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Two Decades of Research Synthesis on Digital Cultural Education: A Tertiary Review

Abstract

Digitalization fundamentally increased access to receptive cultural participation for a wide audience and created new opportunities for active participation such as video games and social media. In order to obtain a comprehensive overview, we conducted a tertiary review of published research syntheses on effects of digital cultural activities, mapped their topics and analyzed the research methods applied. We screened n = 5880 raw hits from Scopus, resulting in n = 65 research syntheses that met our inclusion criteria; n = 22 were systematic literature reviews and n = 43 were meta-analyses. The most frequently investigated cultural facet was video games. Traditional facets were less frequently synthesized. While most syntheses focused on online interactions, some syntheses studied activities such as VR, which require special hardware. The included syntheses heavily focused on the research topics "learning" and "subjective well-being and mental health". Most of the included syntheses on video games and social media focused on negative effects such as addictive or aggressive behavior, positive effects of those activities were synthesized less frequently. The included syntheses also only rarely synthesized qualitative studies. The implications of those desiderata for systematic reviews and empirical original research on digitalization in cultural education are discussed.

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Keywords
arts education, digitalization, cultural education, research synthesis, tertiary review

Zwei Jahrzehnte Forschungssynthesen zur Digitalisierung in der kulturellen Bildung: Ein Tertiary Review

Zusammenfassung
Die Digitalisierung hat den Zugang zu rezeptiver kultureller Teilhabe für ein breites Publikum grundlegend verbessert und neue Möglichkeiten für Aktivitäten im Kontext von Videospielen oder Social Media geschaffen. Um einen umfassenden Überblick zu erhalten, haben wir in einem Tertiary Review veröffentlichte Forschungssynthesen zu den Effekten digitaler kultureller Aktivitäten zusammengefasst und nach ihren Themen sowie den angewandten Forschungsmethoden analysiert. Um dieses Ziel zu erreichen, sichteten wir n = 5880 Scopus-Treffer. Es resultierten n = 65 Forschungssynthesen, die unsere Einschlusskriterien erfüllten. Davon waren n = 22 systematische Literaturübersichten und n = 43 Metaanalysen. Die am häufigsten untersuchte kulturelle Facette war die der Videospiele, klassische Facetten wurden weniger häufig synthetisiert. Während sich die meisten Synthesen auf Online-Interaktionen konzentrierten, untersuchten einige Synthesen Aktivitäten wie VR, die spezielle Hardware erfordern. Die eingeschlossenen Synthesen konzentrierten sich stark auf die Themen „Lernen" und „subjektives Wohlbefinden und psychische Gesundheit". Die meisten eingeschlossenen Synthesen zu Videospielen und Social Media konzentrierten sich auf negative Effekte wie süchtiges oder aggressives Verhalten, positive Auswirkungen dieser Aktivitäten wurden seltener synthetisiert. Nur sehr wenige eingeschlossene Synthesen fassten qualitative Studien zusammen. Implikationen dieser Desiderate für systematische Übersichtsarbeiten und empirische Originalforschung zu Digitalisierung in der kulturellen Bildung werden diskutiert.

Schlagworte
künstlerische Bildung; Digitalisierung; kulturelle Bildung; Forschungssynthese; Tertiary Review

1. Introduction

Even in predigital times, artistic and cultural activities have played a central role in everyday life and in leisure activities. It comes therefore with little surprise that in the course of the digital transformation of society as a whole, these activities are

undergoing a digital transformation as well (Jörissen et al., 2019; OECD, 2015). For example, during the last two decades, digital platforms such as Netflix, YouTube, Instagram or Amazon have fundamentally changed cultural activities by altering the classical facets of visual arts (including photography and architecture), performing arts (including movies, TV series, videos), music and literature. Meanwhile, social media (e. g. Facebook, Twitter/X, Reddit, TikTok) and platforms related to cultural facets such as DeviantArt, Internet Movie Database (IMDb), YouTube, Soundcloud or Goodreads enabled a larger fraction of the population to participate in cultural activities, interact with cultural artifacts and communicate about them. To an even greater extent, a new facet of cultural activities stepped into the limelight and grew to become one of the largest sectors of the entertainment industry by the mid-2010s: video games (Businesstech, 2015; Stewart, 2019; Wijman, 2018). One commonality among analogue and digital cultural activities is their potential impact on personal development and on educational processes. The potential of classical analogue cultural activities for positive effects on personal development has been demonstrated in many studies in the last decades (for example music and well-being, MacDonald et al., 2013). The same potential can be expected for their digital counterparts.

Although research on video games and other digital environments relevant to cultural participation has grown significantly over the past two decades and is expected to continue to do so, the vast majority of these studies did not emerge from the perspective of cultural and aesthetic education. Rather, even a cursory glance at the literature reveals two main topics. One is focused on the positive effects of digital environments on the acquisition of competencies and formal learning processes in schools, the other highlights negative effects caused by digital environments in informal settings, such as aggressive behavior, internet gaming disorders and excessive social media usage (Greitemeyer & Mügge, 2014; Gnambs & Appel, 2018; Stevens et al., 2019). While there are indeed video games that are aesthetically sophisticated and rich in content (Clarke & Mitchell, 2007; Robson & Tavinor, 2018; Sweeney & Franklin, 2014), only few published research syntheses focus on the relation of digital cultural activities including gaming with subjective well-being or empowerment (with Anderson et al., 2010 and Hamari & Keronen, 2014 among the rare exceptions). The same holds for syntheses focusing on digital cultural activities and learning processes in the informal domain and their potential to foster personal development (Boulianne & Theocharis, 2018; Camilli-Trujillo & Römer-Pieretti, 2017). The focus on formal learning processes and negative effects on mental health of research syntheses on digital cultural activities may to some degree reflect the current state of original quantitative-empirical research on digitalization in aesthetic, arts, and cultural education (D-ACE; Christ et al., 2021; Christ et al., 2024). However, it does not reflect the diverse and ubiquitous engagement with digital cultural activities in everyday life and their resulting effects on individuals (Christ et al., 2021, 2024), nor does it take into account the large body of recent qualitative-empirical research on participatory culture and positive effects of digital cul-

tural activities (i. e. Cayari, 2011; Ito, 2013; Jenkins et al., 2013; Jenkins & Deuze, 2008).

In order to obtain an at least somewhat more balanced view on research syntheses on digital cultural activities, it is important to consider studies from various, only loosely connected research fields (including informatics, video game research, sociology, and psychology; Fink et al., 2012, pp. 10–11; Kröner et al., 2021). In particular, it is important not to neglect such syntheses that have been conducted from the perspective of research on aesthetic, arts and cultural education, including music education or theatre education (D-ACE; Christ et al., 2021; Jörissen et al., 2019). Broad scoping reviews based on such an interdisciplinary approach may help to overcome barriers of research fields that sometimes are even present within a single discipline, which may help to improve transfer between only loosely interconnected research fields. Unfortunately, however, even many research syntheses are based on narrow perspectives that prevail in certain areas of research, thus perpetuating the fragmentation present in original research (Christ et al., 2021, 2024). Therefore, to initiate transfer between fields of research related to D-ACE, a comprehensive, cross-disciplinary tertiary review of research syntheses on D-ACE-related activities is needed that categorizes and analyzes published research syntheses on D-ACE. Beyond fostering transfer, such a tertiary review may also confirm or refute our impression of an imbalance in the existing research syntheses on effects of D-ACE-related activities, resulting from our initial assessment of the literature. Here it looks very much as if a considerable amount of original research on possible positive effects has been published – especially studies with a qualitative-empirical orientation (Kröner et al., 2021). Yet quantitative studies and subsequently also research syntheses, which are mostly based on quantitative studies, seem to predominantly focus on negative effects of D-ACE-related activities.

Thus, this tertiary review aims at giving an integrative overview of current trends and research gaps of research on D-ACE-related activities as it emerges from available research syntheses in various disciplines, as well as over implications for research and practice. This should provide researchers with a broad context for their research that is rooted not only in their discipline but also in a broader interdisciplinary context, enabling them to compare their results with systematically aggregated scientific evidence by analyzing meta-analyses and narrative research syntheses. Moreover, it might sensitize researchers from the field of D-ACE for the general, negative perception of digital phenomena in empirical research and stimulate them to increase their own quantitative-empirical research as well as further research syntheses with a special focus on also including qualitative studies.

We aim at supporting interdisciplinary exchange and informing future research by providing information on published research syntheses on D-ACE. To this end, we intend to answer the following three main research questions: (1) How did the included syntheses assess the *evidence levels* of their synthesized original research, did they use tools of evidence assessment and did they categorize the *research methods* in their synthesized original research? (2) How may the included synthe-

ses be categorized regarding *the investigated cultural facets and digital phenomena*? (3) What are the *main overarching research topics* across all cultural facets and digital phenomena?

We analyzed whether the identified research syntheses on D-ACE-related activities included an assessment of the *level of evidence* of their synthesized studies, as this is essential to assess the validity of the implications of syntheses. If it turns out that the levels of evidence of the synthesized studies have either not been assessed, or if it is revealed that weak empirical designs prevail, the conclusions drawn by the authors of these syntheses should be taken with caution. If, in contrast, the evidence levels of the original studies are assessed and it is established that strong empirical designs prevail, then more confidence can be placed in the resulting implications. Thus, for each synthesis we determined whether an evidence assessment tool has been used and whether the authors of the syntheses have coded the *research method* applied in the included studies original research. The latter helps to identify potential avenues for future research syntheses, as it may reveal potential biases and blind spots of published research syntheses.

The categorization of all included syntheses in terms of the investigated *cultural facets* and investigated *digital phenomena* is particularly important in order to map current themes and trends in D-ACE research syntheses within cultural facets and digital phenomena. This provides researchers with the opportunity to situate their research in a broader context and creates new points of departure for future research.

When planning empirical studies, it is also helpful to have an overview on the field that goes beyond a categorization of original studies according to the investigated cultural facets and digital phenomena. Rather, it is essential to be oriented regarding the *overarching research topics* addressed in studies from various disciplines such as syntheses on cultural activities for informal learning with video games (Boyle et al., 2016) or with eBooks (Takacs et al., 2014). To this end, a broad scoping review on D-ACE-related activities might be helpful. It may inform researchers in the field about research gaps and emerging hot topics of current research in various disciplines and regarding various activities related to D-ACE. This can foster transdisciplinary exchange in the field and help overcome limitations to specific cultural sub-facets as well as a purely technical research perspectives on digital phenomena.

Beyond its usefulness for further research, this tertiary review may also inform decision makers in politics and education as well as practitioners regarding important design characteristics of D-ACE interventions, to facilitate their successful planning, implementation and execution. Before presenting this endeavor in the present paper, we will outline the utilized definitions of D-ACE and its facets aesthetics, arts & culture, education, and digital aspects.

1.1 Defining Digitalization at the Interface of Aesthetic/Arts, Culture and Education (D-ACE)

Since the field of D-ACE is fragmented into various research disciplines utilizing differing definitions (Ijdens, 2016, p. 9; Keuchel, 2016, p. 31), the following paragraphs will present the working definitions applied for this paper.

Aesthetics, Arts & Culture (AC): With literally hundreds of definitions of culture to choose from (Reckwitz, 2004), the term is still often defined according to the classical, broad definition from Tylor (1871/2010, p. 1), as "*that complex whole which includes knowledge, belief, art, morals, law, customs, and many other capabilities and habits acquired by man as a member of society*". However, current research on cultural activities is not restricted to classical "highbrow" culture, but also includes phenomena of youth and working-class or local folk culture (Bourdieu, 2015; Schulze, 2000; Warde et al., 2007). Thus, in the present paper, we define *cultural activities* as active, reproductive or creative participation in either highbrow, midbrow or lowbrow culture (Hahl et al., 2017; Peterson & Kern, 1996) not restricted to the five classical major genres of paintings, sculptures, architecture, music and poetry (Kristeller, 1951). As culture is changing over time, the definition applied in this paper includes the following facets of culture: visual arts (including photography), performing arts (dance/exercise, theatre, movies, videos), literature (poetry, reading, creative writing), music and video games (Jörissen et al., 2019).

Education: The working definition of education (in the context of cultural education) applied in this paper describes self-regulated interactions of persons with their environment (P-E-transaction, Kröner, 2013). P-E transaction describes all relevant aspects of individuals interacting with their respective environments by investigating effects of individual predispositions and environmental parameters on the interaction. This perspective, though, is not limited to the processes of interaction in institutions, learning or acquiring competencies. It also encompasses all educational processes, programs, tools and resulting outcomes of individual self-regulated interaction with environments, which include, but are not limited to, educational institutions, cultural artifacts or activities, extracurricular programs and leisure activities in general. It therefore follows the Humboldtian Ideal of education: Education as personal development enables a person to

> "[...] absorb the great mass of material offered to him by the world around him and by his inner existence, using all the possibilities of his receptiveness; he must then reshape that material with all the energies of his own activity and appropriate it to himself so as to create an interaction between his own personality and nature in a most general, active and harmonious form." (p. 117, Humboldt 1779/1904 translated by Hohendorf 1993, p. 675).

Cultural education is the process of personal development that occurs through P-E transactions (Kröner, 2013) during cultural activities, whether classical, modern, digital or analogue. Both dimensions of those transactions, person and environ-

ment, heavily affect its outcome: personal development. Design choices applied to the cultural environment may affect cognitive, affective or motivational outcomes of the interacting individual, while cognitive, affective or motivational predispositions may affect the cultural activity in turn.

Digitalization: The digital transformation of society (Marres, 2017; Stalder, 2017, p. 18) has not only heavily affected professional life, but also has changed leisure activities in itself (Buckingham, 2007; Silk et al., 2016). As cultural activities represent a large fraction of leisure activities, cultural education has been transformed by digitalization as well. For a cultural activity to be considered digital, digital environments or artifacts at the heart of the P-E-transaction are a fundamental requirement for an activity to be defined as "digital". For example, listening to music with a CD player is not considered a D-ACE-related activity; however, listening to music via a music database such as Spotify is considered as D-ACE-related, as underlying algorithms may affect the future choice of music and listening behavior. Digital transformation of cultural artifacts may even involve phenomena such as hybrid digital-material projects, i. e. musical interfaces that are based on 'traditional' instrument metaphors and techniques, but are capable of augmenting the acoustic capacities of those instruments (Lösener, 2017) or the creation of music via digital networked communities using software protocols (Jörissen et al., 2019; Rolle et al., 2019). In addition, studying how the design of human-computer interfaces (HCI) involved in D-ACE can be adapted to the needs of children would be consistent with our definition (Danby et al., 2018), in contrast to mere technical improvement of sensor technology in HCI (Spanogianopoulos et al., 2014). As the aforementioned examples show, digitalization in itself is not a singular phenomenon but has to be differentiated into different digital phenomena. Those phenomena are distinguished by (a) a central role of online connectivity, interaction between users and user-driven content and (b) the requirement of special hardware such as VR headsets or 3D printing devices. This classification results in 4 potential digital phenomena: (1) activities neither requiring special hardware nor online connectivity, (2) activities focusing on online connectivity, without special hardware, (3) activities requiring special hardware with no focus on online connectivity and (4) activities requiring special hardware and focusing on online connectivity.

D-ACE-related activities: Resulting from the three working definitions, D-ACE-related activities describe all highbrow, midbrow, and lowbrow cultural activities (Hahl et al., 2017; Peterson & Kern, 1996) via digital tools or digital environments, which may lead to personal development. It occurs in multiple facets of cultural activities (visual arts, performing arts, literature, music, and video games), digital phenomena, educational settings and phases of life with a multitude of possible outcomes.

1.2 Relevance of a Tertiary Review

The necessity for an overview of existing research syntheses from various disciplines relevant to D-ACE results from a combination of an increasingly growing relevance of digitalization in formerly analogous domains together with the dispersion of existing evidence across disciplinary boundaries. If such syntheses are mapped regarding to relevant dimensions, they may inform the scientific community regarding desiderata for further research. By synthesizing research across disciplinary boundaries, it is possible to increase the transfer between disciplines researching aspects of D-ACE, and thus to foster a deeper understanding of relevant phenomena (Gough et al., 2017). In the present study, we aim at merging interdisciplinary results and overcoming the existing jingle-jangle fallacies. Unfortunately, research syntheses on D-ACE-related activities are subjected to the same fragmentation and noisiness of data as original research (Christ et al., 2021; 2024). Therefore, a synthesis of available systematic reviews and meta-analyses, a so-called tertiary review, is a good starting point for an interdisciplinary approach to relevant phenomena that have so far been followed by, if at all, loosely interconnected researchers from disjoint research disciplines. For the present study, we therefore set out to conduct a synthesis of available research syntheses on D-ACE.

1.3 Aim of the Present Study: A Tertiary Review on Research on D-ACE-related activities

As discussed in the previous paragraph, a tertiary review on research on D-ACE-related activities may improve the transfer within fields and represent a starting point of integrating research approaches and results from various disciplines. We therefore aimed at mapping a large fraction of available systematic reviews on D-ACE-related activities in this paper, by applying a broad search query from 2000 to 2019 to one of the largest databases for scientific publications which also features advanced search queries and export functions for all bibliographic variables as well as abstracts (Elsevier, 2020). Additionally, by focusing on Scopus, the results of this tertiary review can be directly compared to already published reviews on digitalization in cultural education (Christ et al., 2021; 2024; Kröner et al., 2021). As Kröner et al. (2021) were not able to identify a single relevant original research paper on digitalization in cultural education that has been published before 2000, we chose 2000 as the lower bound of the timeframe of our search. In the same vein, to enable comparability of this tertiary review with the synthesis by Kröner and colleagues, the upper bound of our literature search was set to 2019. By first screening the resulting papers for relevance to D-ACE, it is possible to identify a majority of systematic reviews and meta-analyses investigating effects in the scope of this review. Following, we will assess whether levels of evidence (Bromme et al., 2014) were analyzed in the syntheses included in our review, by at least coding study types such as experimental, quasi-experimental and qualitative study designs or based on evidence classifi-

cation systems such as Cochrane's GRADE (Schünemann, 2013). The latter is a system mainly used for meta-analyses and syntheses in medicine to enable researchers conducting research reviews (1) to systematically assess the levels of evidence of synthesized studies and (2) to assess the generalizability of their results. This is made possible by determining the evidence level of every study not only based on study design or utilized methods, but also on further aspects of the synthesized studies. Those aspects include risk of bias due to sampling, amount of missing data, deviations from the intended interventions or specific selections of reported outcomes. Other factors also affecting the evidence levels include weak effect sizes or imprecision due to small sample sizes or uncorrected skewness or kurtosis. Identification of such sources of bias result in downgrading the level of evidence assigned to a study under scrutiny. Finally, we will categorize every synthesis according to (a) the investigated cultural facet, (b) classification of digital phenomenon, and (c) the main research topic (e. g. learning or aggressive behavior). Cross-classifying cultural facets and main topics will provide us with a broad yet differentiated picture of research on D-ACE-related activities across the borders of specific disciplines and approaches and free of jingle-jangle fallacies. The expected results of those analyses may provide added value for (a) further research and (b) practitioners and politics. (a) Further research benefits from interdisciplinary analyses of the field by merging scientific knowledge of various disciplines, which may provide the groundwork for future comprehensive assessments of digital leisure activities beyond single cultural facets, research disciplines and digital phenomena. (b) Practitioners and politics may also benefit from those interdisciplinary results, as established interventions and approaches in well-researched D-ACE-related activities may be transferable to fields with a lower amount of published research. Added value of this study may be a temporal relief for both researchers and practitioners, due to enabling transfer between established cultural facets and new or even upcoming digital cultural leisure activities. In short, we aimed at categorizing existing, peer-reviewed meta-analyses and systematic reviews on D-ACE, published in international, scientific journals listed in the research database scopus.com (Elsevier, 2020), to answer the following questions:

1. How do published available research syntheses on D-ACE-related activities assess different evidence levels of original research?
2. How are cultural facets and classifications of digital phenomena distributed in published syntheses on D-ACE-related activities?
3. Which underlying main research topics can be identified?

2. Method

2.1 Database Search

The search terms for the facets digital, culture and education were based on previous computer linguistic analyses of quantitative research on D-ACE by Christ et al. (2021). Those analyses utilized text mining, predictive modelling and topic modelling to identify significant terms indicating research on D-ACE. As this study aimed at identifying relevant research syntheses, terms indicating systematic reviews or meta-analyses were added as the fourth facet of the search string (Table 1).

Table 1: *Search terms of database search for scopus.com*

Facets	Synonyms
Cultural in general	aesthet*, "art", "arts", artist*, postmodern*
Visual arts	craft*, draw*, paint*, portray*, museum*, exhibition, galler*, picture*, camera*, photograph*, selfie
Music	music*, melody, orchestra, "sing", "singing", "song", "songs"
Performing Arts	"performing arts", "act", "acting", actor*, actress, ballet*, circus, comedy, dance*, "dancing", drama*, "opera", theatre*, choreography, cinema, film*, movie*, video*
Video Games	game*, videogame*, seriousgame*, Kinect, multiplay*, gameplay, console, "gbl", adventure*, exergame*
Literature and Creative Writing	book*, letter*, lyric*, novel*, poetry, read*, "write", "writing", Shakespeare, storybook, storytell*
Movies	video*, cinema*, "motion picture", picture, "silver screen", film*, flick*, dvd, blu-ray, broadcast, "tv program*"
Photography	snapshot*, camera*
Education and Learning	affect*, behavior*, behaviour*, bildung*, cogniti*, colleg*, educat*, engag*, enjoy*, fun, immersi*, learn*, literacy, motiv*, pedagog*, pupil*, school*, social*, societ*, student*, teach*, univers*, child*, adolesc*, emotion*, knowledg*, kindergarten*, entertain*, edutain*, teen*, classroom*, flow, participat*, pedagog*
Digital	digital*, "app" , "apps" , artificial*, (audio* AND visual*), blog*, computer*, cyber*, facebook, game*, interact*, ipad*, iphone*, itune*, media*, Minecraft, "mmo" , "mmorpg" , mobile, network, online, pc, phone, secondlife, (social AND network*), stream, tablet, technology, twitch, twitter, video, virtual, visual, vr, web, website, youtube, seriousgame*, crowdfund*, ebook, selfie*, meme, troll*, weblog*, gamif*, hypertext, bot, keyboard, Kinect, socialmedia, (social AND media), multiplay*, software, internet, tweet*, interface*, console*, user*, gbl, smartphone*, avatar, laptop, offline, google, multimedia, interactive
Systematic Review	meta analy*, (meta AND synthes*), (systematic AND review), (systematic AND mapping), (critical AND review), (literature AND review)

Note. * indicates wildcards such as learn* also finds "learner" and "learning".

The final search string was applied to all articles included in the database Scopus published from 2000–2019, resulting in a corpus of $n = 5{,}880$ potentially relevant research papers. Following, bibliographic information and abstracts were exported for identified papers and saved as a CSV-data file.

2.2 Screening Processes

For the screening processes, a set of comprehensive in- and exclusion criteria based on Christ et al. (2021) were applied (Table 2). These were used in all screening processes, starting with title screening of all $n = 5{,}880$ papers. Subsequently, all abstract of all papers with titles satisfying the inclusion criteria were screened according to the in- and exclusion criteria. Finally, the same process was repeated for all full-texts which were included during the abstract screening. For a paper to be included during title screening, a single reviewer had to check whether it adhered to our inclusion criteria. These reviewers had been trained on the inclusion criteria and were instructed to also include cases of doubt. During abstract screening and the subsequent full-text screening, two reviewers completed a process of consensus validation resulting in a decision of inclusion or exclusion.

Table 2: *Inclusion and exclusion criteria*

I. Bibliographical Inclusion Criteria	a) The study was published in either English or German.
	b) The study's abstract and full-text was available and accessible.
II. Content Inclusion Criteria	a) Educational learning processes were studied in the context of cultural activity while using cultural artifacts.
	b) Processes of digitalization were central for the study.
	c) The study in question was a systematic review or a meta-analysis.
III. Exclusion Criteria	a) Studies were excluded if they only researched learning processes in non-cultural subjects such as business education, health education mathematics without assessing additional constructs relevant for cultural education such as engagement, immersion, personality or other affective or motivational outcomes.
	b) Studies about learning tools focusing on learning alone such as serious games for surgeon training or digital tools for second-language learning were excluded, while playing entertainment games (such as "SimCity" or "This War of Mine") in according school university courses for learning purposes were included.

2.3 Categorization

All full-texts of all included syntheses were subsequently analyzed according to bibliographic parameters (i. e. affiliation country, journal, publication year) and the main categories presented in the section "Aim of the present study: A tertiary review on research on D-ACE-related activities":

Evidence levels: Every included research synthesis was categorized according to the authors' assessment of evidence of the synthesized respective original research. At first, it was determined, whether different evidence levels or research designs were assessed at all. As a following step, the applied approaches of assessing evidence were categorized, such as approaches similar to Cochrane's GRADE classification of evidence (Schünemann, 2013) or by coding research designs. For the research designs, each study was coded as to how it differentiated between all or some of the types of longitudinal, experimental, quasi-experimental, cross-sectional and qualitative studies.

Cultural facets: For each synthesis, the investigated cultural facet was categorized. An overarching "culture in general" facet was included for syntheses investigating cultural activities in general or more than two distinctive cultural facets. This resulted in a total of six potential facets: culture in general, visual arts (including photography), performing arts (dance/exercise, theatre, movies, and videos), literature (poetry, reading, creative writing), music, and video games.

Digital phenomena: Investigated digital phenomena were categorized according to two distinguishing indicators: (1) a pivotal role of online connectivity from which user-interaction or user-driven content results; (2) requirement of special hardware such as VR headsets or 3D printers. Intersecting both indicators resulted in four categories (Table 3).

Research topics: For this and all subsequent categorizations, our analyses included syntheses on a broad range of cultural facets, digital phenomena, and research disciplines. This allowed us to identify hot topics and research gaps in current D-ACE research beyond disciplinary perspectives and currently trending cultural facets (such as video games) or digital phenomena (such as the use of social media). Based on preliminary analyses and previous research, all research topics in all included syntheses were classified into three categories: learning, subjective well-being and mental health or engagement and enjoyment (Kröner et al., 2021). Within these categories, we further focused on illustrative articles reporting potential positive effects of the activities studied.

3. Results

3.1 Results of Screening Processes

In the first stage of screening, n = 5,323 papers were excluded, while only n = 557 (9.5%) were retained for further screening. In the abstract screening, n = 453 additional papers were excluded, while n = 104 (18.7%) were retained for the full-text screening. During screening of full-texts, we excluded $n = 37$ studies due to a lack of direct relevance to ACE in the full-text. Two further studies were excluded, one for the full-text being available only in Spanish and one for not satisfying our definition of digitalization. Summarizing, screening of titles, abstracts and full-texts of $n = 5{,}880$ potentially relevant papers resulted in the inclusion of $n = 65$ syntheses

investigating educational processes at the intersection of cultural activities and digitalization.

The large proportion of excluded syntheses was due to the noisiness of the literature corpus stemming from the application of the broad search query. Abstracts of many syntheses contained single occurrences of words that are potentially relevant to D-ACE but also have a multitude of other meanings. Excluded articles frequently contained parts of the search string within the copyright statements or in combinations not relevant to D-ACE such as "state of the *art*", "in the *act*" or "this *book* review", "*game* theory" or "nursing *education*". This is the price to be paid for a broad search aiming at preventing a premature exclusion of relevant papers due to narrow search terms. Nonetheless, the exclusion ratio of our screening processes is in the same range as previous research syntheses (O'Mara-Eves et al., 2015).

3.2 Description of the Corpus of Included Studies[2]

3.2.1 Authors' Affiliation Countries and Journals

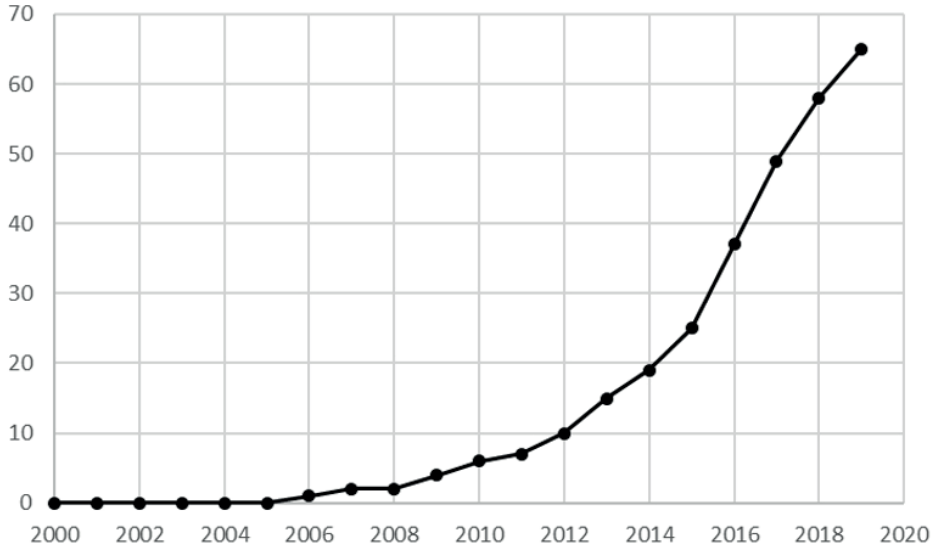
The $n = 65$ included syntheses were categorized as systematic reviews ($n = 22$) with either qualitative or descriptive approaches or as meta-analyses ($n = 43$). The biggest fraction of papers was published by authors from the USA ($n = 15$). Followed by the UK ($n = 8$), Germany ($n = 6$), and China ($n = 5$). Researchers from Australia and Spain published $n = 4$ papers each, while $n = 3$ papers each were from authors from the Netherlands and Switzerland. Two papers each were published by researchers from Austria, Singapore, and Turkey. One article per country was published by authors from Canada, Denmark, Finland, France, Greece, Hong Kong, Italy, Malaysia, Norway, Portugal, and Taiwan. The most common journals were "Computers in Human Behavior" ($n = 6$), "Computers and Education" ($n = 5$), "Psychological Bulletin" ($n = 4$), and "Proceedings of the European Conference in Games-based Learning" ($n = 3$). Two papers each were published in "Cyberpsychology, Behavior, and Social Networking", "Educational Technology Research and Development", "Frontiers in Psychology", "Journal of Computer Assisted Learning", "Review of Educational Research", and "Social Science Computer Review". Finally, $n = 35$ other journals only appeared once.

3.2.2 Year of Publication

Analyzing years of publication resulted in no papers published from 2000 to 2005. A substantial increase of the number of yearly publications can be identified for 2013 and following years, with local maxima for 2016 and 2017 with $n = 12$ pub-

2 See Appendix at the end of the Manuscript for authors, titles, publication year, journal, research topic and main research question for all included syntheses.

Figure 1: *Cumulative sum of included reviews from 2000 to 2019*



lished papers. Almost two thirds of the studies ($n = 40$) were published after 2015 (Figure 1).

3.3 Results Regarding Research Questions

3.3.1 Research Question 1: Evidence Level

Approximately half ($n = 27$) of all included syntheses assessed evidence levels of their respective synthesized original research. Tools for evidence assessment such as Cochrane's GRADE system (Schünemann, 2013) were not utilized, instead, the authors coded the synthesized original research according to the research design of the included studies. Of all included syntheses, $n = 11$ also analyzed qualitative studies, of which $n = 4$ simply distinguished between qualitative and quantitative studies. Quantitative studies were further differentiated into experimental, quasi-experimental, cross-sectional, and longitudinal studies. The coding of quantitative research designs resulted in four categories (i) $n = 4$ syntheses coded longitudinal, experimental, and cross-sectional study types, (ii) $n = 6$ coded experimental, quasi-experimental, and cross-sectional studies, of which $n = 5$ synthesis also coded qualitative studies, (iii) $n = 8$ syntheses only synthesized and differentiated between experimental vs. quasi-experimental studies, and (iv) $n = 5$ studies assessed experimental and cross-sectional studies, of which $n = 2$ also coded qualitative studies.

3.3.2 *Research question 2: Cultural-aesthetic Facets and Digital Phenomena*

Cultural-aesthetic Facets: Regarding the facets of cultural activities, video games dominated the corpus with $n = 36$ syntheses. The second most common facet was culture in general with $n = 19$ syntheses, followed by $n = 5$ syntheses investigating the facet of literature/creative writing. Activities of the facets performing arts were analyzed by $n = 3$ syntheses and $n = 2$ syntheses investigated digital musical activities. No synthesis investigated the facet visual arts.

Digital Phenomena: Categorizing the investigated digital phenomena of the included papers resulted in $n = 42$ papers researching stand-alone or offline applications of digitalization requiring no specific hardware. A total of $n = 19$ syntheses reviewed articles focusing on online connectivity and user-driven content. The largest fraction of those syntheses focused on social media activities. Only $n = 4$ syntheses investigated research questions about cultural activities which require specific hardware. This hardware solely consisted of VR/AR devices with no studies investigating even more modern technologies such as 3D-printing or smart fabrics (Table 3).

Table 3: *Cross-Table of digital phenomena differentiated into (a) activities focusing on online connectivity or user-driven content and (b) activities requiring special hardware.*

		Requirement of Special Hardware	
		No	Yes
Focus on Online Connectivity/ User-Driven Content	No	42	4
	Yes	19	0

3.3.3 *Research Question 3: Main Overarching Research Topics*

Each synthesis' research topic was categorized in up to two categories. While only $n = 13$ syntheses investigated articles form the topic "engagement and enjoyment",

Table 4: *Research topics of current systematic reviews with relationship to D-ACE.*

	Research Topic	Sum	Video games	Cultural in general	Literature	Performing Arts	Music	Visual Arts
(a)	Learning	29	20	4	4	0	1	0
(b)	Subjective Well-being and Mental health	26	11	12	1	2	0	0
(c)	Engagement and Entertainment	13	7	4	0	1	1	0

the topics of "learning" and "subjective well-being and mental health" were investigated by at least twice as many syntheses. The topic "learning" consisted of syntheses investigating learning processes with digital cultural artifacts or in digital cultural environments. The topic "subjective well-being and mental health" contained articles synthesizing research on positive and negative effects on individual well-being, including risky behavior such as aggressiveness and addictive behavior. Syntheses within the topic "engagement and enjoyment" investigated the relations between D-ACE-related activities and enjoyment of the activity itself as well as engagement during the activity. An unambiguous assignment of a single research topic was possible for $n = 62$ papers. The other $n = 3$ syntheses investigated research questions at the intersection of two research topics. Of those $n = 3$ syntheses, $n = 2$ syntheses investigated "learning" and "engagement and enjoyment". One synthesis analyzed research on "learning" and "subjective well-being and mental health" (Table 4).

3.3.3.1 Topic 1: Syntheses on Learning

Within the topic "learning", three major subtopics can be discerned: formal learning ($n = 17$), informal learning and personal development ($n = 9$), and effects of D-ACE-related activities on general cognitive abilities in learning or training settings ($n = 6$).

Formal Learning: The largest fraction of research syntheses on formal learning processes investigated articles on video games ($n = 14$): While $n = 8$ syntheses descriptively summarized, categorized and mapped articles on formal learning with games or game-like environments without meta-analytical methods (Boyle et al., 2016; Calderón & Ruiz, 2015; Connolly et al., 2012; Fang & Lee, 2009; Fotaris et al., 2017; Fu et al., 2016; Ke, 2016; Novak, 2015), $n = 6$ syntheses on video games used meta-analytical approaches to determine effect sizes for various outcomes of formal educational processes (Clark et al., 2016; Girard et al., 2013; Sailer & Homner, 2019; Vogel et al., 2006; Wang & Goh, 2017; Wouters & van Oostendorp, 2013). Two meta-analyses on formal learning investigated effects of reading with digital devices vs. reading print media (Delgado et al., 2018; Xu et al., 2017). A single narrative research synthesis investigated culture in general in formal learning processes (Manca & Ranieri, 2013).

Most syntheses on formal learning focused on positive effects of digital activities on learning-related outcomes. They seldom differentiate between school types or focus on a special school type (Fotaris et al., 2017) nor do they very often differentiate between subjects or focus only on specific subjects (Ke, 2016; Fu et al., 2016).

Meta-analyses on video games as learning tools commonly utilized aspects of games, such as graphics or storytelling, and intervention design as moderators. The different moderators led to varying results: For example, utilizing games with narratives or storylines led to mixed (Novak, 2015) or smaller effects (Clark et al., 2016) compared to games without narratives. Collaborative games also led to high-

er effects vs. competitive games (Clark et al., 2016). Higher effects also resulted for games with schematic graphics instead of cartoonlike or photorealistic graphics (Wouters & van Oostendorp, 2013). Wang and Goh (2017) found differing effect sizes for utilitarian vs. hedonic games, with the former resulting in higher correlations for attitude-perceived usefulness and intention-perceived usefulness, while the latter resulting in higher correlations between attitude and perceived enjoyment. Additionally, they urge researchers to focus on the process of playing itself, instead of the more broadly used approach of assessing attitude and intention towards playing games. The results of the meta-analysis of Girard et al. (2013) indicated a lack of research on serious games and formal learning.

The syntheses on the cultural facet literature led to diverging results: While Delgado et al. (2018) found higher reading comprehension for reading print media vs. digital media, Xu et al. (2017) found the inverse effect for narrative and practical texts especially for digital natives.

The single synthesis on culture in general of Manca and Ranieri (2013) systematically reviewed articles on Facebook as a suitable learning platform in formal education focusing on barriers and potentials for the implementation of the social media platform in formal educational processes.

Informal Learning and Personal Development: Of the $n = 9$ syntheses on informal learning and personal development, $n = 4$ syntheses investigated research questions on video games (Boyle et al., 2016; Connolly et al., 2012; Magnussen, 2017; Wang & Goh, 2017), $n = 2$ syntheses each investigated culture in general (Boulianne & Theocharis, 2018; Camilli-Trujillo & Römer-Pieretti, 2017) and literature (Takacs et al., 2014, 2015), and one synthesis focused on the facet music (Lavranos et al., 2016). In this subtopic, most syntheses were systematic reviews without meta-analytical approaches.

Regarding syntheses on informal learning and games, Connolly et al. (2012) and its update (Boyle et al., 2016) systematically reviewed and categorized articles on learning with video games, while assessing whether those articles investigated cognitive, affective, behavioral or motivational outcomes. Magnussen (2017) systematically reviewed articles on games in citizen science, crowdsourced and community driven research, resulting in research hot topics on motivation, quality of participants' contribution and learning, while also identifying a research gap on the involvement of citizen scientists in the design process of citizen science games and the accompanying research processes. Wang and Goh's (2017) results did not differ for articles on informal learning vs. articles on formal learning processes (see section "formal learning processes"): research generally focuses on attitude and intention of playing games, the actual playing of the game is being neglected by research.

Of the two syntheses on culture in general, Boulianne and Theocharis (2018) investigated, whether political activities on social media such as signing petitions and joining political groups lead to political activities offline and increased civic engagement, which resulted in positive effects, which also carry strong evidence on a reversed direction of those effects. A broader perspective was taken by the systematic

review of Camilli-Trujillo and Rämer-Pieretti (2017) by synthesizing articles on digital literacy and empowerment: their results indicate improvements in digital literacy lead to empowerment of vulnerable groups by giving them access and the competence to acquire and wield digital knowledge.

Two syntheses by the same authors (Takacs et al., 2014, 2015) meta-analytically compared digital vs. analogue leisure time reading of children. Both syntheses resulted in positive effects of digital storybooks vs. reading alone on story comprehension and no statistically significant differences for digital storybooks vs. reading together with an adult.

Lavranos et al.'s (2016) categorization of articles on the genre of music showed musical creatives utilizing search engines and musical databases for scholarly activities, creative needs, communication, and socializing.

Cognitive Abilities: All $n = 6$ syntheses on general cognitive abilities utilized meta-analytical approaches. Of those $n = 6$ meta-analyses, $n = 5$ focused on cognitive training via video games (Bediou et al., 2018; Powers et al., 2013; Sailer & Homner, 2019; Sala et al., 2017; Toril et al., 2014). One meta-analysis focused on training with VR environments (Howard, 2018).

For syntheses on games, these trainings led to differing effect sizes, ranging from small (Sailer & Homner, 2019; Sala et al., 2017) to medium effect sizes (Bediou et al., 2018; Powers et al., 2013; Toril et al., 2014), which were moderated by video game experience of participants (Bediou et al., 2018; Sala et al., 2017), intervention settings such as collaborative vs. competitive or possible social interaction (Sailer & Homner, 2019), and video game genre (Bediou et al., 2018).

Training with specialized VR hardware and utilizing game elements led to positive effects on training outcomes for the only meta-analysis on cognitive abilities not focusing on video games (Howard, 2018).

3.3.3.2 Topic 2: Syntheses on Subjective Well-Being and Mental Health

Within this topic, we were able to identify four major subtopics: (1) risky behavior with a major focus on games and aggressive behavior ($n = 8$) and (2) internet gaming disorder ($n = 4$), (3) therapeutic benefits of D-ACE-related activities ($n = 4$), (4) negative ($n = 7$) and positive ($n = 6$) effects of D-ACE-related activities on personality and its development.

Risky Behavior – Games and Aggressive Behavior: Of all $n = 8$ syntheses on risky behavior, $n = 6$ reviews synthesized articles on the relation between video games and aggressive/violent behavior (Anderson et al., 2010; Bushman, 2016; Ferguson, 2007; Furuya-Kanamori, 2016; Greitenmeyer & Mügge, 2014; Mitrofan et al., 2008). Chen and Shi (2019) on the other hand synthesized the effectiveness of parental mediation strategies to reduce risks of media consumption and Fischer et al. (2011) synthesized articles on the adoption of risky behavior such as reckless driving and smoking based on media consumption. The effect sizes for the relation between video games and aggression ranged from no significant relations to medi-

um effect sizes. Positive effects of D-ACE-related activities were not analyzed in this subtopic.

Internet Gaming Disorder: In a similar vein, $n = 4$ syntheses summarized articles on internet gaming disorder (IGD; Argyriou et al., 2017; Cheng et al., 2018; Fam, 2018; Stevens et al., 2018). Their results varied from a medium effect of IGD on anxiety and depression (Stevens et al., 2018) to IGD leading to impaired response inhibition (Argyriou et al., 2017). Additionally, Cheng et al. (2018) found a positive correlation between IGD and psychological and interpersonal problems as well as lower subjective well-being (Cheng et al., 2018), while the analyses of Fam (2018) resulted in a higher prevalence of IGD for men (Fam, 2018). Analogue to the previous subtopic, no positive effects of D-ACE-related activities were analyzed in those syntheses.

Therapeutic Benefits of D-ACE-Related Activities: Syntheses on therapeutic benefits of D-ACE-related activities were much more diverse than the former two subtopics: In Howard (2018), specialized input hardware and game elements led to larger effect sizes for therapies utilizing VR applications (Howard, 2018). Li and colleagues (2014) found positive effects of VR applications and games in therapies against depression. Syntheses on classical cultural facets included Petko et al. (2015) systematically reviewing articles on blogging vs. stress and Silva et al. (2018) analyzing digital dance interventions for depression with older adults, which resulted in no significant effect.

Personal Development: The last, but largest, subtopic of syntheses on subjective well-being and mental health was on the effects of D-ACE-related activities on personality and personality development. Of those syntheses, $n = 7$ mainly focused on negative effects, while $n = 6$ (also) analyzed positive effects of D-ACE-related activities on personal development.

Personal Development – Negative Effects: All syntheses focusing on negative effects were on D-ACE-related activities on social media (Appel et al., 2019; Appel & Gnambs, 2019; Gnambs & Appel, 2018; Liu & Baumeister, 2016; McCain & Campbell, 2018). They mainly focused on the relation between social media activities and narcissism/shyness. Active social media behavior via posting text and pictures and time spent on social media was positively related to narcissism (Appel et al., 2019). Social media activities also increased with higher shyness (Appel & Gnambs, 2019) and higher loneliness (Liu & Baumeister, 2016), while effects of social media activities on other indicators of well-being, such as depression, loneliness and academic achievement, only resulted in small effects, if at all (Appel et al., 2019; Yin et al., 2019).

Personal Development – Positive Effects: Positive effects of D-ACE-related activities on well-being were investigated by $n = 6$ syntheses, with $n = 4$ focusing on effects of social media (Caton & Chapman, 2016; Liu et al., 2018; Nef et al., 2013; Yin et al., 2019) and $n = 2$ on effects of prosocial video games (Ferguson, 2007; Greitenmeyer & Mügge, 2014).

The results of positive effects of social media activities on personal development varied for the utilized variables and moderators: Liu et al. (2018) and Yin et al. (2019) found positive, albeit small, effects of social media activities on social and emotional support (Liu et al., 2018) and on positive indicators of well-being (Yin et al., 2019). According to both syntheses, individuals with intellectual disabilities felt empowered by social media activities, especially due to positive effects on self-esteem, number of friendships and social identity. Caton and Chapman (2016) and Nef et al. (2013) found empowering effects of social media activities for specific subpopulations, especially older users utilizing social media to participate in civic, social and political life, which increased their subjective well-being and led to empowerment.

The meta-analytical results of the two syntheses on effects of video games on prosocial behavior by Ferguson (2007) and Greitenmeyer and Mügge (2014) both showed video gaming leading to prosocial as well as aggressive behavior. Playing violent games led to an increase in aggressiveness, while playing prosocial games led to an increase in prosocial behavior (Greitenmeyer & Mügge, 2014).

3.3.3.3 Topic 3: Syntheses on Engagement and Enjoyment

Syntheses focusing on engagement and enjoyment mainly focused on D-ACE-related activities on social media ($n = 4$; Baruh et al., 2017; Brandtzaeg, 2010; Jungherr, 2016; Wang et al., 2016) and video games ($n = 7$; Boyle et al., 2012; Caroux et al., 2015; Cummings & Bailenson, 2016; Hamari & Keronen, 2017; Novak, 2015; Rasul, 2015; Wang & Goh, 2017). Engagement and enjoyment in the context of classical cultural genres was investigated by $n = 1$ synthesis each for music (Platz & Kopiez, 2012) and performing arts (de Jager et al., 2017).

Results from the $n = 4$ syntheses focusing on social media and engagement included two syntheses on privacy related concerns, which resulted in no or only small effects of privacy concerns on engagement with social media (Baruh et al., 2017; Wang et al., 2016), while higher trust scores in a social media platform resulted in higher engagement (Wang et al., 2016). Similar to those syntheses, Brandtzaeg (2010) classified users and their engagement to social media platforms into user types, ranging from sporadic users over lurkers and entertainment users to advanced users, which mirrored Jungherr's (2016) systematic review on individuals' engagement with political campaigns on twitter, which resulted in a small, nonrepresentative and partisan subgroup of advanced users contributing to political discourse on Twitter/X.

Engagement and enjoyment with video games were investigated in $n = 7$ syntheses resulting in positive effects on both for games with storylines (Novak, 2015), high technical fidelity (Cummings & Bailenson, 2016) and entertainment games vs. "utilitarian" games such as serious games (Wang & Goh, 2017). Vice versa, immersion, subjective feelings of enjoyment and perceived usefulness resulted in engagement while playing and continue to play video games (Boyle et al., 2012; Caroux et

al., 2015; Hamari & Keronen, 2017; Wang & Goh, 2017), whereas violent content did not increase enjoyment (Rasul, 2015).

The sole synthesis on engagement and enjoyment of music by Platz and Kopiez (2012) found a medium positive effect size of enjoyment of the visual presentation on the enjoyment of the music. Finally, De Jager et al.'s (2017) synthesis on digital stories created by individuals via videos or audio-visual presentation resulted in a high motivation and engagement of participants.

4. Discussion

4.1 Conclusion

In the last decades, especially from 2015 onward, an increasing number of meta-analyses and systematic reviews on D-ACE-related activities have been published, the majority of them by researchers from the USA, UK and Germany. Among the syntheses included in this tertiary review, many investigate phenomena that are genuinely digital, especially on video games and social media, with more than half of all included syntheses related to video games and the remaining syntheses strongly focusing on social media. Digital phenomena related to "classical" aesthetic-cultural facets like music, literature, visual or performing arts have only rarely been addressed in syntheses. Especially as there are similar trends in original research (Christ et al., 2021; 2024), we do not assume that this discrepancy is a consequence of overlooking research syntheses due to weaknesses in our search strategies and our screening processes. After all, our comprehensive search query was specifically and iteratively developed to prevent such bias. Nevertheless, on the level of original research, there may well be a substantial amount of so far unsynthesized – published or unpublished – quantitative-empirical research on the overlap between digitalization and activities related to classical aesthetic-cultural facets. These include studies like those by Hsiao (2010) on digital picture books for children and by Manero et al. (2015) on the effects of educational videos on high school children's interest in theatre. Given the vast amount of original research on topics such as effects of video games on aggressive behavior, we nevertheless do not expect an "undersynthesis" of even quite a few studies to be responsible for the exceptionally strong predominance of syntheses on video games and social media in our review – and the strong focus on negative effects.

Categorizing the identified syntheses resulted in three topics, each of them combining syntheses related to various facets of cultural-aesthetic education. Nevertheless, each of these topics displayed a clear focus: The syntheses categorized in the topic "learning" mainly focused on formal learning processes and on effects regarding cognitive outcomes. Studies on non-formal or informal learning were synthesized substantially less in the syntheses of this hot topic. This contradicts the reality of digital cultural activities mainly occurring in non-formal and informal settings rather than in formal educational settings. Even though the broad topic of subjec-

tive well-being and mental health is among those that are most frequently covered by syntheses in our corpus, there is a large blind spot of syntheses on this topic: Most identified reviews on social media and video games as determinants of subjective well-being and mental health did not cover the question of positive effects from activities on the criteria, but rather focused on negative (side-)effects such as addictive or aggressive behavior. Note that it is improbable that the scarcity of syntheses on positive effects on mental health does result from a bias of our search or screening processes towards negative effects, as the search string applied includes terms for positive effects even in a larger margin than for negative effects. Rather, there are two other plausible reasons: Firstly, many researchers in the field may simply focus on negative effects due to the nature of their disciplinary perspectives (i. e. psychological disorders), secondly, the operationalization of cultural activities used in the original studies and, as a consequence, in research syntheses may not have been useful. This may be illustrated with examples from the main topic of subjective well-being and mental health, which focuses strongly on video games and social media use: Most syntheses on video games focus either on addictive online games or on competitive online shooters, rather than at least also including games with rich narratives, thought provoking storylines and characters or high levels of artistic expression. Research syntheses on social media activities or content also mainly focus on aspects associated with negative effects such as unhealthy fashion trends, negative body images, loneliness or narcissism, rather than on aspects with potential positive effects like watching and discussing videos on creative software or sharing blueprints and plans for 3D-printing. Of course, this focus on negative effects is no coincidence, as large parts of the video game and social media industry are solely profit driven and aim at capturing people's attention and dominating their leisure activities for economic reasons. However, this is no necessity, as shown by the example on cultural activities in video games and social media discussed above, which clearly demonstrates the potential for positive effects. In this respect, condemning video games and social media as cultural activities would be comparable to a negative perspective on reading based on the widespread consumption of tabloids or dime novels or a negative view on movies based on the widespread success of blockbuster movies, as advocated by Adorno and Horkheimer (1947).

Thus, apart from the implication of taking special care not to miss out existing original work from facets that may be related to positive effects in future syntheses, there are also implications for both future research syntheses and original studies on D-ACE: For such research, it is important to differentiate more precisely on the side of D-ACE-related activities in order to gain insights into which of the activities studied only aim maximizing the user's screen time by establishing a firm hold of his attention with detrimental content and which are empowering and provide the users with interesting artistic and aesthetic experiences. While the former may be predominantly associated with many of the negative effects discussed in the literature, the latter may well be associated with a net positive effect on well-being and personal development. Taking such a differentiated perspective on D-ACE-related

activities may provide a more balanced picture of both hazards and potential associated with video games and social media and how interventions may be tailored to maximize the potential and to minimize the hazards. Here, the core D-ACE research community is encouraged to conduct and publish more studies in peer-reviewed journals beyond the typical discipline-specific journals. Doing so, researchers should consider following a research logic involving a path from descriptive over longitudinal to experimental studies, eventually involving an increasing proportion of studies with quantitative designs (Rosenshine & Furst, 1973). Otherwise, a flood of research on negative effects of certain activities such as addictive online games from communities other than that of research on D-ACE may overwhelm the considerably smaller amount of original research on positive effects of a wide variety of D-ACE-related activities. This in turn may lead to the erroneous conclusion that D-ACE-related activities inevitably lead to negative effects.

Syntheses based on a differentiated view on D-ACE may also help to bring research on the hot topics of D-ACE in line with existing research on "classical" cultural activities. The latter often focuses on positive effects on personal development, such as musical activities empowering youths and strengthening their personal growth and general life satisfaction. If future syntheses in the research field of D-ACE also differentiate according to the type of activity or content, this may help to identify precisely those activities and related content that leads to positive effects and those that lead to negative effects. It may also help to avoid lumping together rather heterogeneous groups of activities or content, with evidence on negative effects of hazardous but frequent activities, masking positive effects of valuable games and social media activities in niches of the digital world not infected by platform capitalism (Raman et al., 2019). In the long run, such syntheses would allow for accumulating evidence on both positive and negative effects of D-ACE-related activities, which is currently neither provided by mostly quantitative studies on negative effects of video games and social media nor by mostly qualitative studies on positive effects of digital music technologies or digital tools for visual arts.

Those syntheses should also include qualitative research, as many qualitative empirical studies focus on positive effects of digital cultural activities (i. e. Cayari, 2011; Ito, 2013; Jenkins et al., 2013; Jenkins & Deuze, 2008). Such syntheses would provide a more comprehensive picture of international research on D-ACE, which would finally translate into balanced tertiary reviews of both negative and positive impacts of D-ACE-related activities.

4.2 Limitations

Probably being the first tertiary review on research on digitalization in cultural, arts and aesthetic education, this review sheds light on published systematic reviews on D-ACE-related activities. Nonetheless, as any research paper, it comes with several limitations. First, while the database used for this study, Scopus, is currently described as "*the largest abstract and citation database of peer-reviewed liter-*

ature" (Elsevier, 2020) and its interdisciplinary, multi-dimensional and extensive nature make it suitable as a basis for literature reviews. Nevertheless, future work should explore sources of published information beyond Scopus, as there may exist systematic reviews only listed in other databases. Moreover, we deliberately focused on the journal articles which are largely covered by Scopus, and decided not to include books and book chapters, which are only partially covered in this database. However, the inclusion of book chapters would probably not have changed the broad picture substantially. Nevertheless, an even broader search strategy than the one used in this paper might allow future reviews to identify even more potentially relevant research syntheses. The same holds true for increasing the time frame of the literature search. While, however, there will probably not be many additional studies that were both published prior to the year 2000 and still be relevant for current trends like social media use, periodic updates to this tertiary review every few years might be of interest. A second limitation relates to the screening process. While two screeners had to agree on the inclusion of a research synthesis, this was based on a communicative process, and previous individual opinions were not recorded. Future reviews should do this, so that interrater reliability can be reported. A third limitation concerns the quantitative focus of most of the research syntheses on which our tertiary review is based. Drawing conclusions about the entirety of the original studies on D-ACE from the syntheses included in the tertiary review would therefore lead to a distorted picture of international research, as a considerable amount of qualitative research not previously included in research syntheses would be ignored.

While the proposed solutions to the limitations described above that are related to a modified search strategy may result in the identification of some additional relevant reviews, they would certainly also be accompanied by an order-of-magnitude increase in the number of irrelevant reviews in the initial search results. This in turn would result in a much greater amount of time required for the screening process. Thus, future reviews that apply broader search terms, several literature databases or larger time frames may benefit from text mining and machine learning methods during the screening and categorization processes (Christ et al., 2021, 2024; O'Mara-Eves et al., 2015).

4.3 Implications for Research Syntheses on D-ACE

This tertiary review clearly indicates the relevance of research from outside the D-ACE research community for research on D-ACE. Thus, if D-ACE researchers conduct secondary studies in the future, they could benefit from a broad approach similar to the one we used in this work at the tertiary level. That is, future research reviews on D-ACE should also include original studies that are only implicitly relevant to D-ACE. Thus, beyond using search terms explicitly referring to D-ACE in general like "cultural education" or "aesthetic education", they might also use search terms for specific facets of D-ACE such as "education" combined with "mu-

sic", "game" or "literature". Doing so, it is advisable not to exclude potentially irrelevant combinations of words such as "state of the art" or "game theory" during the initial search, as this would exclude potentially relevant publications like those of the "state of the art on arts education". Rather, to cope with the huge amount of raw search results to be expected from this procedure, we suggest using text mining and big data methods to support the processes of screening and categorization (Christ et al., 2021; O'Mara-Eves et al., 2015).

An interesting question for future research might be how hot topics of research differ across regions. Unfortunately, this information related to the original studies had not been reported in most of the syntheses included in our tertiary review. Thus, analyzing regional foci of research on D-ACE remains an open question for future studies.

Another avenue for further research relates to synthesis of qualitative research. As qualitative studies have largely been ignored in the research reviews that could be identified for this tertiary review, future reviews should put an emphasis in including and analyzing qualitative studies. In this way, both methodological paradigms may inform and complement each other to cover the respective blind spots. For this purpose, established methods for the synthesis of qualitative studies in research reviews may be applied (e. g. Saini & Shlonsky, 2012; Sattar et al., 2021).

4.4 Implications for Original Research on D-ACE

Original research on aesthetic and cultural education is very broad in nature. It includes studies on a wide range of sometimes barely related facets such as puppet theatre and video games (Fink et al., 2012, p. 10). Unfortunately, its findings are often neglected in related fields such as that on video games or online learning. In order to promote the wide dissemination of innovative approaches and increase the visibility of reviews written from the (D-)ACE perspective, it would therefore be advantageous if D-ACE researchers would also include terminology from neighboring research fields when writing abstracts. This terminology may be combined with keywords such as "cultural education", "aesthetic education" or "art education" in a meaningful way to make them easy to find in literature databases for searches that are not carried out from either perspective.

Note that, even though this review showed that existing reviews on D-ACE tend to pile up in fields like research on video games and social media while there is a scarcity of reviews related to classical cultural facets, this does not imply a lack of original research on digital phenomena in those classical facets. Rather, the lack of research syntheses on those facets may be just that, a lack of research syntheses. This caveat is supported by published syntheses of original research on this article's subject (Christ et al., 2021, 2024; Kröner et al., 2021), which indicate a substantial amount of original research on all cultural facets.

Along the same lines, the present tertiary review is just that: a summary of syntheses on D-ACE, based on an extensive search query, involving the definition and

application of inclusion and exclusion criteria that results in the categorization of relevant research topics, questions and main findings. We hope that it might inform further research on D-ACE and related fields, be it additional third-level reviews, research synthesis or original research, eventually leading to a body on evidence regarding video games and social media that is based on strong research designs and goes beyond highlighting the dangers associated with activities in these fields.

Author Credits (alphabetical)

Conceptualization: AC, MP, SK; Data Curation: AC, MP; Formal Analysis: AC, MP; Funding Acquisition: SK; Investigation: AC, MP; Methodology: AC, MP, SK; Project Administration: AC, MP, SK; Supervision: SK; Validation: MP, SK; Visualization: AC; Writing – Original Draft: AC, MP, SK; Writing – Review & Editing: AC, MP, SK

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Statements on open data, ethics and conflict of interest

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