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Teacher motivation for participating in school innovations – supporting factors

Abstract

The successful implementation of school innovations is based on teachers' motivation taking part into this innovation. We examine teachers' motivation and its supporting conditions within the scope of two school innovation projects. Self-determination theory and person-object-theory of interest provide the theoretical background for these studies. Furthermore we investigate in how far certain incentives are able to activate motivation. Results show that an important factor regarding the motivation to participate in a project of school innovation is the attachment of significance to the innovation. Interestingly, the basic needs (for autonomy, competence and relatedness) captured in both studies resulted in different kinds of influences for motivational types based on self-determination. In addition, the examined incentives have also shown effects on controlled types of motivation.

Keywords

Teacher motivation; Self-determination; Interest; Incentives; School innovation projects

Motivation von Lehrkräften, sich an Schulinnovationsprojekten zu beteiligen – unterstützende Bedingungen

Zusammenfassung

Die erfolgreiche Verbreitung von Schulinnovationen basiert auf der Motivation von Lehrkräften, sich an der Innovation zu beteiligen. Wir untersuchen die Motivation von Lehrkräften und deren unterstützende Bedingungen im Rahmen von zwei Schulinnovationsprojekten. Theoretische Grundlage bildet dabei die Selbstbestimmungstheorie in Verbindung mit der Interessentheorie. Ferner erforschen wir, inwieweit bestimmte Anreizdimensionen die Motivation aktivieren können. Dabei zeigt sich, dass insbesondere die Bedeutsamkeit, die die Lehrkräfte der Innovation zuschreiben, wichtig für die Beteiligungsmotivation ist. Interessanterweise haben die psychologischen Grundbedürfnisse (nach Autonomie, Kompetenz und sozialer

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Eingebundenheit) in beiden Projekten unterschiedliche Auswirkungen auf Motivationsformen, die auf Selbstbestimmung beruhen. Außerdem beeinflussen die untersuchten Anreizdimensionen insbesondere die stärker kontrollierten Motivationsformen.

Schlagworte

Lehrermotivation; Selbstbestimmung; Interesse; Anreize; Schulinnovationsprojekte

1. Introduction

We refer to school innovation projects as measures intended to bring new ideas into schools and allow these to be tried out in practice with the aim of making a contribution towards improving the quality of the educational system. Research on school innovations addresses the conditions according to which innovations are successfully spread. A range of different authors conducting research in this field emphasize the significance of teacher motivation for participation in innovation projects (e.g. Jäger, 2004). Findings from the field of innovation research also confirm that teacher motivation is an important influencing factor in the spread of innovations (Gräsel, Jäger, & Willke, 2006). There is, however, one essential question that arises within this context: What does teacher motivation depend on when it comes to participation in school innovation projects?

The aim of the studies being reported on here is to identify factors that support teacher motivation. Data from two school innovation projects on two different subjects will be presented. In general motivation means to direct one's behavior to a goal which is positive valued (Rheinberg, 2004, p. 15). We use the term teacher motivation here to refer to the particular reasons as to why a teacher takes part in a specific school innovation project. Our study thus differs from other investigations which regard teacher motivation as a form of general professional motivation. In the following section, the theoretical background to motivation will be presented which both of the studies in question are based upon. Both projects will then be described in more detail before the studies and their findings are presented and discussed.

2. Theoretical background

A range of different theoretical frameworks can be used to investigate teacher motivation. Much of the research carried out over the last few years has been related to teachers' learning and achievement goal orientation (Dweck & Leggett, 1988; Elliott & Dweck, 1988; Elliott & Harackiewicz, 1996; see section 3). Our work deals with the question of why teachers decide voluntarily and on their own authority to take part in innovation projects. We therefore follow theories appropriate for explaining actions through intrinsic motivation. There are two theories that are of central importance in our work: Deci and Ryan's self-determination theory (2000)

on the one hand and Krapp and Prenzel's person-object-theory of interest (1992) on the other. Both of these theories are supplemented by aspects of the expectancy-value-models, which are suitable for the analysis of additional external incentives.

On the basis of the self-determination theory, we distinguish between different types of motivation that depend on the perceived autonomy (Deci & Ryan, 1993): self-determined motivation and controlled motivation (Gagné & Deci, 2005; Schellenbach-Zell, 2009). Self-determined motivation is linked to carrying out activities just for the sake of it because of fun and interest (U. Schiefele & Köller, 2001). This form of motivation also comprises experiencing a highly positive emotional state in terms of an experience of flow, e.g. working on the innovation is experienced as pleasant and time flies (see e.g. Csikszentmihalyi, 1975). Self-determined motivation further implies specific consequences, which are related to a high perceived autonomy. The "behavior is recognized as being personally important and valuable to one's self" (Deci & Ryan, 1993, p. 228, translation by authors). Some examples of why teachers take part in school innovations include their own personality development or the opportunity to organise lessons in a more varied and more interesting manner. Controlled motivation represents a form of motivation with a high degree of perceived control. It therefore represents classic extrinsic motivation, with actions being carried out based on specific anticipated consequences (U. Schiefele & Köller, 2001). For example, teachers that work according to controlled motivation participate in school innovation projects because they feel obliged to do so, because their headmaster want them to or because it is of relevance for their reputation.

Self-determination theory also refers to three basic psychological needs that contribute to the development of self-determined motivation (Deci & Ryan, 2000): (1) Need for autonomy originates from the "locus of causality" (deCharms, 1968) and means that a person seeks to experience oneself as independent (Krapp, 2005, p. 635). This implies that the actions in question are thus caused by the person and that the person perceives one's own scope (Ryan & Deci, 2002). (2) Need for competence bases on White's concept of competence (1959) and means that a person experiences oneself as competent and capable of taking such action. The focus here is not on an ability actually acquired but rather on "a felt sense of confidence and effectance in action" (Ryan & Deci, 2002, p. 7). (3) The need for relatedness assumes that humans strive for satisfying social contacts and for recognition by "significant others", means people who are of personal importance to them. The satisfaction of these needs results in a feeling of well-being and high contentment. Correspondingly, the structures of a school innovation project can consider these needs and thus making teachers feel at ease when working on the project. This in turn increases the likelihood that teachers will commit to the project in the long term as well. There are a range of different opportunities for such projects to take these basic needs into consideration, including, for example, teachers' perceptions that they have a broad scope for taking action or their possibilities to choose the focus of their work individually. Projects could consider the questions, wills and

the working tempo of participants (Gräsel et al., 2006). In addition to such ways of supporting autonomy, projects can, for example, also provide particular phases in which feedback is given with regards to the need for competence (Kramer, 2002). Project structures that promote cooperation between teachers such as working groups encompassing more than one school are suited to facilitate relatedness.

We would like to supplement these theoretical considerations with Krapp und Prenzel's person-object-theory of interest (e.g. Krapp, 1992b), which regards the content-orientation of motivation and defines interest as the relationship between a person and a particular object or subject. This relationship can be of a long or short-term nature (Prenzel, Krapp, & Schiefele, 1986; H. Schiefele, Prenzel, Krapp, Heiland, & Kasten, 1983). Within our study, the most important aspect of this type of interest is that the person attributes a large personal significance to the object in question and the relationship one has with it.

Participating in school innovation projects we are dealing with here is, in principle, voluntary. However, the question still arises as to whether particular incentives can have a motivational effect when it comes to taking part in an innovation. Expectancy-value-models, in particular the Advanced Cognitive Model of Motivation (Heckhausen & Rheinberg, 1980) assume that the particular consequences of an action have an incentive character and thus have an effect on whether the action in question is carried out. The question can thus also be asked as to what sort of incentives support involvement in school innovations. Schellenbach-Zell distinguishes between different types of incentives to work more engaged with the innovation (2009, p. 127): (1) material incentives like teaching hours for relief or a payment; (2) social incentives like the recognition of colleagues or headmasters; (3) project-specific incentives like a well-designed project, or a clear central concept related to high quality-materials. The theoretical concepts outlined above will now be applied to two school innovation projects. Prior to this, however, previous findings on teacher motivation based on a range of theoretical approaches will be presented.

3. Teaching motivation: Findings and approaches

To a large extent, research refers to the subject of behavior and effects of motivated teachers (Deci, Spiegel, Ryan, Koestner, & Kauffmann, 1982; Kramer, 2002; Kunter et al., 2008; Roth, Assor, Kanat-Maymon, & Kaplan, 2007; Wild, Enzle, Nix, & Deci, 1997). The number of studies exploring teacher motivations' influencing factors has increased over the last few years. Such work can be principally categorized as belonging to the field of achievement motivation research. The focus of the research was on goal theories and the construct of self-efficacy. It is possible to distinguish between the following goal orientations (Dweck & Leggett, 1988; Elliott & Dweck, 1988; Elliott & Harackiewicz, 1996): Learning goal orientation, that is, motivation directed towards expanding one's own competences and abili-

ties. Achievement goal orientation on the other hand is directed either at a demonstration of one's own abilities ("approach achievement goal orientation") or at concealing one's own weakness or incompetence ("avoidance achievement goal orientation"). Additional work has also looked at work avoidance as a goal at the same time (e.g. Butler, 2007). A high learning goal orientation has a reducing effect of some aspects of burnout. Motivation directed at concealing personal incompetence led, on the other hand, to more marked levels of all three types of strain (Tönjes, Dickhäuser, & Kröner, 2008). Butler (2007) examined the relationship between goal orientation as a motivational variable and the behavior of teachers with regards to asking for help. Results referred to a connection between teachers with a clear learning goal orientation and those who show a high level of appreciation for asking for help, while avoidance achievement goal orientation was linked to the opinion that asking for help amounts to a confession of personal incompetence. High levels of work avoidance orientation thus correlated with a pragmatic attitude towards asking for help, for example that it saves time and effort. Further, teacher students' learning goal orientation is a strong predictor of intrinsic motivation for the teaching profession as achievement goal orientation is of extrinsic motivation (Malmberg, 2006, study 1).

Self-efficacy has formed an additional research focus and implies teachers' regard to their own competence for dealing with difficult situations in school life (Schwarzer, 1998). High teacher self-efficacy is negatively related with the tendency for burnout (Schmitz & Schwarzer, 2000) and influences intrinsic motivation (de Jesus & Lens, 2005).

A Chinese study explored the extent to which taking the three basic needs into consideration motivates teachers to establish new types of teaching in school in a long-term manner (Lam, Cheng, & Choy, 2010). The basic needs had both a positive effect on motivation as well as on whether the teachers were interested in working with the new teaching structures in the long term. Pelletier, Legault and Séguin-Levesque (2002) investigated the influence of working environment on the professional motivation of teachers in a similar manner. They showed that a working environment which removes the need for autonomy and compels teachers to comply with a restrictive set of requirements has a negative effect on teachers' self-determination. The importance of perception of autonomy was also proven by a study on primary school teachers (Roth et al., 2007). In addition, a negative correlation between autonomous professional motivation and feelings of exhaustion in the teaching profession could also be shown here. Teacher motivation is essential for the success of school innovations. But what actually constitutes teacher motivation? This report seeks to investigate teacher motivation for participating in school innovations by using two projects as examples, which will be described consecutively.

4. Two school innovation projects

We examine teacher motivation in the context of two school projects. The projects in question are “Chemistry in Context” (Chemie im Kontext) project and “Transfer-21”, both of which will be described in more detail in the following.

The aim of the Chemistry in Context project was to improve chemistry teaching in secondary schools and to support students’ learning in the process (Parchmann, Gräsel, Baer, Demuth, & Ralle, 2006). The teaching concept behind the project was based on three principles (Gräsel & Parchmann, 2004a; Nentwig, Demuth, Parchmann, Gräsel, & Ralle, 2007): a) Lessons should be closely related to everyday life and embedded in particular contexts; b) Lessons should introduce central fundamental concepts, that are chemical principles behind the examples used. These principles can then, in turn, be applied to new contexts; c) Chemistry in Context intends for different types of teaching methods to be used in lessons, with appropriate methods being selected with regards to the respective learning goals and types of tasks involved. A “symbiotic” implementation strategy (Gräsel & Parchmann, 2004b) was used to implement Chemistry in Context, referring to the fact that people with different levels of expertise worked together in groups. As such, teachers, experts on teaching chemistry and administrators worked together to design teaching units and materials and to reflect upon how they could be used in lessons. The project was carried out from 2002 to 2008 (for further information about the project see Demuth et al., 2008).

The Transfer-21 project (de Haan, 2004) was a follow up project to the “Education for Sustainable Development (21)” (Bildung für nachhaltige Entwicklung) programme set out by German State Commission for Educational Planning and Research Promotion. The project focused on changes in the area of environmental and development-related education on the one hand and on improving teaching quality and school development on the other (Rode, 2005). The central goal of the programme was to allow Education for Sustainable Development policy to reach different schools as well as to impart the concept of the “Gestaltungskompetenz” to students. These skills refer to the ability to align one’s behavior with the principles of sustainability (deHaan & Harenberg, 1999). The programme also included different ways for spreading the policy mentioned above, with networks on particular themes and competence centers being set up in the German states. In addition, the programme entailed training specialists with the aim that they subsequently pass on their expertise to others; many of them are still active as consultants for specific thematic fields relating to Education for Sustainable Development (de Haan, 2004; Rode, 2005). The project ran from 2004 to 2008.

5. Research questions

It appears essential for both school innovation projects that teachers are motivated to co-operate in implementing the innovation in question. We distinguish between two types of motivation: self-determined motivation which focuses on reasons for taking part in the innovation just out of enjoyment and personal development, and controlled motivation, which means reasons like the headmasters' requests to participate. We showed different theoretical factors influencing motivation: (a) attribution of significance as a theoretical determinant of the person-object-theory of interest; (b) satisfaction of basic needs as contemplated in the self-determination theory; (c) different types of incentive as an element of the Advanced Cognitive Model of Motivation. This raises the question what effect each factor has on both types of motivation and how strong this effect is.

6. Study 1: Chemistry in Context

6.1 Method

In spring 2007, a questionnaire was administered to 350 chemistry teachers who were involved in the project. The teachers thus received a stamped addressed envelope with a questionnaire to fill out and send back. A total of 128 teachers took part in the investigation, of which 61 were male and 64 were female. Most of the teachers worked at grammar schools (77%), followed by 5.6% at traditional secondary modern schools and 4.8% at middle schools. 12.7% chose the category "others". The age of the majority of teachers was distributed fairly evenly over the following age brackets: 31–40 years (38.1%), 41–50 years (25.4%) and 51–60 years (34.1%).

The questionnaires included questions pertaining to different types of motivation, which we formulated as reasons why the teachers were involved in the Chemistry in Context project. This entailed translating research instruments used in previous studies and adapting them for use with the teachers who had worked on the Chemistry in Context project (Deci & Ryan, 2006b, 2006c). The "self-determined motivation" scale refers to enjoyment in the project work and describes reasons for participation linked to individual personality development or improvements in lesson planning. The "controlled motivation" scale encompasses such reasons for participation as potential improved career prospects or the expectation of headmaster, for example. In addition to this, the questionnaire also includes theoretical factors that influence motivation. Here too, the scales used had already been tried out in previous research projects and were adapted to Chemistry in Context setting accordingly (Deci & Ryan, 2006a; Fussangel, 2008; Ilardi, Leone, Kasser, & Ryan, 1993; Kramer, 2002; Prenzel, Kristen, Dengler, Eittle, & Beer, 1996). The scale related to the construct "significance" describes the importance of the project to the teacher. The three scales relating to basic needs describe the extent

to which the teachers feel supported in their autonomy and competence within the projects, but also to what extent they feel a sense of relatedness amongst their Chemistry in Context colleagues. In addition, the teachers were also asked whether they would be more committed to the project if particular incentives were in place (Schellenbach-Zell, 2009). These includes “material incentives”, such as getting teaching hours for relief, “social incentives” such as the prospect of gaining recognition from headmaster and “project-related incentives” such as a clear, sophisticated project concept and good materials.

The answer format used for all the above scales consists of 4 steps running from 1) I disagree to 4) I agree. Most of the scales show a reliability of over .70, while some of the scales used, such as the one for controlled motivation and material incentives, have worse internal consistencies (cf. Table 1). Despite of this we used these scales, however this fact has to be taken into consideration when interpreting possible results.

Table 1: Summary of the scales used to investigate teacher motivation within the Chemistry in Context (CiC) project

Scale	<i>M</i>	<i>SD</i>	Cronbach's α	Example Items
Selfdet. motivation	3.32	.43	.87	I'm taking part in the CiC project to introduce variety into my job. (13 items)
Controlled motivation	1.88	.42	.61	I'm taking part in the CiC project because it is of relevance for my reputation as a teacher. (7 items)
Significance	3.39	.53	.74	I experience things that are of personal significance for me whilst working on the CiC project. (3 items)
Experience of autonomy	3.61	.40	.77	I feel under pressure when working on the CiC project (rec.). (5 items)
Experience of competence	3.27	.52	.64	I don't feel particularly competent when working on the CiC project (rec.). (4 items)
Experience of relatedness	3.13	.48	.73	My CiC colleagues are always willing to listen to my problems. (4 items)
Material incentives	2.27	.73	.61	I would devote more time and effort to the CiC project if suitable financial compensation were in place to make the increased effort worth. (3 items)
Social incentives	1.99	.67	.74	I would devote more time and effort to the CiC project if my achievements were recognized by my colleagues. (3 items)
Project-spec. incentives	2.00	.58	.67	I would be more committed to the CiC project if the concepts behind it were more sophisticated. (4 items)

Note. Number of items per scale is given in round brackets after each of the example items.

6.2 Results

A regression model was used to provide answers to the question, which theoretical factors are of particular significance for teacher motivation. It is intended for use on both self-determined and controlled motivation. The inclusion of the predictors is carried out in different blocks: as interest is one of the main reasons for participating in a school innovation, the first block encompasses the significance that the teacher attaches to the project content. In order that additional relevant theoretical factors can be identified, the second block contains the basic psychological needs of autonomy, competence and relatedness. To investigate the influence of any factors that go beyond those formulated by the self-determination and educational interest theories, the three incentive factors (material, social and project-specific incentives) are included in the last block. Table 2 contains the bivariate correlations. The corresponding modeling parameters are listed in Table 3.

Table 2: Bivariate correlations of the variables investigated in Chemistry in Context ($n = 122-128$)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Self-determined motivation (1)	-							
Controlled motivation (2)	.06	-						
Significance (3)	.59**	.13	-					
Autonomy (4)	.55**	-.09	.44**	-				
Competence (5)	.47**	.03	.38**	.60**	-			
Relatedness (6)	.35**	.01	.25**	.18*	.28**	-		
Material incentives (7)	-.18*	.27**	.04	-.26**	-.22*	-.04	-	
Social incentives (8)	-.10	.24**	.01	-.22*	-.27**	-.11	.59**	-
Project-specific incentives (9)	-.34**	.21*	-.23**	-.39**	-.39**	-.12	.47**	.51**

** $p < .01$. * $p < .05$.

Table 3: Regression parameters for the influence model for motivation used for Chemistry in Context ($n = 120$)

		Self-determined motivation				Controlled motivation			
Variables		β	T	F	ΔR^2	β	T	F	ΔR^2
1	Significance	.39	4.98**	64.05**	.35	.15	1.48	2.04	.02
	Autonomy	.25	2.82**			-.14	-1.21		
2	Competence	.09	1.04	10.85**	.14	.17	1.50	1.27	.03
	Relatedness	.18	2.54*			-.02	-1.17		
	Material incentives	-.13	-1.52			.15	1.32		
3	Social incentives	.13	1.44	1.57	.02	.09	.77	3.48*	.08
	Project-specific incentives	-.10	-1.17			.14	1.19		
	corr. R^2			.48				.08	

** $p < .01$. * $p < .05$.

Looking at the model for self-determined motivation, i.e. reasons for working on Chemistry in Context such as individual personality development, a considerable amount of the variance can be explained via attribution of significance. The more strongly teachers perceive the project content as being important for their profession as well as for them personally, the more likely they are to work in a self-determined manner on the school innovation. Looking at the next block, the three basic needs are also able to explain another significant part of the additional variance. The beta values reveal that this explained variance can be put down to the needs for autonomy and relatedness. Experiencing high levels of autonomy and a strong sense of relatedness within the project's working groups support feelings of self-determination within project cooperation. Experiencing competence, however, does not play a role in self-determined motivation. In addition to this, none of the incentives investigated are able to contribute to further variance explanation. The model is significant for self-determined motivation ($F(7, 120) = 16.98^{**}$) and is able to account for a very large part of the explained variance (48%).

With respect to controlled motivation, it can be seen that the theoretical determinants of interest (attaching significance) and the self-determination theory (the basic needs for autonomy, competence and relatedness) are not able to make a significant contribution to the explained variance. However, the three different incentives have a collective influence on controlled motivation. When taken individually, none of the incentive factors showed an outstanding effect; it seems instead that all

three of them contributed to the explanation of controlled motivation to the same extent. Although the model is significant ($F(7, 120) = 2.38^*$), it can only explain controlled motivation to 8%.

6.3 Discussion study 1

The person-object-theory of interest (Krapp, 1992a) states that the significance a person attaches to an object represents an essential factor for intrinsic motivation. The results obtained in this investigation are able to confirm this assumption; significance was the most important predictor of self-determined motivation, but not, however, for controlled motivation. The self-determination theory assumes that there are three basic needs that have a positive effect on self-determined motivation: the needs for autonomy, competence, and relatedness. The experience of autonomy and relatedness played an essential role in self-determined motivation. The basic needs mentioned above did not, however, influence controlled motivation. The effects of these basic needs on the two types of motivation can be explained in theoretical terms: Self-determined forms of motivation are linked to high levels of autonomy and competence as well as relatedness, meaning the influence of experiencing autonomy and competence was to be expected. On the other hand, however, experience of competence proved to be of negligible importance as a predictor for this type of motivation, which was an unexpected result here. This can possibly be put down to the relatively low internal consistency of the scale used; improving it might provide information about the actual effects of the different variables. Controlled motivation on the other hand is linked to the three basic needs not being experienced very strongly. It is conceivable that this can be put down to relatedness, as Deci und Ryan (2002) make the assumption that it is exactly this need that plays a decisive role when it comes to taking on values and attitudes. In our example for a school innovation project, however, this basic need did not end up being of significance.

In addition to the three basic needs already discussed, our theoretical model also took different incentives as predictors for both types of motivation into consideration. Neither the prospect of receiving material compensation, nor the prospect of better materials being made available, nor increased recognition by colleagues or headmasters proved to be suitable incentives to strengthen self-determined motivation for teachers participating in the Chemistry in Context project. This is also in line with the self-determination theory, which assumes that it is a type of motivation that does not need to be reinforced by particular incentives. The self-determination theory also assumes that controlled motivation can be maintained if suitable external incentives remain constantly in place or if these are strengthened. The three incentive factors proved suitable for influencing controlled motivation in a positive manner. None of the factors played a decisive role when their effects were analyzed individually; it seemed instead that it was the combined influence of all three that had an effect.

What do these results mean for the Chemistry in Context project? To begin with, it makes sense to distinguish between self-determined and controlled motivation. The results confirm the theoretical expectation that the former is a type of long-term motivation that does not need to be reinforced via particular incentives. Before the backdrop of a threatened “silting up” (Euler & Sloane, 1998), it would seem worthwhile to promote this type of motivation. For this it is necessary that the teachers are made aware of the relevance of the project content both for their profession as well as for them personally. In addition, allowing teachers broad scope for taking action and giving them the opportunity to decide independently which subjects they want to follow and in what way can have a significant effect on long-term motivation. A friendly, cooperative climate not based on pressure within the project group can also play a role in strengthening long-term teacher motivation. The results on controlled motivation also give rise to the following considerations: Although making financial incentives a reality may be difficult within the current education system, schools could most certainly be sensitized with regards to giving due attention to particularly committed teachers. How a particular project is structured and organized can also contribute to stimulating motivation, such as by communicating the project goals in a clear manner and by making high-quality support materials available for use in the project. Controlled motivation also plays a highly significant role for school innovations: The self-determination theory assumes that this type of motivation can be converted into long-term self-determined motivation by allowing autonomy, competence and relatedness to be experienced (Deci & Ryan, 2000). There is one limitation considering the results’ interpretation: just because we handle with data gained from teachers who already worked in the project, the results are not able to give any information about the question of what prevents those teachers who do not participate in a school-innovation from taking part.

7. Study 2: Transfer-21

7.1 Methods

Data in the Transfer-21 project was collected online. About 2000 headmasters were contacted via e-mail in early 2008 and asked to pass on the mail to their teaching staff. The staff members had then the possibility to fill out the questionnaire online on an internet platform.

216 teachers who stated that they had been involved in the Transfer-21 project were included in the analysis; 63 were male and 148 female. The age structure was balanced: only few of those asked were 30 years of age and younger (5.6%), between 31 and 40 (20.9%) and between 41 and 50 (24.7%). The majority of the teachers were between 51 and 60 (41.9%) years old; 7% were older than 60 years of age. 43.5% of the responding teachers were working at primary schools, 15.3%

were working at schools with more than one courses of education, 13.9% were working at grammar schools, 11.6% at comprehensive schools followed by 8.8% of the sample, who were working at vocational schools. 2.8% of the sample were teaching at middle schools. One person belongs to a traditional secondary modern school (0.5%), and two persons were teaching at schools for children with learning difficulties (0.9%). 2.8% chose the category “others”.

The same research instruments employed for the Chemistry in Context project was partially reworked for the Transfer-21 project. Although the questions on motivation used in the Chemistry in Context project related to why teachers had taken part in the project, the Transfer-21 teachers were asked about their motivation for engaging in the subject of Education for Sustainable Development. The questions relating to the three basic needs also did not refer to how these needs were experienced within the project group but rather how teachers perceived that these needs were dealt with at the school itself. The questions on incentive factors related to a stronger commitment to Education for Sustainable Development being implemented at the school. Essentially however, the respective scales used still reflected the theoretical dimensions of motivation and its influencing factors in the same way as the instruments used for the Chemistry in Context project did. In this way, the reliabilities of the scales could be significantly improved: the scale for “controlled motivation” showed a reliability of .74 (compared to .61 for Chemistry in Context), the scale for “material incentives” had a reliability of .84 (compared to .61 for Chemistry in Context) and the scale for “project-related incentives” showed .72 reliability (compared to .67 for Chemistry in Context). The internal consistency of the scale relating to the “experience of competence” could only be slightly improved to .72 (compared to .64 for Chemistry in Context). The reliability of the scale for the “experience of autonomy” sank noticeably to .61 (compared to .77 for Chemistry in Context). For this scale in particular, any interpretations of possible effects should thus be treated with caution. All other scales used showed satisfactory reliabilities between .77 and .91.

7.2 Results

We used the same model to analyze the data from Study 2 as was used for Study 1. The dependent variables are self-determined motivation and controlled motivation. Table 4 shows the bivariate correlations of all the factors investigated, while Table 5 contains the corresponding regression parameters.

Table 4: Bivariate correlations of the variables investigated in the Transfer-21 project ($n = 210-215$)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Self-determined motivation (1)	-							
Controlled motivation (2)	.29**	-						
Significance (3)	.62**	.20**	-					
Autonomy (4)	.07	-.12	.00	-				
Competence (5)	.18**	-.03	.03	.41**	-			
Relatedness (6)	-.03	.01	-.09	.17*	.35**	-		
Material incentives (7)	-.08	.24**	.03	-.19**	-.07	-.03	-	
Social incentives (8)	.01	.30**	.03	-.23**	-.12	-.10	.34**	-
Project-related incentives (9)	-.27**	.10	-.18**	-.08	-.11	.21**	.40**	.37**

** $p < .01$. * $p < .05$.

Table 5: Regression parameters for the influence model of motivation used for the Transfer-21 project ($n = 209$)

Variables	Self-determined motivation				Controlled motivation			
	β	T	F	ΔR^2	β	T	F	ΔR^2
1 Significance	.58	10.75**	128.97**	.38	.19	2.87**	9.03**	.04
Autonomy	.01	.15			-.05	-.61		
2 Competence	.14	2.29*	3.09*	.03	.00	-.02	1.19	.02
Relatedness	.02	.28			.08	1.07		
Material incentives	-.05	-.79			.16	2.20*		
3 Social incentives	.09	1.43	3.18*	.03	.26	3.47**	7.90**	.10
Project-related incentives	-.16	-2.54*			-.05	-.59		
corr. R^2			.42				.13	

** $p < .01$. * $p < .05$.

The extent to which teachers attached personal and professional significance to the content of the project stimulated both self-determined and controlled motivation. The three basic needs, which were included in a second step, did not make an additional contribution to the explained variance with respect to controlled motivation. Self-determined motivation, however, rose by further 3%, with the experience of competence showing an independent influence. The three incentive factors were then addressed in a third step and were able to explain self-determined motivation by further 3%. The project-related incentive factors emerged as the central predictor with negative sign. High levels of agreement with the statement that teachers would be more committed to implement Education for Sustainable Development if more materials were available and the content to be realized were clearer, were thus linked to a lower self-determined motivation. Self-determined motivation is associated with reasons to engage in Education for Sustainable Development like pedagogical development. Interestingly, it is the two other incentive factors which are strong predictors of controlled motivation. The prospect of increased recognition within the school environment or receiving suitably attractive forms of compensation are suitable incentives to stimulate types of motivation based on reasons such as improving one's personal reputation or following the explicit wishes of the headmaster. The influence model is significant for both dependent variables (self-determined motivation: $F(7, 209) = 22.32^{**}$ / controlled motivation: $F(7, 209) = 5.37^{**}$) and can account for 42% (self-determined motivation) and 13% (controlled motivation) of the explained variance respectively.

7.3 Discussion study 2

The data analysis showed that the significance that teachers attach to the project content represents a particularly important influencing factor for self-determined and controlled motivation. In contrast, however, the three basic needs only played a small role, even when it came to explaining self-determined motivation. Amongst these needs, it is only the experience of competence that made an independent contribution to explained variance. The incentive factors influenced both forms of motivation: the project-specific incentives had a negative effect on self-determined motivation, while the social and material incentives had a positive effect on controlled motivation.

The influence of significance appears to be of particular importance because it applies to both self-determined and controlled motivation. It is only the influence on self-determined motivation that would be expected here based on theoretical principles. The result with regard to controlled motivation could be an indication that teachers nevertheless attach a great deal of significance to Education for Sustainable Development even when they work on this topic just because of feelings of obligation for example. This particular subject content is thus able to support the transition from controlled to self-determined motivation.

Satisfying the three basic needs plays no role with regards to controlled motivation. This result is – as already explained above – in accordance with theory. The less the basic needs are taken into consideration, the more marked the types of motivation with high levels of control experience become. However, the basic needs also show little influence on self-determined motivation, even if they do make a significant contribution when their effects are regarded together.

The investigation of the different incentives leads to some differing results: the more teachers agree with the suggestion that they would devote more of their time and energy to Education for Sustainable Development if the content was clearer to them and more materials were available, the less self-determined motivated they are to take part in this school-innovation. It is possible that project content and goals that are formulated in a clearer, more precise manner together with high-quality materials being made available might play a role in supporting self-determined motivation. It is precisely the other two factors (social and material incentives) that favor controlled motivation: the more that teachers were in agreement with the suggestion that they would show higher levels of commitment if they are released from teaching duties or if their headmaster recognized their achievements, the more likely it was that they would participate in a school innovation project due to controlled motivation. Both forms of incentive are thus suited to stimulate controlled motivation, which, when bearing in mind possible transitions to self-determined motivation, also plays an important role in making sure that the project content endures. Nonetheless, it should be noted that the fact that the teachers rated themselves represents a restriction here. In addition to this, only a sub-section of possible incentives was investigated, a shortcoming that also applies to the Chemistry in Context project.

7.4 Comparison of results

Influence by significance: There are, however, differences between the two studies in this regard. It was not possible to identify any influence of attachment of significance on controlled motivation in the Chemistry in Context project, but in Transfer-21. A possible explanation for this might be that the scales used in the Transfer-21 project included items that encompassed concrete behavior rather than general interest. It was thus also asked whether teachers also dedicated their time to the subject in their spare time, such as in a charity group or similar. Such a scale might be able to chart the “attachment of significance” construct in a more accurate manner.

Influence by basic needs: In the Transfer-21 project, we found just a little influence by the three basic needs. The items used here, however, referred to considering these basic needs at the school at which the respective teacher worked, rather than to working with Education for Sustainable Development, i.e. the project content. This could explain the difference to the results found in the Chemistry in Context project. It is possible that the school on the one hand and commitment to

project content on the other represent different “fields of work” and that a different result would be obtained if the project setting was analyzed in a similar manner. The results of the two studies also differ with respect to the effect of the individual basic needs: while experiencing autonomy and relatedness influenced self-determined motivation in the Chemistry in Context project, experiencing competence had a particular influence on self-determined motivation in the Transfer-21 project. This could also be due to the re-working of the scales however. Aside from the obvious differences in the actual relationship being described (i.e. experiences at the school and within in the project respectively), the scales used for relatedness and experience of competence do not essentially differ from one another. The scale used for experience of autonomy differs between the two projects even if the actual theoretical content being addressed is the same for both. Both scales deal with the perception of scope for taking action and the ability to make decisions freely with respect to different work focuses. However, this is formulated in a more abstract way in the scales used in the Transfer-21 project, while the Chemistry in Context project described it in much more concrete terms. It is possible that this abstraction led to a reduction in the influence of experiencing autonomy.

Influence by incentives: In Chemistry in Context we saw that no effects on self-determined motivation could be identified and all of the three incentives had a combined influence on controlled motivation. A clear project content may influence self-determined motivation in the Transfer-21 project, whereas social and material incentives can activate controlled motivation. This difference could base on the varied project contents. Particularly a concept like Education of Sustainable Development could benefit from a clear description about what this concept contains and how to behave in sense of Sustainability.

8. Summary and general discussion

With regards to which factors influence teachers’ motivation to take part in school innovations, the following summary can be made: it could be revealed within the Chemistry in Context project that the personal and professional significance of the project and its content were able to have a noticeable effect on teachers’ self-determined motivation to participate. Reasons for taking part linked to self-determined motivation included feelings of contentment and fun, as well as teachers’ individual personality development and class’ improvements. Attachment of significance had an effect on both self-motivation and controlled motivation within the Transfer-21 project. Controlled motivation is connected with such reasons for taking actions as feelings of obligation or attempts to further career chances. The three basic needs are able to explain self-motivation within the Chemistry in Context project to a large extent, with the most important influencing factors here being the experience of autonomy and relatedness. On the other hand, these same needs were only able to explain self-determined motivation to a much smaller extent in the Transfer-21

project, the experience of competence forming, by contrast, the essential influencing factor here. When their individual effects were combined, the different incentive factors investigated stimulated controlled motivation in the Chemistry in Context project. There were, however, differences in the effectiveness of the different types of incentive in the Transfer-21 project: project-specific incentives had a negative influence on self-determined motivation, while material and social incentives were suited to improving controlled motivation.

What conclusions can be drawn from these findings? (1) To begin with, the results are suitable as a way of expanding research on teacher motivation. While previous research has primarily interpreted motivation as being a given and dealt in particular with the interrelations of teacher motivation (e.g. with attitudes in asking for help; Butler, 2007) or within the context of experiencing strain (Schmitz & Schwarzer, 2000; Tönjes et al., 2008), this study is able to provide information on which factors have an influence on motivating teachers for particular activities within their profession. The factors investigated here include interest, basic needs and specific incentives. Our findings are to a large extent in keeping with those found in the study already mentioned on Chinese teachers, which confirmed that it is certainly of relevance for a school to take these basic needs into consideration (Lam et al., 2010). The results from the Chemistry in Context project in particular are in agreement with an additional study which emphasizes the particular importance of experiencing autonomy when it comes to self-determined motivation (Pelletier et al., 2002) (2) It is precisely the findings relating to teacher motivation that allow conclusions to be made regarding planning and designing school innovation projects. The findings from the two projects complement each other well. Both projects show how important it is for teachers both to recognize the significance of the content being imparted and to recognize how this content is connected to them personally and professionally. This could be clarified at some points of time during the project-period, for instance in the meetings of the working groups. Such attachments of significance can also have an effect on the way in which teachers deal with this content in the long term and can work against a “silt-ing up” of innovations. In addition, it would also seem necessary that the environment in which teachers work takes their basic needs into consideration. The concept of working environment can refer to both a direct working environment such as a school and a work group that includes staff from a range of schools as part of a particular project. Our results point to the fact that experiencing competence has a positive effect on self-determined motivation in teachers’ direct working environments, while experiencing autonomy and relatedness has a positive effect on self-determined motivation within work groups. When it comes to project structures, it would therefore make sense to give teachers freedom of action like setting the focus of their work independently. For the project leader, this includes letting teachers decide which topic they choose to work and how they want to approach this topic (e.g. not giving strict time-deadlines for work results). A self-determined approach to working with innovation content can also be supported by establishing a working environment within the school that gives teachers the feeling that they are

competent, capable of achievement and that they are valued as a teacher. This can be reached through targeted feedback sessions in which teachers hear about their work results. Due to the universality of basic needs (Deci et al., 2001; Ryan & Deci, 2002), considering these needs in a working environment can be useful not only for motivation regarding innovation implementation but also regarding everyday work at the school.

Clear content and a varied range of materials can also play a role. It is also possible that teachers can be motivated to work more intensively on innovation contents if their achievements received more recognition or if they received financial recognition in the form of material compensation. However, this particular type of motivation, which is based on feelings of obligation or hopes for an improved professional reputation, requires more research, particularly with regard to the influencing factors involved and with regard to changes over longer periods of time.

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