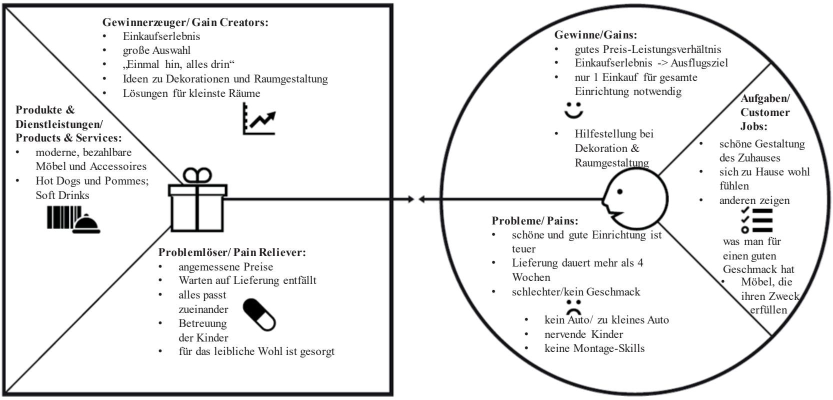
Appendix C.1 Measurement Instruments

Construct	Items (adapted original scales)		Scale	Reference
Intrinsic Goal Orientation	IM1	In a training like this, I prefer course material that really challenges me, so I can learn new things.	7-point Likert scale (strongly disagree to strongly agree)	Pintrich (1991)
	IM2	In a training like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.		
	IM3	The most satisfying thing for me in this training is trying to understand the content as thoroughly as possible.		
	IM4	When I have the opportunity in this training, I chose course assignments that I can learn from even if I can't answer all questions correctly.		
Extrinsic Goal Orientation	EM1	Getting many correct answers in this training is the most satisfying thing for me right now.	7-point Likert scale (strongly disagree to strongly agree)	Pintrich (1991)
	EM2	The most important thing for me right now is getting as many correct answers as possible.		
	EM3	I want to get more correct answers in this training than most of the other students.		
	EM4	I want to do well in this training because it is important to show my ability to my family, friends, employer, and others.		
Engagement	E1*	During the training I was concentrating.	5-point Likert scale (strongly disagree to strongly agree)	Adapted from Hamari (2016)
	E2*	The provided content focused my attention.		
	E3	I enjoyed the training.		
	E4	The interaction with the training program was entertaining.		
	E5	The interaction with the training was fun.		
Satisfaction with Learning Process	How would you describe your learning process on the scale below?		Bipolar (e.g. efficient vs. inefficient etc.)	Gupta and Bostrom (2013)
	Satis1	Efficient vs. Inefficient		
	Satis2	Coordinated vs. Uncoordinated		
	Satis3	Fair vs. Unfair		
	Satis4*	Satisfying vs. Dissatisfying		
	Satis5	Confusing vs. Understandable		
Self-efficacy	SE1	In schwierigen Situationen kann ich mich auf meine Fähigkeiten verlassen.	5-point Likert scale (strongly disagree to strongly agree)	Beierlein et al. (2012)
	SE2	Die meisten Probleme kann ich aus eigener Kraft gut meistern.		
	SE3	Auch anstrengende und komplizierte Aufgaben kann ich in der Regel gut lösen.		
Technology Readiness	TR1	I do not feel confident doing business with a place that can only be reached online.	7-point Likert scale (strongly disagree to strongly agree)	Van der Rhee (2007)
	TR2	I can usually figure out new hi-tech products and services without help from others.		
	TR3	Technology gives people more control over their daily lives.		
	TR4	In general, I am among the first in my circle of friends to acquire new technology when it appears		
	TR5	Technology makes me more efficient in my occupation.		
* Were removed due to loading below 0.7. The scales in this table were adapted and translated in German.				

Appendix C.2 Tasks for Learning Outcome Measurement[11]

Aufgabenstellung Aufgabe 1

VPC der Firma FAFE



Lies dir die Information zum Unternehmen FAFE aufmerksam durch. Du wirst sie im weiteren Verlauf benötigen.

FAFE goes Germany

FAFE ist ein kanadischer Konzern, der jetzt auch in Deutschland Fuß fassen will. Der Name steht für Furniture & Accessoires for Everyone. FAFE bietet moderne bezahlbare Möbel für alle Räume an. Neben Möbeln werden aber auch Stoffe, Kerzen, Bilder und Teppiche angeboten. Für die Küchenausstattung (Töpfe, Pfannen, Geschirr usw.) wird ebenfalls gesorgt. Kundin Alina F. sagt: „Dieser Laden hat wirklich eine Marktlücke geschlossen. Bisher gab es entweder unfassbar teure Möbelausstatter, wo für die Qualität und die Marke, Lieferung und Montage bezahlt wird oder halt so Billig-Läden, wo man zwar einen Kleiderschrank für 150 € bekommt, der aber keinen einzigen Umzug übersteht.“

Im Show-Room werden verschiedene Zimmer komplett mit FAFE Artikeln eingerichtet. Der Einrichtungsleiter John Wessely erklärt das Konzept: „Der Show-Room ist dazu gedacht, unsere Einrichtungsideen für die Kunden zu visualisieren. Viele haben keine Ahnung wie man verschiedene Gegenstände gut kombinieren kann, wie man kleine Räume trotzdem schön gestalten kann oder was für eine wohlige Atmosphäre nötig ist. Wir verkaufen nicht nur Möbel, sondern auch Einrichtungsideen. Wenn ein Student zum Beispiel nur 300€ für die Einrichtung seines WG-Zimmers zur Verfügung hat, kann er sehen, wie schön er dennoch wohnen kann.“

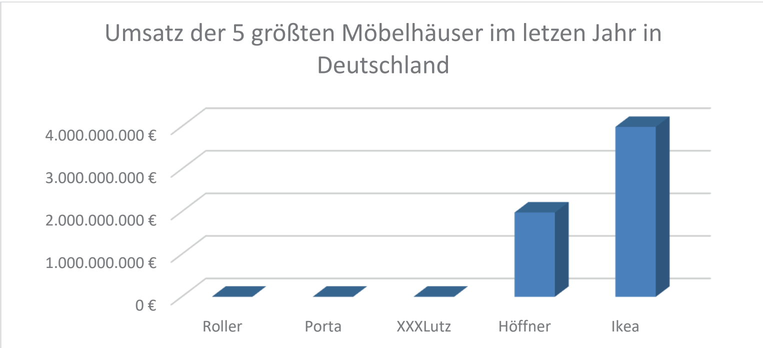
Am Eingang erhält jeder Kunde einen kleinen Scanner. Mit diesem kann er mithilfe von Barcodes alle Artikel scannen, die ihm gefallen (z.B im Show-Room). Kommt er dann großen Lagerraum, zeigt ihm das Gerät an, wo er den jeweiligen Artikel findet. Der Scanner liefert auch Zusatzinformationen zur Produktion und Herkunft der verwendeten Materialien. Besonders Kunden mit ökologisch und sozial ausgeprägtem Gewissen schätzen das. Alle Artikel können transportfreundlich verpackt direkt mit nach Hause genommen werden. Außerdem bietet FAFE ein Spieleland für die Kinder an, damit sich die Eltern ganz auf den Einkauf konzentrieren können. Zusätzlich gibt es ein Restaurant, damit weder Hunger noch Durst vom Einkaufen abhalten. Das Konzept scheint voll aufzugehen. In den letzten Wochen hat die FAFE Community (besondere Rabatte & Gutscheine) 30 % Zuwachs erhalten.

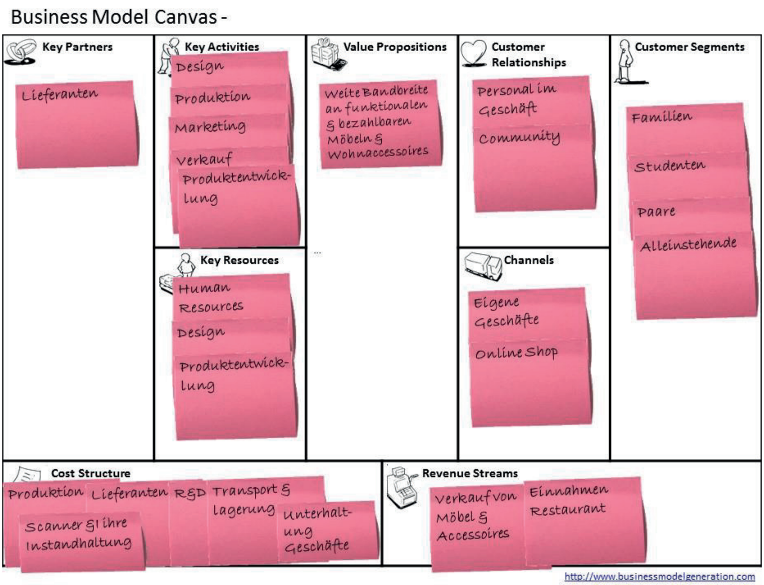
[11] Data were collected at a German University, these are the original tasks.

Wie beurteilst du das Value Proposition Canvas der Firma FAFE? Nenne dabei die wesentlichen Punkte aus den Checklisten zum Kundenprofil und Value Map. Versuche deine Antwort kurz und prägnant zu formulieren.

<u>**Aufgabenstellung Aufgabe 2**</u>

Nutze die VPC und die weiteren Informationen, um das Wertangebot zu bewerten und Vorzüge und Schwachstellen zu identifizieren.



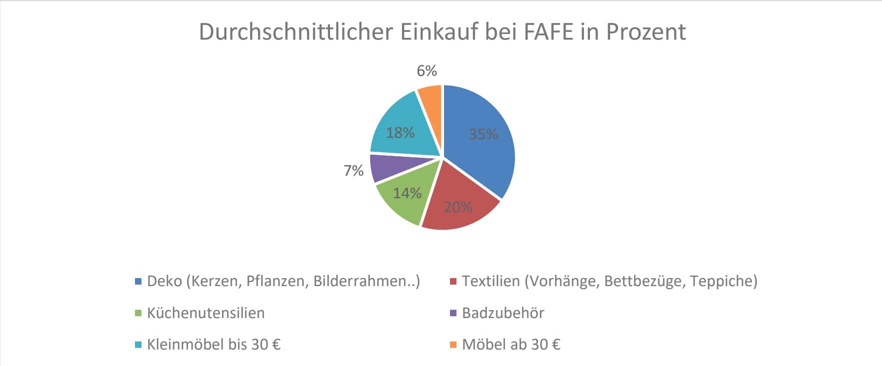


Auf der IKEA Website heißt es:

Das IKEA Konzept lebendig halten

In den frühen 1980er-Jahren, als es bereits in 20 Ländern IKEA Einrichtungshäuser gab und eifrig expandiert wurde, wurde Ingvar Kamprad klar, dass er das einzigartige IKEA Konzept als wichtigen Bestandteil des Wachstums schützen musste.

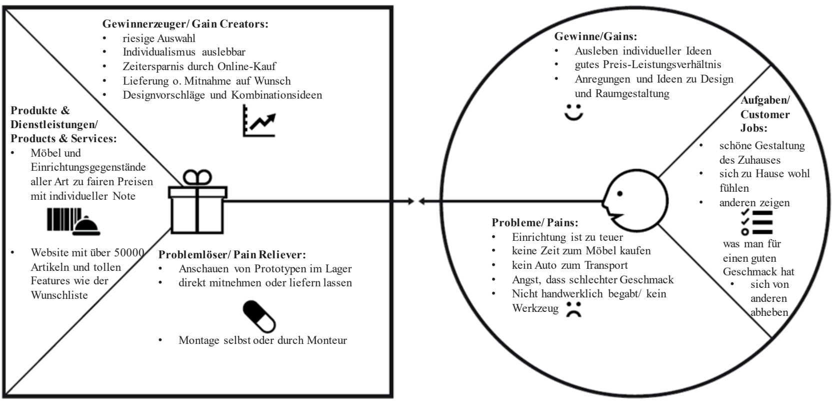
Er wollte komplette Unabhängigkeit und eine langfristige Besitzstruktur. Daher kam ein Gang an die Börse nicht infrage. Und alle Unternehmen, die unter dem IKEA Markennamen arbeiten, sollten Ressourcen bilden, bevor sie weiterexpandierten.
Deshalb wurde das IKEA Franchisesystem entwickelt. Heutzutage werden alle IKEA Einrichtungshäuser mit Lizenzvertrag betrieben. Nur das Haus in Delft in Holland gehört zu Inter IKEA Systems B.V. Inter IKEA Systems B.V. ist Eigentümer des IKEA Konzepts und Franchisegeber.



Nutze die Value Proposition Canvas und die weiteren Informationen, um das Wertangebot zu bewerten und Vorzüge und Schwachstellen zu identifizieren. Versuche hier die wesentlichen Punkte aus den Checklisten zu nennen. Versuche deine Antworten kurz und prägnant zu formulieren.

<u>Aufgabenstellung Aufgabe 3</u>

Sieh dir das Wertangebot von YouFurn an.



Vergleiche das Wertangebot der Firma FAFE mit dem Wertangebot der Firma YouFurn – welche Vorzüge und Schwachstellen hat das Wertangebot der Firma YouFurn? Triff eine begründete Entscheidung, ob du eher in das Wertangebot von FAFE oder in das Wertangebot YouFurn investieren würdest. Welche zusätzlichen Informationen wären für eine solche Entscheidung hilfreich?
Versuche deine Antwort kurz und prägnant zu formulieren.

Appendix D Appendices to Study presented in Section 7

Appendix D.1 Measurement Instrument

Construct	Items		Scale	Reference
Emotional Attachment	Question	Describe the extent to which the following words describe your typical feelings toward this web-based training	7-point Likert scale	Thomson, et al. (2005)
	EA1*	affectionate		
	EA2	lovely		
	EA3	peaceful		
	EA4	friendly		
	EA5	attached		
	EA6*	bonded		
	EA7*	connected		
	EA8*	passionate		
	EA9	delighted		
	EA10*	captivated		
Satisfaction with Learning Process	Question	How would you describe your learning process on the scale below?	7-point bipolar scale	Gupta and Bostrom (2013)
	Satis1	Efficient vs. Inefficient		
	Satis 2	Coordinated vs. Uncoordinated		
	Satis 3	Fair vs. Unfair		
	Satis 4*	Confusing vs. Understandable		
	Satis 5	Satisfying vs. Dissatisfying		
Extraneous Cognitive Load	CL1	How difficult was it for you to follow the web-based training?	7-point Likert scale	Ayres and Youssef (2008)
	CL2	How difficult was it for you to learn from the web-based training?		
	CL3	How difficult was it for you to concentrate during the web-based training?		
Meaning	Question	When I am using the web-based training,	7-point Likert scale	Suh et al. (2017)
	MEA 1	I feel my activities are very important to me.		
	MEA 2	I feel that my activities are personally meaningful.		
	MEA 3	I feel that my interaction with the system is meaningful.		
Active Discovery	Question	When I am using the web-based training,	7-point Likert scale	Suh et al. (2017)
	ACD 1	I feel I exercise powers to deal with challenges I face.		
	ACD 2	I feel I discover new paths to seek answers or resolution.		
	ACD 3	I feel I am aware of how to proceed to fulfil my purposes.		
Self-Expansion	Question	When I am using the web-based training.	7-point Likert scale	Mattingly et al. (2013)
	SEP 1	I feel an increased ability to accomplish new things.		
	SEP 2	I feel that I have a larger perspective on what I am doing.		
	SEP 3	I feel that my activities result in learning new things.		
Outcome Expectations	OE 1	Learning Excel with the web-based training would improve my performance in the class	7-point Likert scale	Gupta (2006)
	OE 2	Learning Excel with the web-based training would improve my performance in future jobs		
	OE 3	Learning Excel with the web-based training would improve my productivity in the class		
	OE 4	Learning Excel with the web-based training would improve my productivity in future jobs		
	OE 5	Learning Excel with the web-based training would enhance my effectiveness in the class		
	OE 6	Learning Excel with the web-based training would enhance my effectiveness in future jobs		
	OE 7	I would find learning Excel with the web-based training useful		
Intrinsic Motivation	IM 1	I would find learning Excel with the web-based training enjoyable	7-point Likert scale	Gupta and Bostrom (2013)
	IM 2	Learning Excel with the web-based training would be pleasant.		
	IM 3	I would have fun learning Excel with the web-based training		
* Were sorted out because of loadings < 0.7				

Appendix E Appendices to Study presented in Section 8

Appendix E.1 Context and Target Group

Source		Context									Target Group			
		General method	*Learning*	*Service*	*Software Development*	*Crowd*	*Health*	*Sustainability*	*Recommender System*	*Project Management*	*Game Developers*	*System Developers*	*Users*	*Others*
1	Deterding (2015)	x									x			
2	Morschheuser et al (2018)	x									x			
3	Klapztein & Cipolla (2016)			x								x		
4	Kirkley et al. (2005)*		x								x			
5	Werbach and Hunter (2003)	x									x			
6	Simoes et al. (2013)		x										x	x
7	Rothschild (2008)*		x								x		x	
8	Zin et al. (2009)		x								x		x	
9	Urh et al. (2015)		x								x		x	
10	Ho et al. (2006)		x								x		x	
11	Gaers & Braun (2013)									x				x
12	Mettler & Pinto (2015)*		x								x			
13	Mozgaleva et al. (2018)		x								x		x	
14	Rodrigues & Oliveria (2016)			x										x
15	Helms et al. (2015)		x								x			
16	Garcia et al. (2017)				x									x
17	Marques et al. (2018)				x									x
18	YanFi & Sari (2017)		x								x		x	
19	Brito et al. (2015)					x						x		
20	Aparicio et al. (2012)**	x									-			
21	Erenli (2013)		x								x			x
22	Eckhardt et al. (2018)*		x								x		x	
23	Korhonen et al. (2017)*						x				x		x	
24	Coltell et al. (2014)***		x								x		x	
25	Gonzales & Carreno (2014)		x								x		x	
26	Khaleel et al.(2017)		x								x		x	
27	Mijangos et al. (2017)**		x								x		x	
28	Mlinar & Weppel (2015)		x								x		x	
29	Moreta et al. (2016)		x											x
30	Supendi & Prihatmanto (2015)**		x								x		x	
31	Paravizo et al. (2018)							x			x		x	
32	Tondello et al. (2017)								x		x		x	

*=Serious Games; **=Research in Progress; ***= Serious Games and Research in Progress

Appendix E.2 Method Steps

Study No.	Method Steps					
	1.	*2.*	*3*	*4.*	*5.*	*6.*
1	User	Action and objects	System and rules	Feedack	Challenge	
2	Project preparation	Analysis of context and user	Ideation	Design	Implementation and design	Evaluation & Monitoring
3	Problematization	Building	Evaluation	Intervention		
4	Analysis	Concepts	Design	QA		
5	Define Business Objectives	Delineate target behavior	Describe your players	Devise your activity loops	Don't forget the fun	Deploy the appropriate tool
6	There is not a step by step linear process. It is more about different aspects and relationships with different aspects: learning contents, gamification tools, game elements, social elements, desired outcome, learning outcome.					
7	Program Requirements	Instructional Content	Game Characteristics	The Game	Learning Outcomes	
8	Analysis	Design	Development	Quality Assurance		
9	Analysis	Planning	Development	Implementation	Evaluation	
10	Learners Analysis	Deciding the learner's role and situation	Demonstration of Problem methods	Problem Analysis and Selection	Evaluation	
11	Analysis of Business Problems	System Analysis and Design	Framework for gamified design			
12	Message	Target Audience	Messenger	Transfer Process	Communication Infrastructure	Evaluation Criteria
13	Recruting the team	Mode of study	Designing own game	Testing	Adjustment	Incorporati on
14	Business object definition	Game model and characteristics definition	Methodology development software and tools	Game design and development	Gamification quality control and feedback	
15	Analysis	Design	Development	Implementation	Evaluation	
16	Design Objectives	Delineate target behavior and metrics	Describe players	Devise activity cycles	Don't forget the fun	Deploy the appropriate tool
17	Identify the objectives	Player analysis	Gamification Scope Definition and Feasibility Study	Game analysis and design	Development of gamified platform	Managing, monitoring, measuring
18	Understand target audience and context	Define learning objectives	Structure the experience	Identify Resources	Apply game elements	
19	Gathering	Analysis	Modeling	Execution		
20	Identification of main objective	Identification of transversal objective	Selection of game mechanics	Analysis of effectiveness		
21	Create a story	Create a walking path	Use a tool to create quiz	Use QR code generator	Test run your game	
22	Learning foundation	Concept	Prototype	Playtesting		
23	Analysis	Concept	Testing/Prototype	Iterate		
24	Intentionality	Instructional Design	Personal Interactions	Knowledge Acquisition	Evaluation	

25	Analyzing user and environment	Defining learning objectives	Designing the experience	Identifying resources	Applying gamification elements	
26	Analysis	Innovation (Design, Development)	Validation (Evaluation)			
27	Understand the target audience and the context	Define learning objectives	Structuring the experience	Identifying Resources	Applying gamification elements	Evaluate
28	Story	Strategy	Scoring	Support		
29	Defining Business Objectives	Understanding Target Behavior	Describe Players	Design Cycles	Maintain Fun	Use appropriate Tools
30	Define Business Objectives	Delineate target behavior	Describe your players	Devise your activity loops	Don't forget the fun	Deploy the appropriate tool
31	Determine concepts and principles of Industry 4.0	Target Group	Planning the gamified system	Development, Prototyping, Testing	Roll out, diffusion, feedback analysis, updating	
32	User Profiles	Items	Transactions	Context	Ratings	
Number of studies can be found in Appendix E.2.						

Appendix E.3 User Attitude, Tasks, and Behavior

Source	Attitude – How it is considered in each method
1, p. 314.	Are considered by skill atoms (intrinsic skill atoms) and questions to analyze needs: 1. What motivates and energizes and directs the activity 2. What challenges are inherent in the activity? What challenges can be removed? What challenges remain that the user can learn to get better at? 3. Hot does my system articulate these inherent challenges? 4. What actions can users take to achieve goals? 5. What objects can the user use to achieve his goals? 6. What rules does the system articulate that determine the actions of users? 7. What feedback does the system provide on how successful the users actions were made and how much progress they made?
2	User groups or personas (player types) can be used to better understand users. Therefore, the following aspects are considered: definition of target users, identification of needs of users (age, gender, job level, motivation, needs, interests, player types, motivation, preferences, behavior, activities)
3	The user's attitude is not considered by involving users, the aspects are considered by referring to literature studies. Hints are given about player types such as the one from Bartle, Lazzaro, Yee and Hamari.
4, p. 5.	The method considers a need analysis and a target audience analysis (it is not mentioned what kind of needs are considered).
5, 91	Questions are considered to analyze user needs: Who are system users? What is the user's relationship to you? Employees, for example, aren't in the same situation as customers. How much does the users relationship with you involve others?
6	-
7	-
8, p. 329.	Students' characteristics such as students' learning style and their existing knowledge are considered.
9, p. 389 – 390.	User needs, behaviors, motivation should be considered. In addition, the user's level of education, age, occupation, gender, culture, skills should be determined.
10	-
11, p. 2.	User needs are considered by self-determination theory and by deriving so-called interaction examples that cover roles of users, the fitting game design pattern and information about how the pattern addresses issues of self-determination theory.
12	Attitudes might be considered, because users are involved in the development phase, it is not outlined in detail how users were involved.
13	-
14	-
15	-
16, p. 33.	Users are asked in interviews about how they work, how task quality could be improved, team cooperation could be better, projects could be better traced. It is also considered that workers are probably motivated by the same things as population in general.
17	Is considered by addressing Bartles player types and by identifying the culture, types of players, and demographics.
18	-
19, p. 447.	In the analysis phase user stories are developed that and are described by participation (heavy contributor, intermittent contributor, lurker), by experience (newcomer, experienced), hierarchy (anonymous, normal user, moderator, admin)
20, p. 2.	Attitudes are considered by addressing the needs of users. The method suggests to refer to self-determination theory, which is a basic needs theory considering autonomy, relatedness, competence
21	-
22	-
23, p. 3.	The only aspect that is mentioned is: Serious games offer customers of different ages a new and entertaining approach to increasing their health and well-being, and the intended impact and needs of the target group must be considered during the development of these games - which needs and how is not specified.
24	-
25, p. 30.	Users are considered by evaluating their age, preferences, knowledge and gender.
26	-
27, p. 3.	Attitudes are considered by student learning profiles
28	-

29, p. 4.	Users are described by categorizing them into player types with verbs that describe each type: 1. Explore (view, collect, rate, vote, curate, review) 2. Compete (win, challenge, compare, showoff, taunt) 3. Create (purchase, design, express, build, decorate, customize, choose) 4. Collaborate (comment, like, greet, help, share, contribute).
30, p. 2.	Are considered by player types (but which and how is not described)
31	-
32, p. 426.	Considered by following aspects: personality types, age, gender, player types, culture or nationality, individual susceptibility to persuasive attempts
Source	**Behavior - How it is considered in each method**
1, p. 314.	Also considered by skill atoms and its components: -Goals, Actions, Objects, Rules, Feedback, Challenge, and Motivation All aspects consider how users behave and what drives their behavior
2, p. 16	User analysis should focus on the definition and characterization of target groups, to collect and analyze information about the potential users of the gamified system, several methods were suggested. These including user interviews, observations, measurements of actual user behavior, analysis of behavior chains, surveys diaries and focus groups.
3	The user's behavior is not considered by involving users, the aspects are considered by referring to literature studies.
4	-
5	The behavior is considered by the business objectives that are defined in a first step and all desired behaviors of users. Therefore, behaviors are translated into objectives and concepts for a game.
6	-
7	-
8, p. 329.	The student's problems with learning history were considered to better understand how they behave and to overcome such barriers that result from existing problems.
9 - 32	No consideration of behavior.
Source	**Tasks - How it is considered in each method**
1, p. 313.	Are considered in skill atoms, because it is considered that a user takes an action which is the input for a system rule.
2, p. 16	A so-called context analysis is made. It is characterized by the identification and understanding of the context, where gamification should be applied. This analysis is particularly important in organizational contexts where the understanding of business processes, corporate culture, and technological constraints is often mentioned as a key requirement to successfully design suitable gamified software
3, p. 592.	In Problematization, which is the initial recognition that drives the rest of the process – the need for a service to be gamified.
4	It is mentioned that for the concept development learning methodologies are considered (but not which and how).
5	Performance goals are considered such as increasing customer retention. It should be carefully considered what the overall goals is (in many different sub goals).
6, p. 350.	The environment must be simple, easy to use and safe (no detailed environment analysis is suggested) – because of the target groups of pupils.
7	Vocabulary acquisition skills are considered.
8, p. 330.	In the analysis phase the statement of learning objectives is considered
9, p. 393.	Factors in e learning are considered such as learning materials, pedagogical aspects, design aspects.
10, p. 458.	The study mentions that it is important to consider the learners problems. (more information are not given)
11, p. 3.	By developing user cases that cover goas of the experience, objectives, business rules, actors, preconditions, course of action
12, p. 261.	It is considered which message should be transferred and to whom the knowledge should be transferred
13, p. 290.	An expert team (teacher, students, experts) is considered to determine work tasks.
14, p. 622.	The first step is an analysis of the business objectives by considering what the purpose of gamification for the business is and what the product is.
15, p. 10.	The target group is analyzed by determining about how to gamify or not and about getting a feeling for the domain.
16, p. 23.	Goals from scrum are derived to better understand work tasks.
17, p. 3.	Scenario is defined as well as the target scenario and SMART is used to define the goals.
18, p. 640	Student were observed while working and while acting in the system by analyzing what they were doing, what mistakes they made etc.
19, p. 446.	The application scenario is analyzed by considering the team, the audience, the game, the client, and the designer itself. Therefore, not only individual goals are analyzed, also collective goals.
20, p. 3.	The main purpose of the task that is gamified is analyzed and considered to identify what is interesting for individuals

21, p. 25.	A story is created in which a user operates in line with storytelling.
22, p. 2.	Looking intensively at the topic and domain of interest by using creative techniques such as brainstorming.
23, p. 4.	The tasks of a user are analyzed by market research and by considering the overall environment of users.
24, p. 2.	Users are analyzed how they work with a system to better understand their work behavior.
25, p. 31.	The learning objectives are explained in detail by defining common skills and specific skills.
26	It is analyzed how gamification relates to programming languages.
27, p. 3.	Tasks are considered by defining learning objectives
28	The learning context is reflected in detail by analyzing what learners will do, if gamification is applicable for their job, and how can they be successful. Especially being successful in their work activities is important because otherwise they would be frustrated.
29, p. 3.	The method considers business objectives (learning objectives) by focusing on the learning situation, the motivation and desired results by indicating for each point what the teacher wants the students to achieve.
30, p. 3.	Considered by the description of business objects (but which and how is not described in detail)
31, p. 441.	The layers of sustainability are analyzed and how they are related to industry 4.0 issues.
32, p. 427.	Activities and strategies of users are considered because a gameful application depends on the domain. Knowledge gathered from the domain is especially important because it allows an adaption of the system to the preferences of users.
Number of studies can be found in Appendix E.2.	

Appendix E.4 User Participation in the Analysis

Source	User Participation	
	Analysis	
	What?	*How?*
1	Skill atoms that cover goals of users, actions, objectives, rules, feedback, and challenges.	This is not exactly outlined.
2, p. 17	Definition of target users, identification of needs of users (age, gender, job level, motivation, needs, interests, player types, motivation, preferences, behavior, activities)	Interviews, observation, measurement of actual user behavior, survey diaries, focus groups.
3	-	-
4, p. 6.	Needs of users and characteristics of target audience	Not further specified
5	By considering the following questions: Will be real people using your system. Who are they? What is their relationship to you? Employees, for example, aren't in the same situation as customers. How much does their relationship with you involve others? What might motivate your players?	For example, by using learning analytics: Analytics are the algorithms and data used to measure key performance indicators for your gamified system. Every online activity generates an event that can be tracked and measured.
6	-	-
7	The target group is not considered in the analysis it just it considered that students are in the 4th grade, that they have to learn vocabulary. Students are not considered by asking them and by analyzing them.	-
8, p. 329.	Students' characteristics such as students' learning style and their existing knowledge were also analyzed. In addition, students were asked about their problems with learning history.	Questionnaire as well as interviews
9, p. 393.	In all phases elements of user experience are considered. The analysis should cover the fields of pedagogy, technology, design, administration, people, learning materials, finance and gamification. The analysis must contain data from the aforementioned fields.	The analysis, as well as data collection, data management and data processing must be properly planned. Properly collected and analyzed data enable efficient and effective of e-learning design.
10	-	-
11	-	-
12, p. 263.	The target audience is considered by having a clear idea about the target audience.	ADR team (comprise researchers and professionals) uses brainstorming, lateral thinking, story planning
13	-	-
14	-	-
15	-	-
16	It is analyzed how scrum masters work, what motivates them, how team cooperation takes place.	With interviews
17, p. 3.	Users are analyzed by referring to player types, demographics, organizational culture.	By filling out a player analysis table that comprise name, demographic prototype, psychographic prototype and bartle player types. Such a table is creasted for each user.
18, p. 640.	Students behavior and computer usage skills and their knowledge in general (how many mistakes they make during working with a computer) were made.	Teachers were asked, students were observed while working and their results with working with the system were analyzed.
19, p. 447.	Users are considered in the analysis by developing a user story based on different components such as the user's participation, their experience and hierarchy.	By developing user stories considering user participation, experience, and hierarchy.
20, p. 3.	In line with the identification of main objectives it is analyzed which objectives are interesting for users and which not.	Not described in detail
21	-	-
22, p. 2.	Students are used for the generation of ideas about the game	Work of groups of students that developed a game concept.
23, p. 4.	Meaning of health professionals, user needs, and market research	Hints are given in the game canvas the authors present: Player, target group: Describe the typical player by age, gender, type. Is the game played alone or in a team? Does the player have some restrictions?

		What is the target group like? Is the buyer of the game the same as the player?
24	-	-
25, p. 30.	Age, gender, previous knowledge, preferences of users in line with their environment.	With a questionnaire asking students about their age etc.
26, p. 5.	Understanding the meaning of programming language	By interviews and surveys (but it is not specified what is part of both). And by literature reviews.
27, p. 3.	Analysis of target audience	Literature review and field study, as well as task analysis
28	Game mechanics are matched with different representatives of a company. Knowledge workers prefer game play, as well as marketing & development employees, and retail associates. Sales representatives prefer leaderboards and at the same time game play. Social elements are not that much preferred by all four representatives.	
29	-	-
30, p. 3.	Target Behavior of users and which player type they are	Not specified
31, p. 442.	A target group is defined badges on the definition of the main goals of the gamified system that is closely related to the outcome that is of interest.	Not specified.
32, p. 426.	Different personalization criteria such as age, user type, personality are analyzed.	User type survey (user is asked about different elements and system therefore combines the perfect bundle)
Number of studies can be found in Appendix E.2.		

Appendix E.5 User Participation in the Design

Source	User Participation	
	Design	
	What?	*How?*
1, p. 316.	By using five different steps: 1 Strategy (Define target outcome and metrics, Define target users, context, activities, Identify constraints and requirements) 2 Research (Translate user activities into behavior chains (optional), Identify user needs, motivations, hurdles, Determine gameful design fit 3 Synthesis (Formulate activity, challenge, motivation triplets for opportune activities/behaviors) 4 Ideation (Brainstorm ideas using innovation stems, Brainstorm ideas using design lenses, Prioritize ideas Storyboard concepts, Evaluate and refine concept using design lenses (optional) 5 Iterative Prototyping Build prototype, Playtest, Analyze playtest results, Ideate promising design changes)	Strategy: design interventions are defined by designers, desk research or interviews or observations are used to define the target audience. User activities are transferred into behavior chains. Needs are considered by asking users to describe their actual engagement. For the game design fit questions can be considered to ask users like does the activity connect to the actual user need, is lacking motivation a central issue. In the ideation phase a brainstorming phase is considered using sticky notes in a workshop. To test the developed design lenses experiments are suggested.
2	User are not exactly mentioned and considered for the design phase.	-
3	-	-
4, p. 4.	Game features are connected to learning mythology in addition a formative evaluation is considered	Not specified. However, the term of formative evaluation is described like this: For instance, in formative evaluation there is a need to not only test learning effectiveness, but "play testing" to determine if the game is actually fun, engaging and meaningful and that its narrative supports instructional goals.
5	-	-
6	-	-
7	-	-
8	-	-
9, p. 393.	In all phases elements of user experience are considered. Planning of e-learning must be done on the basis of good preliminary analysis.	The obtained results of the planning instruct us, what, why, when and how to develop e-learning. The cost of the design compared to the actual development costs is relatively low. Relatively low costs of the planning phase allow experimentation with different e-learning alternatives.
10	-	-
11	-	-
12	-	-
13, p. 290.	Users are considered (together with game experts) to develop a game concept	By literature, online material, meetings, presentation
14	-	-
15	-	-
16	.	
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22, p. 3.	A prototype is developed by selecting game elements and see how they fit together	Using a physical or a digital prototype.
23	-	-
24	-	-
25	-	-
26, p. 5.	User Centered Design (just in the design phase) is used to identify game elements and program learning requirements.	Survey, Interviews and instructional designs (not specified in detail)
27, p. 3.	In the design phase student learning profiles are analyzed	Contextual study

28	-	-
29	-	-
30	-	-
31	-	-
32, p. 426.	Game elements are matched with the personality designs of users.	Not specified
Number of studies can be found in Appendix E.2.		

Appendix E.6 User Participation Development

Source	User Participation	
	Development	
	What?	*How?*
1, p. 319-320, 326.	Prototyping which is actually described as part of the overall design phase. However, a prototype is iteratively developed.	Playtesting can be used to find out if the developed game concepts fit to the needs of users.
2	Prototyping is used in 3 different phases design, create, evaluate prototype, and users are part of the evaluation phase.	Playtesting
3, p. 593.	It is mentioned that brainstorming is used to improve user experience (but it is not specified who is going to participate).	-
4, p. 5.	Character design, design lessons, story boards, assessment design	Not further specified.
5	-	-
6	-	-
7	-	-
8, p. 330.	Prototyping with Users	Playtesting and alpha testing
9, p. 393.	In all phases elements of user experience are considered. E-learning is most often developed and implemented in the online environment.	The most commonly used tools for the development of e-learning and web-based applications are: Ajax, ASP, ASP.NET, CSS, ColdFusion, Java EE, JavaScript, Perl, PHP, Ruby on Rails, CGI, Django, Wt–Web toolkit, WebObjects and others. It is very important to write the project documentation about the process of making e-learning.
10	-	-
11, p. 4.	So called interaction examples are developed considering the kind of interaction, user role, game design pattern, and self determination	A Role-Motivation-Interaction Framework (RMI) was introduced to facilitate the architecting of gameful interactions
12, p. 261.	End users are considered in developing paper-based prototypes in an all-day play event.	An all-day play event is used to develop the game with users. The event ended with an open-ended discussion about the game and learning experience.
13-21	-	-
22, p. 3.	The game is further developed by playtesting.	By playtesting that are performed by designers together with users because they can give information about what they like and what they don't like. Additionally, it is analyzed if the game works if it is conclusive and fun.
23, p. 4.	Users are considered in the iterate phase and prototyping phase.	By making rapid prototyping and playtesting.
24	-	-
25	-	-
26, p. 5.	Users test a low fidelity prototype	Heuristic evaluation
27-32	-	-
Number of studies can be found in Appendix E.2.		

Appendix E.7 User Participation Evaluation

Source	User Participation	
	Evaluation	
	What?	*How?*
1, p. 327-328.	Although there an evaluation phase is considered users are not part of it. The evaluation is not part of the method. The method was evaluated but not the game concept by using a method.	-
2	User behavior is evaluated	Qualitative as well as quantitative research
3, p. 593.	It is tested whether the design and the game is satisfactory.	Evaluation of prototypes (it is not indicated what was measured and if interviews of surveys are used)
4, p. 8.	It is called QA	Bug testing, usability testing, play, fun testing, learning testing
5	Ask yourself the following question: Would players participate in your system voluntarily? If there weren't any extrinsic rewards offered, would they still be likely to play? If the answer is no, then you should think about what might make your system more fun.	Not specified.
6, p. 352.	Usability and user experience	With a heuristic evaluation
7	Increase word knowledge and strategy use	Analyzing the results, the students make in vocabulary learning.
8, p. 331.	For the implementation and evaluation phase, the prototype will be developed and tested completely. It will be launched in Compact Disc (CD) form. This educational game will be installed in school computer lab for evaluation. The effectiveness and usability of PMIS prototype will be evaluated by target users form four students who took History subject.	Usability testing were made.
9, p. 393.	In all phases elements of user experience are considered. Evaluation of e-learning is a process where the achieved objectives of e-learning are determined. Through evaluation we get the information about students' satisfaction, motivation, efficiency and effectiveness.	Not specified.
10, p. 460.	Users are observed in the evaluation phase by letting them collect points	Skill assessment and progress tests
11, p. 5.	Not specified. Just one hint is given in the conclusion: Game design patterns were customized to offer employees a positive and engaging experience.	-
12, p. 262.	Game flow, game experience	One-on-one interviews with users.
13, p. 295.	The developed game is tested by students.	By questions about how well the game fulfills the need of users.
14, p. 623.	Users are asked about how they felt during the game use, what they liked best, the least liked features, what is missing.	With a questionnaire.
15	Trainees are asked about their experience. The outcome is used to reflect on original decision about to gamify, the selection of game elements, and implementation	With experts of training by letting them use the gamified system and observing and questioning them.
16	Eval is not a part of the method.	-
17	Indicator values from execution logs, action plans for the gamified system	Log Data and action plans
18, p. 640.	Problems that students have while working with the system, feedback, user experience, overall rating of application.	With a questionnaire and interviews.
19	Users are considered to test the developed gamification concept; the concept is rebuilt if the usability is not sufficient.	Usability testing were made.
20, p. 3.	Fun, quality of indicators, satisfaction, service quality	Completion of questionnaires and test of users with specific metrics or performing a heuristic evaluation by experts.
21, p. 26.	Experience and feedback are used to improve the app.	Surveys and data about how individuals solved cases.
22, p. 6.	Overall Impression, Game design Elements, usability and navigation, fun, design are evaluated. The evaluation is not part of the method!	With a questionnaire.

23, p. 5.	Testing the prototype	It is not outlined how users are exactly involved and what is measured.
24, p. 3.	Usability and learning effectiveness	For example, by playtests, evaluation is not outlined in detail.
25, p. 29.	Motivation and Engagement	At the end after implementing a gamification concept. However, the evaluation is not a part of the overall method.
26, p. 5.	Effectiveness and Motivation of users	Questionnaire based on ARCS
27, p. 4.	Efficiency (time spent in solving the instrument), Effectivity (total number of questions that were solved correctly), Learning Competencies (Homework and student self-evaluation)	Experiment with group that uses the tool and one that does not use the tool.
28	-	-
29, p. 4.	Users were considered after the product release by an evaluation of gamification elements that were implemented.	Not specified.
30, p. 2.	Users were considered a performance evaluation	Performance of the job was measured.
31, p. 443.	Testing of developed gamification concept is made with users.	Not specified.
32	User have to evaluate the developed gamified solution.	User have to rate the activities that they work with and that are gamified.
Number of studies can be found in Appendix E.2.		

Appendix E.8 Stakeholders – Users

Source	Stakeholders	
	Users	
	When?	*How?*
1	In the analysis, development and design phase (an evaluation phase that is part of the method is not specified)	Interviews, Workshops
2	In all phases besides the design phase.	Different techniques are suggested such as interviews, workshops, observations.
3	In the evaluation phase	By considering it the design is satisfactory for the users.
4. p. 5.	In all phase's users are considered	Not specified in detail
5, p. 352.	In the analysis phase and the evaluation phase to test whether the developed game is fun. Or by considering player types.	By answering different question (in which way is not specified)
6, p. 352.	In the evaluation phase.	With a heuristic evaluation.
7	In the evaluation phase	From the perspective of the player, the achievement of learning outcomes will be apparent as the player is able to progress from level to level, meeting the criteria required for game progression—criteria that are instructionally based.
8, p. 330.	In all phases.	In the analysis by a requirement analysis and determination of student characteristics.
9	All over the process	By considering different elements of user experience in line with user age, culture, experience. Elements: project management, user research, usability evaluation, information architecture, user interface design, visual design, content strategy, accessibly, web analytics
10, p. 460.	Users are observed in the evaluation phase by letting them collect points	Skill assessment and progress tests
11	In the development phase	By using self-determination theory
12	In the analysis phase (but not by letting them participate). In the design and development phase and in the evaluation phase.	In the design and development phase by letting users participate in an all-day prototyping workshop. In addition, user performance is measured by a quantitative evaluation measuring the users flow and their performance. Users are considered in the evaluation phase by interviews.
13	In the design and evaluation phase	Letting users create a game and evaluating it with a questionnaire
14	In the evaluation phase.	Letting the users test the game and answering a knowledge test
15, p.10.	In the Implementation phase and evaluation phase (implementation is after development)	Users are asked about their experience but how this takes place is not specified.
16, p. 27.	In the Analysis phase by asking them about how they work.	Interviews
17	In the analysis and evaluation phase.	By describing players, and users characteristics and by documenting logs and activity plans.
18, p. 639-640.	In the beginning and after the development of the concept	In the beginning by observations and interviews with teachers. In the end with interviews and some questions.
19	In the beginning of the process and in the evaluation phase.	By using a questionnaire to learn more about how users behave and how they act. Aspects such as age, place of birth, or job position were considered.
20, p. 2-3.	In the analysis and evaluation phase	By considering needs of users and by questioning them about the developed game concept
21, p. 26.	In the evaluation phase.	Survey.
22	In all four phases.	In the analysis phase by letting them brainstorm (in groups) about game ideas. In the design and development by letting them do a playtest. In the evaluation by letting them judge about the developed concept.

23	User needs are considered in the beginning, and development phase as well as in the evaluation phase.	Not specified.
24, p. 2.	In the evaluation and in the beginning by analyzing how they work with a system.	Playtesting and observation.
25, p. 30.	In the first step by analyzing the user's environment and in the evaluation of the system.	Age, gender, previous knowledge, preferences are considered for the user analysis. Adequately users are considered in the beginning. Additionally, users are asked to test the gamified system.
26	In all phase's users are considered	By different methods: literature review, interviews, questionnaires
27, p. 2-3.	Users are considered by understanding them and their context	With a literature review, and a field study.
28	In the strategy phase of the four analysis phases.	By considering what learners will do, how they act and what their possibility of success is.
29, p. 4.	In the analysis by evaluating their experience with risk management. In addition, they are considered by addressing different player types.	Interviews to evaluate state of the art. And categorization of verbs to describe players.
30, p. 3.	Target behavior is analyzed by delineate target behavior and description of players is made in the beginning	Not specified
31, p. 442.	Users are considered by the identification of the target group and the goals.	Not specified
32	In the analysis, design, evaluation phase	By evaluating preferences and by a survey to identify user characteristics.
Number of studies can be found in Appendix E.2.		

Appendix E.9 Stakeholders – Gamification Experts

Source	Stakeholders	
	Gamification Experts	
	When?	*How?*
1, p. 320.	To construct the game concept and the design lenses.	Interviews, workshops
2	In the implementation and development phase when game elements are selected	By advice and management implementations how is not further outlined.
3	-	-
4, p. 6.	Instructional designers and game designers must work together to understand the key elements of successful instructional game design. In order to do so, we must first agree on an integrated process that focuses on creating games that are instructionally sound, and well-designed in terms of playability and fun.	Not specified
5	Game designers, or people who can function like them	To do gamification well, you'll need a team with a variety of skills. This is not to say that a single person can't implement an effective system—in a startup, for example—but they will need expertise in more than one area.
6-12	-	-
13, p. 290.	In the design phase.	Assisting students when developing the game concepts.
14	-	-
15, p. 11.	It says that domain knowledge is acquired but not if such domain knowledge will come from game experts or end users or teachers.	-
16-19	-	-
20, p. 2-3.	In the evaluation phase	Letting experts test the developed game concept
21, p. 24-25.	In the design and development phase.	By letting them analyze existing scavenger hunt games.
22	-	-
23	In the design and development phase	Users and experts collaborate. Additionally, experts were considered in the evaluation to better judge about the developed concept.
24	-	-
25-32	-	-
Number of studies can be found in Appendix E.2.		

Appendix E.10 Stakeholders – Usability Designers

Source	Stakeholders	
	Usability Designers	
	When?	*How?*
1	Some might be considered in the method evaluation phase but it is not clear if usability designers for the system are considered.	-
2-3	-	-
4, p. 6.	Instructional designers and game designers must work together to understand the key elements of successful instructional game design. In order to do so, we must first agree on an integrated process that focuses on creating games that are instructionally sound, and well-designed in terms of playability and fun.	Not specified
5, p. 100	People who understand the business goals of the project; the best game designers in the world may produce something useless if they aren't tethered to the desired strategic objectives.	To do gamification well, you'll need a team with a variety of skills. This is not to say that a single person can't implement an effective system—in a startup, for example—but they will need expertise in more than one area.
6-8	-	-
9, p. 393.	It is just mentioned that various experts should be considered in the process but not when and how.	-
10-13	-	-
14	In the second, fourth and fifth step	Not specified
15-18	-	-
19	In the beginning to better understand the scenario, in the analysis phase and in the modelling, phase were the system is gamified.	It is not exactly outlined how they proceeds.
20-21	-	-
22, p. 2-4.	In the development phase for the overall right design of the game.	Not further described.
23	-	-
24	Are necessary, but not considered in the game concept development (or not described in detail)	-
25	-	-
26, p. 4.	In the development phase	Not outlined
27	Not considered for the game concept but probably for the system development but this part is not outlined in the paper.	-
28	-	-
29, p. 4.	In the development process to guarantee that the application has friendly styles and designs.	By letting designers features such as drag and drop or dynamic tables.
30-32	-	-
Number of studies can be found in Appendix E.2.		

Appendix E.11 Stakeholders – System Developers

Source	Stakeholders	
	System Developers	
	When?	*How?*
1, p. 312.	When developing so called design lenses: This lens instructs designers to code a design space in terms of meaningless versus meaningful choice.	Design lenses provide a design guideline that is both generative and evaluative, and devised to be self-contained. This makes design lenses an ideal starting point for gameful design.
2	Are part of all phases.	Are for example considered by brainstorming of game ideas.
3	-	-
4, p. 5.	In the design phase	Not specified
5	Technologists able to implement your vision. And Analytics experts able to make sense of the data your gamified systems generates.	To do gamification well, you'll need a team with a variety of skills. This is not to say that a single person can't implement an effective system—in a startup, for example—but they will need expertise in more than one area.
6-9	-	-
10, p. 459.	In the design process.	Not specified.
11, p. 4.	It is not specified the only aspect that is mentioned: Role-Motivation-Interaction Framework (RMI) was introduced to facilitate the architecting of gameful interactions.	-
12	In the complete process	Computer scientists are part of the action design research team and assist during the complete process.
13	-	-
14, p. 622.	In the second phase of game model and characteristic definition	Not specified
15, p. 11.	In the design phase when selecting the right elements.	Not specified
16	-	-
17, p. 4-8.	In the Developing and testing phases.	By being part of an agile team and by developing use cases.
18-21	-	-
22, p. 3.	In the prototyping phase.	By letting them build the prototype based on the recommendations given by the users.
23, p. 8.	Were considered to develop the prototype based on the developed concept.	Not specified
24	Are necessary, but not considered in the game concept development (or not described in detail)	-
25	-	-
26, p. 5.	In the development phase when developing prototypes	Not outlined.
27	Not considered for the game concept but probably for the system development but this part is not outlined in the paper.	-
28	-	-
29	Although a system was developed, the role of system developers in not specified in detail.	-
30-32	-	-
Number of studies can be found in Appendix E.2.		

Appendix E.12 Gamification Elements and Analyzed Outcomes

Sources	Analyzed Outcome	Gamification Elements
1	Effective game design	Different such as points, levels, avatars etc.
2	Effective game design	Different such as points, levels, avatars etc.
3	Improvement of user experience and engagement in services	Different
4	Effective design while integrating game processes (e.g., Waterfall Method) and best practices.	-clear goals that students find meaningful, - multiple goal structures and scoring to give students feedback on their progress, -multiple difficulty levels to adjust the game difficulty to learner skill,-random elements of surprise, and -an emotionally appealing fantasy and metaphor that is related to game skills
5	Fun	Different such as points, levels, avatars etc.
6	Usability and user experience	Feedback, Rewards, achievements, gifts, tasks
7	Student engagement and learning outcomes	Fantasy, Rules, Sensory Stimuli, Challenge, Mystery, Control, Genre and Form
8	Effectiveness and Usability of gamified prototype	Game Story, multimedia technology, rules, feedback, immersive, challenge/competition, rewards/awards
9	Motivation, Engagement, Satisfaction, Effectiveness, Efficiency, Experience, Knowledge Acquisition, Flow	Points, Badges, Levels, Challenges, Virtual Goods, Leaderboard, Gifts, …..,
10	Strengthen problem solving ability	Avatar, Points
11	Positive and engaging experience	Not specified.
12	Flow, Enjoyment and Performance of Learners	Not specified in detail
13	Training efficiency	Achievements, avatars, collections, content unblocking, gifting, leaderboards, level, points, quests, social graph, team, virtual goods
14	Usage of applications	Game, product, security, process, information
15	System usage	Different elements grouped in seven groups: progression, rewards, rules, social, competition, communication, general
16	Better scrum processes	Team achievements, progress bar, points, level, badges, gems
17	Better quality solution	Avatar, Icon, Leaderboard, Rules, Goals, Reward, Badge,
18	Usage of application and how easy it is to understand application.	User guidance, timer, score, error typing, answer question, warning signal when excess quantity of words, save features for name, time, error typing and assessment.
19	Improve user interface of collaborative activities, usability, and trustworthiness	Not specified
20	Fun, quality, satisfaction, service quality	Profiles, avatars, macros, configurable interface, alternative activities, privacy control, notification control, feedback, optional challenges, progressive information, intuitive controls, points, levels, leaderboards, groups messages, blogs, connection to social network, chats
21	Quest solving	Different kinds of games (geocaching etc.) are addressed and thus a bunch of elements is used.
22	Overall impression, impression about elements, usability, fun, design	Different kinds that are not described in detail
23	Not outlined	Levels, points, achievements
24	Formalize specific teaching needs in medicine subjects.	Elements are defined that could be used to gamify: Competition, Goals, Rules, Challenge, Safety, Outcomes, Interaction, Exploration, Fantasy
25	Engagement in learning as well as motivation	Levels and Badges
26	Improve programming skills of students.	Not specified in detail

27	Learning outcomes	Not specified by mechanics but by key concepts: goal-focused activity, reward mechanisms, progress tracking.
28	How do learners score when playing games in relation to their work tasks.	Game play, leaderboard, rewards, report card, social elements
29	Improve teaching risk management.	Points, Progress Bar, Score bar
30	Better performance on the job	Rules (user action, rules of the game), Feedback (Bonus, Domain learning), Goal (gameplay, goals), Challenge (domain problem, progress user)
31	Sustainable Behavior	Challenges, rewards, feedbacks by using achievements, quests and points
32	Personalized gamified systems	Indication about most used elements: points, badges, leaderboards, levels, avatars, narratives, quests, challenges, rewards
Number of studies can be found in Appendix E.2.		

Gamification is about using gamification elements in contexts such as digital learning and aims to motivate and engage users to change their behavior. So far, gamification has been proven as effective concept to support learners in achieving better learning outcomes. However, challenges remain about how to design gamification concepts to make them more meaningful and relevant for learners.

Sofia Schöbel presents approaches and concepts about how to design and consider gamification for digital learning solutions. The empirical evaluations demonstrate, that designing effective gamification concepts is more than just selecting a bundle of elements. It is about adapting selected gamification elements to a specific context and the needs of a target group.

The book targets researchers, lecturers, and students in information systems, business administration and educational technology. The book provides insights for practitioners concerned with the development of gamification concepts for digital learning solutions.

ISBN 978-3-7376-0835-0