Innovative work behaviour

Investigating the nature and facilitation of vocational teachers'
contributions to innovation development

vorgelegt von

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Contents

Chapter 1

Introduction

"Innovations, like flowers, start from tiny seeds and have to be nurtured carefully until they blossom"

(Kanter, 1988, p. 170)

"Only by examining the innovation process in depth, from the first emergence of an idea for change to its final outcome (...) can we understand why particular factors in particular circumstances influence innovative activity within organizations"

(King, 1992, p. 89)

Benefits of innovations in organizational work practice

There is considerable consensus in the literature that as a consequence of societal and economic developments, technological advancements, and transformations of organizational structures and tasks, innovations have become a crucial feature of today's world of work (Anderson, De Dreu, & Nijstad, 2004). Innovations are new and potentially useful products or processes that are applied to address the problems and challenges of a particular work context and help to maintain or improve the current state of this context (West & Farr, 1990). For organizations, innovations are important to enhance the effectiveness of internal processes and the quality of outcomes, to achieve and maintain a competitive advantage, and to secure the organization's long-term survival (Amabile, 1988; Damanpour & Gopalakrishnan, 2001; Kanter, 1988; Marinova & Phillimore, 2003; Oldham & Cummings, 1996; Scott & Bruce, 1994; Woodman, Sawyer, & Griffin, 1993). Because of these benefits of innovation and due to more flexible work structures, organizations increasingly expect and need their employees to contribute to change and improvement at work. This means that employees are required to reflect on their work practice and pro-actively deal with work-related problems and challenges (Anderson *et al.*, 2004; Morrison & Phelps, 1999; Shalley, 1995). For employees who contribute to the development of an innovation, this engagement may bring the benefit of a better fit between conditions and requirements of work and personal needs and competences, an improved collaboration and communication with colleagues, and higher levels of job satisfaction and well-being (Janssen, 2000). At the same time, however, employees who participate in innovation processes may also run the risk of conflict and

resistance of colleagues or supervisors who want to prevent changes of established work patterns and norms (Janssen, 2003).

The role of individual contributions to innovation development

Although innovations have been investigated by a great number of disciplines (e.g. economics, management sciences, sociology, communication research, and psychology) and from various theoretical angles (King, 1990; Marinova & Phillimore, 2003), the implications and the complexity of individual engagement in organizational innovation processes were not always reflected to its full extent (Anderson *et al.*, 2004). Nevertheless, important advancements regarding the involvement of employees in the innovation process were made by theoretical and empirical investigations of creativity and innovation in organizational work practice, mainly in the field of psychology (Amabile, 1988; Kanter, 1988; Oldham & Cummings, 1996; Shalley, Zhou, & Oldham, 2004; West, 2002; Woodman *et al.*, 1993; Zhou & Shalley, 2003). In this respect, *creativity* refers to the behaviour employees assert to recognize problems and explore opportunities in their work practice, and to generate ideas that address corresponding changes and improvements. Building on the outcomes of this creative stage, *innovation* refers to the promotion and realization of ideas in organizational work practice which requires behaviours such as championing, coalition building, experimentation, and modification (Hammond, Neff, Farr, Schwall, & Zhao, 2011).

Innovative work behaviour defined

A construct that integrates both components as a set of 'innovation' *tasks* (Kanter, 1988) which have to be accomplished for the successful development of an innovation is the construct of innovative work behaviour (Janssen, 2000; Scott & Bruce, 1994). In line with the mentioned two-stage models of creativity and innovation, four prerequisite innovation tasks, namely *opportunity exploration* (or problem recognition), *idea generation*, *idea promotion*, and *idea realization*, can be derived from studies on innovative work behaviour (De Jong & Den Hartog, 2010; Dorenbosch, Van Engen, & Verhagen, 2005; Janssen, 2000; Kleysen & Street, 2001; Scott & Bruce, 1994). Although these tasks partly build on each other (e.g. ideas are generated based on opportunities explored or problems recognized), they are also iteratively connected by feedback loops (e.g. the promotion of an idea may lead to the exploration of further opportunities or ideas). Hence, the tasks do not follow a linear sequence and are rather complexly related (Dorenbosch *et al.*, 2005; Kanter, 1988). Furthermore, innovative work behaviour encompasses all work activities that are required from employees to accomplish the prerequisite innovation tasks. These work activities may by physical or cognitive, carried out solitarily or in a social setting, and contribute to multiple innovation tasks (e.g. a discussion with a colleague may help to explore a problematic situation, collaboratively search for solutions, and promote an idea already in one's head). Hence, employees may be involved in the accomplishment of several of these tasks simultaneously and repeatedly (Scott & Bruce, 1994). Based on these considerations, it can be concluded that innovative work behaviour represents a holistic construct composed of interdependent tasks and activities embedded into the iterative and complex process of innovation development.

Unfortunately, only part of the existing studies on innovative work behaviour specifically took into account concrete work activities of employees (De Jong & Den Hartog, 2010; Dorenbosch *et al.*, 2005) and instead operationalized and measured the construct at the level of abstract innovation tasks (Janssen, 2000; Scott & Bruce, 1994). As a consequence, it was neglected that, because innovation development is based on timely and socio-culturally interdependent work activities carried out by employees in their work context, innovative work behaviour is dynamic and context-bound. This has important implications for innovation development as well as for employees' professional development. These implications, however, may not always be explicit for employees. Therefore, *reflection* emerges as a further task that is required throughout the entire process of innovation development for linking and regulating all other innovation tasks (West, 2000). In addition, reflection enables employees to monitor and improve their professional performance (Van Woerkom, 2004). With respect to conceptualizations and investigations of innovative work behaviour, these implications derived from the construct's dynamic, context-bound nature have to be taken into account.

Based on these considerations, innovative work behaviour as a dynamic and context-bound construct is defined as *the sum of physical and cognitive work activities carried out by employees in their work context, either solitarily or in a social setting, in order to accomplish a set of tasks required for achieving the goal of innovation development*.

Innovation and innovative work behaviour in vocational colleges
A domain in which innovations play a considerable role is vocational education (OECD, 2009, 2010). Because the work in vocational colleges is characterized by a close connection to the world of work, the effect of the above mentioned societal, economic, and technological developments is especially significant. In particular, increased diversity of students and high qualification demands of companies make it difficult for vocational colleges to prepare students adequately for future jobs. Vocational colleges have to respond to these challenges by providing a job preparation that includes innovative learning environments derived from real jobs. Innovations in vocational colleges can for instance be related to instructional design in the classroom such as new learning goals, to methods of learning and teaching, or to products and processes outside the classroom such as collaboration with companies and quality management at school (Mulder, 2004; Nijhof & Streumer, 1994).

Furthermore, these demands and challenges for vocational colleges lead to new responsibilities and roles for vocational teachers. This includes the expectation to be flexible, reflective, and willing to adapt, as well as to contribute to the development of innovative instructional environments (Attwell, 1997). In spite of this expectation for teachers to be innovators, there is lack of insight into teachers' contributions to innovation development. Existing research on innovations in schools rather focused on factors determining the implementation of externally designed innovations for the classroom context. However, in order for innovations to have a sustainable impact on processes and outcomes of work and learning in vocational colleges, it is inevitable that they establish links between the contexts inside and outside the classroom, and that they are developed in accordance with the goals and needs of a particular school context and by local actors such as vocational teachers who work and learn in this context.

Aims of the thesis

In essence, the aim of this thesis is to gain insight into individual contributions to the development of innovations in vocational colleges by investigating the nature and facilitation of vocational teachers' innovative work behaviour. Two broad research tasks have to be accomplished to achieve this goal.

Conceptualizing and measuring innovative work behaviour

The first task regards the construct of innovative work behaviour itself: A theoretical conceptualization of innovative work behaviour is required that helps to overcome the addressed shortcomings of previous research by taking into account the construct's dynamic, context-bound nature. In particular, this conceptualization has to widen the construct's focus from being solely concerned with innovation development to an additional focus on employees' professional development. This thesis approaches this question by taking a general perspective on innovative work behaviour as well as a domain-specific perspective focussing on vocational teachers' innovative work behaviour. Furthermore, the theoretical conceptualization of innovative work behaviour as a dynamic, context-bound construct has to be realized in a measurement instrument. This instrument can then be used to empirically test the theoretical conceptualization and to analyse employees' contributions to innovation development. This thesis addresses this task by developing a measurement instrument that measures innovative work behaviour based on the characteristics of the process of innovation development in a particular work context such as the work practice of vocational teachers.

Facilitating innovative work behaviour

The second task regards the determinants of innovative work behaviour: Because innovations provide alternative or new approaches and solutions to problems and challenges in organizational work practice, fostering innovation development is a crucial task for managers and HRD practitioners. Employees' contributions to the development of innovations represent a valuable resource for gaining access to the benefits of innovations (Zhou & Shalley, 2003). Accordingly, the question arises to which degree employees in a particular work context perform innovative work behaviour and, subsequently, how their innovative work behaviour can be facilitated. This question regards the identification of factors that trigger the initiation of efforts to develop an innovation, and the investigation of factors that enhance and sustain employees' contributions to innovation development. These factors can then be used to derive practical steps that enable management, supervisors, and employees to facilitate their own and colleagues' innovative work behaviour. As the goal of this thesis is to provide insight into the facilitation of vocational teachers' innovative work behaviour, factors that facilitate vocational teachers' efforts to initiate and contribute to innovation development are investigated.

Overview of the thesis

The subsequent chapters of this thesis are based on five highly related articles – one theoretical examination and four empirical investigations – which collectively contribute to an understanding of the construct of innovative work behaviour and its facilitation, particularly

in the domain of vocational teachers' work. As each chapter represents an independent piece of work, some repetitions however are unavoidable.

(1) *Relations between vocational teachers' characteristics of professionalism and their innovative work behaviour*

In a questionnaire study the role of characteristics of professionalism as prerequisites of vocational teachers' innovative work behaviour is explored. Accordingly, the study addresses the question: *What is the relation between vocational teachers' professional knowledge, professional performance, and professional development on the one hand and their innovative work behaviour on the other hand?* In particular, it is analysed whether vocational teachers' contributions to innovation development are determined by their professional knowledge and their level of professional performance. Moreover, it is analysed whether vocational teachers' engagement in innovation development is determined by their engagement in professional development activities. By looking at individual prerequisites of vocational teachers' innovative work behaviour, practical steps to facilitate their engagement in innovation development can be derived from the study. Furthermore, insight into the adequacy of a domain-specific approach to measuring vocational teachers' innovative work behaviour (which differs from the later measurement approach) is provided.

(2) *Innovative work behaviour in vocational colleges: Understanding how and why innovations are developed*

This explorative interview study provides detailed insight into innovations and their development in the work context of vocational teachers. Thus, the central question addressed in the study is: *How and why are innovations developed in the work context of vocational teachers?* Based on examples of innovations in vocational colleges provided by the interviewees, the study aims at tracing the work activities vocational teachers perform and the tasks they accomplish during the development of a particular innovation. This insight can be used as basis for conceptualizing innovative work behaviour as a dynamic, context-bound construct. Furthermore, the study helps to reconstruct which personal and contextual factors trigger vocational teachers' engagement in innovation development. The corresponding findings represent a necessary first step for formulating hypotheses for the quantitative main study.

(3) *Innovative work behaviour and learning: A theoretical reconceptualization*

Based on the insight from the first two studies and an extensive literature search, it is examined how the construct of innovative work behaviour can be advanced and linked to employees' professional development. Hence, the central question is: *What are the components of a theoretical conceptualization of work behaviour that integrates employees' contributions to innovation development with their professional development?* In answering this question, a theoretical conceptualization of innovative work behaviour as a dynamic, context-bound construct is presented. Social activities and the reflection on professional performance and outcomes throughout the entire process of innovation

development play a key role in this conceptualization. Furthermore, it is depicted how individual contributions to innovation development lead to work experiences that provide opportunities for professional development. Finally, implications for operationalization and measurement of innovative work behaviour as a dynamic, context-bound construct are derived from the construct's theoretical conceptualization.

(4) *Development of a measurement instrument for innovative work behaviour as a dynamic and context-bound construct*

This contribution illustrates the development of a measurement instrument of innovative work behaviour. The central question that is addressed is: *How can innovative work behaviour be measured as a dynamic and context-bound construct?* From the theoretical conceptualization of the construct specific criteria for measurement are derived. These include the use of concrete work activities grounded in specific work contexts and the consideration of social and reflective components of innovation development. Furthermore, the instrument is applied and validated in two professional domains, that is, in the industrial sector and in vocational education. By realizing the dynamic and context-bound nature of innovative work behaviour in a measurement instrument, a deeper understanding as well as empirical support for the theoretical conceptualization of innovative work behaviour is provided. Furthermore, the instrument enables the investigation of determinants of vocational teachers' innovative work behaviour.

(5) *Facilitating vocational teachers' innovative work behaviour: Effects of social support and the mediating role of individual perceptions and motivation*

In this quantitative study an integrative model of facilitating factors for vocational teachers' innovative work behaviour is developed and tested. Accordingly, the question addressed in the study is: *Which individual and contextual characteristics facilitate vocational teachers' innovative work behaviour?* Based on previous research on creative and innovative work behaviour and using the Theory of Planned Behaviour as theoretical basis, vocational teachers' perceptions of responsibility, self-efficacy, and impact, as well as their perception of social support by the supervisor and the work climate are analysed as determinants of innovative work behaviour. Furthermore, vocational teachers' intrinsic motivation is included as a central antecedent of innovative work behaviour and as a mediating mechanism for the effects of individual perceptions and social support. The study contributes to a substantiated understanding of factors that determine vocational teachers' innovative work behaviour. This insight, in turn, is useful for school management and teachers in vocational colleges to derive practical steps that enhance their own and foster each others' contributions to innovation development.

In the final chapter, an integrative discussion of the findings of each contribution of this thesis as well as reflections on directions for future research and implications for work practice in vocational colleges are presented.

Chapter 2

Relations between Vocational Teachers' Characteristics of Professionalism and their Innovative Work Behaviour[1]

Introduction

Vocational colleges are faced with the results of ongoing economic and technological developments in our globalised society in several ways. First, the cognitive and cultural diversity of youngsters that enter this kind of education is increasing. Second, the workplaces are changing, for which these youngsters have to be prepared in school. Third, our society expects more of teachers in terms of education; it is expected that they prepare students not only for work but for life in general. In addition, changes in political behaviour, administration, and laws have an effect on the work in vocational colleges (Nieuwenhuis, Mulder, & Van Berkel, 2004).

As a consequence of all these changes and demands, vocational colleges must be responsive (Nijhof & Streumer, 1994) and innovations are required. Innovations are considered as products or processes that are new, applicable, and useful in a specific work context (Kanter, 1988). Innovations in vocational colleges can be new instructional objectives or didactic methods, changes in work processes such as collaboration between teachers, or new work tasks of teachers (Fullan, 2007). Innovations are not restricted to the classroom but include the wider context within and outside the school. In addition, it is crucial that innovations are developed for the requirements of a local school context. It has been argued that it is important to take into account the leading actors within a local school context in order to create a sustainable success of innovation development (Tuomi, 2007).

The development of innovations requires substantial contributions of individuals. Therefore it is important to understand their activities that lead to innovations. In organizational psychology these activities are referred to as innovative work behaviour (Janssen, 2000). With regard to the context of vocational colleges, the work activities teachers carry out in order to find new ideas for coping with challenges and problems at their school play an important role. The interactions of teachers as well as the support they provide each other are influential for realizing an idea.

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[1] This chapter is based on:

Messmann, G., Mulder, R. H., & Gruber, H. (2010). Relations between vocational teachers' characteristics of professionalism and their innovative work behaviour. *Empirical Research in Vocational Education and Training, 2*(1), 21–40.

In order to foster such behaviour, the individual requirements for these activities have to be understood. In research on expertise, knowledge is emphasized as a major determinant for performance (Berliner, 2001). In organizational approaches, the focus is on competences as individual capabilities to deal successfully with work tasks (Ellström, 1997). Although both perspectives differ with regard to their research approach, they share the notion that individual characteristics are an important prerequisite for successful work activities. Hence, they might also be an important prerequisite for innovative work behaviour.

In vocational colleges transformations do not only lead to new organizational structures, goals, and work tasks, but also to a revised picture of a professional teacher. Because teaching is a knowledge-intensive job, knowledge is an important prerequisite for performance. Thus, due to knowledge expansion and changes of performance standards (Simons & Ruijters, 2004), professional development is crucial for teachers, too.

There is little research which attempts to understand the activities teachers carry out in relation to the development of innovations. Our central research question therefore is: *What is the relation between vocational teachers' professional knowledge, professional performance, and professional development on the one hand and their innovative work behaviour on the other hand?*

Theoretical framework

Innovative work behaviour

While in economics there is a long tradition to conceive innovations as macro level phenomena (Schumpeter, 1942), organizational psychology emphasizes the individual perspective including the individual and contextual characteristics that determine the success of innovations (Anderson, De Dreu, & Nijstad, 2004). Based on West and Farr (1990), we define innovations as products or processes that are new, applicable, and useful for a certain individual, group, or organization. Innovations can differ with regard to the persons involved, the time required for its development, and the range of persons affected by the innovation.

In the context of vocational colleges innovations are significant changes and improvements of complex learning environments that include a redefinition of basic goals. Some of the relevant aspects of such learning environments are not restricted to the classroom context. There are aspects that are situated in the wider context within and even beyond a school. Examples of innovations in vocational colleges are new learning goals and methods, new work processes, collaboration between teachers, and cooperation with other schools, educational institutions, or companies.

A number of studies in work contexts investigated employees' *innovative work behaviour* which is defined as the sum of all work activities carried out by individuals during an innovation process. The *generation* of new and applicable ideas is a core part of this process, but such ideas have to be *realized* in practice as well (Janssen, 2000; Kanter, 1988). In educational settings innovations and innovative work behaviour are an important issue as well. However, analyses of teachers' work activities that are carried out to develop innovations are still missing. Although there is recognition of the crucial role of teachers in the development of innovations, it has not yet been investigated how teachers are involved in innovation processes and how their active contributions can be encouraged and fostered.

As teachers work both *inside* and *outside* the classroom, work activities related to innovations in both forms of contexts have to be focused on. Moreover, the participation in an innovation process has to be distinguished from innovative work behaviour. While it is likely that teachers at some stage are involved in an innovation process at their school, innovative work behaviour only refers to those work activities that are actually carried out in order to generate ideas or to support other persons in realizing their ideas. Only the latter is referred to as 'being innovative'.

For instance, a daily challenge in vocational colleges might be that teachers have to cope with a large number of students with motivational problems due to a lack of job perspectives. An 'innovative' teacher may therefore have an idea, how (s)he can motivate these students by involving them into realistic work situations. However, in order to realize this idea (s)he needs support: A necessary first step would be to introduce the new plans to colleagues, possibly by showing them some prepared sketches. Furthermore, (s)he may need the help of companies that offer materials and provide appropriate facilities. The teacher may also think of other schools that have the same problems and could be interested in joining the process. In addition, the teacher may need the permission and support of the school management. Taken together, the process may become increasingly complex with many persons involved. At some stage the teacher has to prove the success of the idea by showing results. In the end, this complex interaction of individuals may turn a simple idea into an innovation that significantly changes and improves the status quo.

Characteristics of professionalism
In order to foster innovative work behaviour it is important to understand the individual requirements of professionals for these activities. Professionalism can be broken down into three constructs:

- Professional knowledge
- Professional performance
- Professional development

Professional knowledge
The role of knowledge for performance was repeatedly emphasized in research on expertise. Qualitative and quantitative characteristics of expert knowledge were described and analysed in various domains (Berliner, 2001). A common distinction divides knowledge into declarative and procedural knowledge, into know-what and know-how (Ryle & Tanney, 2009). With regard to occupational knowledge this distinction refers to codified facts and concepts of the occupation and to rules and conditions of the practical application of this knowledge. Some researchers stressed the role of metacognitive knowledge, that is, knowledge about oneself and one's knowledge as well as about tasks, cognitive strategies, actions, and their regulation (Veenman, Van Hout-Wolters, & Afflerbach, 2006). Finally, workplace knowledge – knowledge about persons, resources, and traditions – is increasingly important to cope with constraints and affordances of the workplace (Billett, 2001).

With regard to teachers, Shulman's (1987) distinction between content knowledge, pedagogical knowledge, and curriculum knowledge underlines the importance of different

kinds of knowledge in this domain. Through work experience teachers acquire metacognitive knowledge (Kremer-Hayon & Tillema, 1999). Workplace knowledge is crucial for organizing classroom work and for coping with the social and organizational context of the school (Sternberg & Horvath, 1995). In sum, professional knowledge can be separated into three core dimensions:

- Occupational knowledge as a basis for standard professional performance in a specific domain
- Metacognitive knowledge as a requirement for self-regulation
- Workplace knowledge as a prerequisite for actions and interactions at work

Professional performance

The domain-specific ability to successfully solve work tasks is described in research on competence (Ellström, 1997). Successful performance depends on self-regulation in order to set goals and to plan and monitor one's actions (Veenman *et al.*, 2006). Collaboration was emphasized as an important characteristic of professional performance in order to solve work tasks more easily (Brown & Duguid, 1991).

In the domain of teaching, there are some studies that addressed teachers' influence on student success. Characteristics of good teaching are often based on normative performance standards that include high capabilities for problem-solving, improvisation or decision-making, self-regulation, and context sensitivity (Leinhardt & Greeno, 1986). Teachers' collaboration at school also was emphasized (Grangeat & Gray, 2008). Taken together, professional performance can be separated into three core dimensions:

- Occupational performance as the sum of one's standard occupational actions
- Self-regulation as all activities to plan and monitor actions
- Collaboration as all interactive activities at work

Professional development

As organizational structures and work tasks are changing, professionals cannot rely on their knowledge and performance standards, but have to continue to develop as professionals. Professionals have to keep in touch with the knowledge and performance standards of their particular domain. Therefore, adaptation to changes through occupational learning is an important issue (Simons & Ruijters, 2004). Moreover, reflection is a crucial activity to explain success and errors of past experiences and to plan future actions (Van Woerkom, Nijhof, & Nieuwenhuis, 2002). Finally, because the work context holds important social resources to learn with and from others, it is important to expand social relations at work and to improve the quality of existing relations (Van der Heijden, 2002).

In the domain of teaching, evidence exists about the importance of these aspects. Attwell (1997) argued that professionals in vocational education and training must adapt new roles and tasks such as the creation of conditions for organizational learning, reflection on professional activities, and collaboration with colleagues or clients. Sternberg and Horvath (1995) included reflective practice as part of a prototypical model of the expert teacher. Kwakman (2003) emphasized the importance of professional development in contexts of changes at schools and analysed factors that affect teachers' participation in professional learning activities such as reflection and collaboration. Moreover, Snow-Gerono (2005)

studied teachers' activities in professional development communities and emphasized that attempts to maintain and expand social relations at work are important for professional growth as well as for educational change. In sum, three core dimensions of professional development can be distinguished:

- Occupational learning, including activities to update occupational knowledge and performance standards and the growth of competences
- Reflection on experiences in order to plan future actions
- Social expansion containing the intensification of existing and the establishment of new social relations at work

Changes, challenges and innovations in vocational colleges have only rarely been investigated. Therefore, relations between vocational teachers' professional knowledge, professional performance, and professional development with their innovative work behaviour were investigated in a study.

Method

Participants and procedure

In fall 2007, all teachers of one German vocational college ($N = 60$) participated in a cross-sectional questionnaire study. The sample consisted of 38 males and 20 females (background information on two respondents is missing) with an average age of 44.33 years and an average work experience of 14.42 years (Table 1). The questionnaires were filled out by the teachers after a teacher conference at the beginning of the school year.

Table 1. Background characteristics of the vocational teachers

Gender	N	Age (*M*, *SD*)		Work experience (*M*, *SD*)	
Female	20	40.94	8.95	11.61	13.73
Male	38	46.03	10.35	15.86	11.29
Total	60*	44.33	10.12	14.42	12.21

Note. *Background information on two respondents is missing.

Item and scale development

A questionnaire consisting of 115 self-report items was developed to measure innovative work behaviour, professional knowledge, professional performance, and professional development. Based on a literature review, items were constructed in order to capture the different facets of teachers' work situations and corresponding activities. With regard to innovative work behaviour, a 2×2-matrix (tasks *idea generation* and *idea realization*; contexts *inside the classroom* and *outside the classroom*) was used to construct items. A 3×3-matrix (constructs *professional knowledge*, *professional performance* and *professional development*; dimensions *occupational*, *metacognitive* and *social*) was used to develop the measure for characteristics of professionalism.

Self-reports were used for assessment of work-related constructs in order to take advantage of teachers' familiarity with their own work and abilities compared to supervisor ratings. With regard to innovative work behaviour, supervisor ratings seem to be inappropriate, because they do not capture early stages of idea generation. For instance, if ideas are not applicable or not promising, they may be discarded or rejected by colleagues and are not communicated to

the supervisor. In order to investigate the dimensional structure of the constructs, factor analyses were conducted. The items of each of the four constructs were analysed separately.

Prior to the factor analyses, the following procedures were carried out to select items: The correlation matrix of the items was checked for correlations exceeding a certain minimum or maximum ($.20 < r < .80$). The Kaiser-Meyer-Olkin-Coefficient and the Measure of Sample Adequacy were calculated to check the adequacy of the item matrix ($KMO > .60$) and of the single items ($MSA > .60$). Bartlett's Test on sphericity was performed to secure that the matrix contains substantial inter-item-correlations. Communalities were calculated to check the reliability of the single items in the matrix ($h^2 > .60$).

In the factor analyses, principal axis factoring with a promax rotation was applied. An oblique rotation technique was chosen in order to take into account the theoretical linkages of the different dimensions of innovative work behaviour and professionalism. For the decision to extract factors the Scree Test and the Eigenvalue criterion (> 1) were used. Items were eliminated if they had loadings of .40 or larger on more than one factor.

The 13 extracted factors were then used as measurement scales for the corresponding dimensions of innovative work behaviour and professionalism. With regard to these scales, Cronbach's α ($\alpha > .60$) and item-scale-correlations ($r_{it} > .30$) were computed as indicators of internal consistency. Next, the measurement scales were transformed into variables by computing the means of the corresponding items of each scale. These variables were used for all further analyses. Finally, the Kolmogorov-Smirnov-Test was carried out with all 13 variables in order to check for normal distribution.

In the following paragraphs the item and scale development are described in detail for the four constructs innovative work behaviour, professional development, professional performance, and professional development.

Table 2. Factor structure and scale characteristics of the *innovative work behaviour* measure

Variable	Items	IC	OC	Scale characteristics			α if item deleted
				M	SD	α	
Inside the classroom (IC)	Last school year I used new approaches of supporting students.	.80		3.50	1.21	.90	.88
	Last school year I used new instruments to guide students.	.83					.87
	Last school year I used new methods for student assessment.	.67					.90
	Last school year I used methods that take into account characteristics of students.	.90					.87
	Last school year I used methods that take into account characteristics of students' future jobs.	.84					.87
Outside the classroom (OC)	Last school year I established cooperations with companies and other institutions outside school.		.64	4.23	1.17	.85	.81
	Last school year I established new collaborations at my school.		.81				.80
	Last school year I used insights from lectures and professional development courses for changes at school.		.82				.76
	Last school year I used insights from journals for teachers for changes at school.		.69				.82

Note. 6-point Likert scales were used (1 = 'applies not at all', 6 = 'fully applies'). $N = 60$. Factor loadings below .40 are suppressed.

Innovative work behaviour. Thirty-four items were formulated that represented the two tasks *idea generation* and *idea realization* in the two contexts *inside the classroom* and *outside the classroom*. In the factor analysis, two separate factors for the contexts inside and outside the classroom were found. However, a separation of idea generation and idea realization was not possible, in both contexts items of the two tasks loaded on the same factor. Due to the similarity of these items it was decided to exclude all items that represented idea generation. Therefore, the remaining nine items associated with the two factors *innovative work behaviour inside the classroom* and *innovative work behaviour outside the classroom* only contained items related to idea realization (Table 2).

Professional knowledge. The measure for this construct consisted of thirty-one items that represented the dimensions *declarative* and *procedural occupational knowledge*, *metacognitive knowledge*, and *workplace knowledge*. In the factor analysis, five factors were extracted. Twenty items were associated with these factors. Contrary to the assumed factor structure, workplace knowledge was represented by two factors: The first factor was related to knowledge about needs of other persons. The second factor represented knowledge about constraints and affordances of the workplace (Table 3).

Table 3. Factor structure and scale characteristics of the *professional knowledge* measure

Variable	Sample item	DOK	POK	MK	WK1	WK2	Scale characteristics			α if item deleted
							M	*SD*	*A*	
Declarative occupational knowledge (DOK)	I am able to find concrete examples for abstract topics.	.64					4.89	.66	.88	.84
		.85								.81
		.81								.86
		.88								.81
Procedural occupational knowledge (POK)	I know how to use my educational knowledge for lessons.		.45				4.83	.58	.87	.83
			.63							.82
			.61							.86
			.63							.85
			.66							.83
Metacognitive knowledge (MK)	I know how I can acquire subject-specific contents for lessons.			.69			4.96	.60	.85	.78
				.61						.79
				.64						.77
Workplace knowledge 1 (WK1)	I know how I have to respond to my colleagues' needs.				.77		4.80	.59	.82	.74
					.62					.79
					.79					.74
					.69					.81
Workplace knowledge 2 (WK2)	At my school, I know how I can exploit useful information for work.					.67	4.28	.80	.78	.72
						.77				.77
						.66				.68
						.48				.71

Note. 6-point Likert scales were used (1 = 'applies not at all', 6 = 'fully applies'). *N* = 60. Factor loadings below .40 are suppressed.

Professional performance. Thirty items were formulated to measure this construct. These items represented the dimensions *occupational action*, *self-regulation*, and *collaboration*. In the factor analysis, three factors were extracted that represented the three assumed dimensions. Fifteen items were associated with these factors (Table 4).

Table 4. Factor structure and scale characteristics of the *professional performance* measure

Variable	Sample item	OA	SR	CO	Scale characteristics			α if item deleted
					M	SD	α	
Occupational action (OA)	So far, I was able to recognize problems and critical situations in class quickly.	.69			4.81	.60	.90	.88
		.84						.88
		.78						.87
		.54						.89
		.90						.87
		.56						.89
		.73						.88
Self-regulation (SR)	So far, I always pursued a concrete goal in my lessons.		.71		4.90	.63	.87	.85
			.69					.87
			.89					.82
			.84					.82
			.54					.85
Collaboration (CO)	When I work together with colleagues, I am usually good at the coordination of tasks.			.71	4.33	.80	.80	.81
				.70				.73
				.92				.59

Note. 6-point Likert scales were used (1 = 'applies not at all', 6 = 'fully applies'). *N* = 60. Factor loadings below .40 are suppressed.

Professional development. This construct was measured by twenty items that represented the dimensions *occupational learning*, *reflection*, and *social expansion*. In the factor analysis, three factors were extracted that represented the three assumed dimensions. Fourteen items were associated with these factors (Table 5).

Table 5. Factor structure and scale characteristics of the *professional development* measure

Variable	Sample item	OL	RE	SE	Scale characteristics			α if item deleted
					M	SD	α	
Occupational learning (OL)	I invest much time to inform myself about teaching methods in professional journals.	.60			3.79	1.10	.89	.85
		.56						.86
		.85						.85
		.92						.87
Reflection (RE)	I use discussions with colleagues to get a picture of the quality of my teaching.		.73		4.37	.84	.84	.78
			.63					.81
			.74					.81
			.67					.82
			.73					.80
Social expansion (SE)	I invest much time to establish contacts with other schools.			.63	3.88	1.00	.82	.80
				.75				.79
				.66				.75
				.53				.77
				.58				.78

Note. 6-point Likert scales were used (1 = 'applies not at all', 6 = 'fully applies'). *N* = 60. Factor loadings below .40 are suppressed.

Relations between the three professionalism constructs. A second order factor analysis was carried out in order to analyse whether the 11 primary factors of professionalism could be associated with general factors. Factor values of the 11 primary factors were computed and entered into the second order analysis (Table 6).

Two factors were identified. The first factor represented the *occupational dimension of professionalism*. Declarative and procedural occupational knowledge, occupational action and occupational learning were associated with this factor. However, workplace knowledge about

constraints and affordances was associated with this factor as well. The second factor represented the *metacognitive* as well as the *social dimension of professionalism*. Metacognitive knowledge, self-regulation, and reflection as well as workplace knowledge about needs of other persons and social expansion were associated with this factor. Collaboration was not associated with any of the secondary factors.

Table 6. Secondary factors of professionalism

Primary factors	Secondary factor 1	Secondary factor 2
Declarative occupational knowledge	.91	
Procedural occupational knowledge	.61	
Metacognitive knowledge		.52
Workplace knowledge 1		.73
Workplace knowledge 2	.83	
Occupational action	.90	
Self-regulation		.53
Collaboration		
Occupational learning	.58	
Reflection		.86
Social expansion		.42

Note. Factor values of the primary factors were used. $N = 60$. Factor loadings below .40 are suppressed.

As the aim of the study was to identify relations of innovative work behaviour with different characteristics of professionalism, it was decided to use the primary factors for further analysis. The implications of two secondary factors will be discussed in the concluding section.

Analyses

First, a descriptive analysis was made. In addition to values of the background characteristics *gender*, *age*, and *work experiences* (Table 1), mean values of the two dependent variables *innovative work behaviour inside the classroom* and *innovative work behaviour outside the classroom* as well as of the 11 independent variables related to professional knowledge, performance, and development were calculated.

Next, a correlation analysis was carried out. Here, the two dependent variables, the 11 independent variables, and the three background variables were taken into account. Based on these results a hierarchical multiple regression analysis was conducted. Two separate regression models for the dependent variables *innovative work behaviour inside the classroom* and *innovative work behaviour outside the classroom* were specified. Variables were included in the regression analyses if they had shown significant correlations with the dependent variables. A hierarchical procedure was chosen to take into account the amount of variance explained by background variables, knowledge-related variables, performance-related variables, and development-related variables. First, all variables of a particular block were entered into the regression model. Next, the variable with the lowest beta-weight was excluded. This procedure was repeated until only predictors with beta-weights of at least .20 remained in the model. Then, the next block of variables was added and the whole procedure was repeated for these variables.

Table 7. Scale inter-correlations of professional knowledge, performance, and development and innovative work behaviour

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Declarative occupational knowledge	—											
2. Procedural occupational knowledge	.62**											
3. Metacognitive knowledge	.45**	.63**										
4. Workplace knowledge 1	.25	.41**	.49**									
5. Workplace knowledge 2	.43**	.44**	.47**	.30*								
6. Occupational action	.69**	.82**	.60**	.35**	.46**							
7. Self-regulation	.31*	.68**	.49**	.46**	.19	.60**						
8. Collaboration	-.11	.03	.22	.45**	.04	.07	.26*					
9. Occupational learning	.44**	.57**	.52**	.19	.27*	.60**	.53**	.16				
10. Reflection	.05	.21	.34**	.42**	.09	.23	.31*	.49**	.19			
11. Social expansion	.08	.33*	.50**	.26*	.27*	.30*	.32*	.46**	.64**	.34**		
12. IWB Inside the classroom	.27*	.37**	.44**	.12	.24	.44**	.35**	.20	.48**	.42**	.48**	
13. IWB Outside the classroom	.31*	.50**	.55**	.28*	.27*	.48**	.32*	.13	.64**	-.00	.49**	.44**

Note. *p* < .05, **p* < .01. *N* = 60. **IWB** = innovative work behaviour.

In order to take into account strong correlations between predictors in the model ($r > .60$), a decision for one predictor was made based on theoretical considerations and on the strength of the relation with the dependent variable.

Results

The mean scores of the 13 analysed variables ranged from 3.50 to 4.96. The corresponding variables of professional knowledge and performance had the highest means (4.28–4.96) followed by those of professional development (3.79–4.37). Compared to knowledge and performance, the means of innovative work behaviour inside the classroom ($M = 3.50$) and innovative work behaviour outside the classroom ($M = 4.23$) were also lower.

Correlation analyses provided information about the relations of background variables and independent variables with innovative work behaviour both inside and outside the classroom. Age was positively related with innovative work behaviour inside the classroom ($r = .43$, $p < .01$). Work experience was positively related with innovative work behaviour inside ($r = .34$, $p < .05$) and outside the classroom ($r = .30$, $p < .05$). With the exception of collaboration, all variables of professional knowledge, professional performance, and professional development were substantially related to innovative work behaviour in at least one of the two contexts. If the strength of these relations is taken into account, the most important variables were *procedural occupational knowledge*, *metacognitive knowledge*, *occupational action*, *occupational learning* and *social expansion*.

The correlation analysis also showed how the variables of the three constructs concerning professionalism were related to each other (Table 7). The five knowledge variables were significantly related with only one exception. The performance variables and the development variables were, with only few exceptions, substantially related to each other. However, positive relations with the corresponding variables of the other constructs were also found. In some cases these relations were even larger than the correlations within constructs. Professional knowledge, professional performance, and professional development seem to be interdependent constructs.

The regression analyses provided insight into the weighted importance of the relations of background and independent variables with innovative work behaviour (Table 8).

Table 8. Hierarchical multiple linear regression models for innovative work behaviour

Innovative work behaviour inside the classroom				Innovative work behaviour outside the classroom			
Age	.43**	.35**	.33**	Work experience	.30*	.21	.10
Metacognitive knowledge		.41**	.21	Metacognitive knowledge		.54***	.35**
Reflection			.27*	Occupational learning			.38**
Social expansion			.22				
R^2	.17**	.32***	.41***	R^2	.07*	.34***	.43***
ΔR^2		.15	.09	ΔR^2		.27	.09

Note. All betas are standardized. *$p < .05$, **$p < .01$, ***$p < .001$. $N = 60$.

With regard to innovative work behaviour inside the classroom ($R^2 = .41$, $p < .001$), age was the strongest predictor ($\beta = .33$, $p < .01$), but reflection explained a significant amount of variance as well ($\beta = .27$, $p < .05$). In addition, metacognitive knowledge and social expansion proved to be important predictors ($\beta > .20$). Due to their own close relation ($r = .50$, $p < .01$)

and to their relation with reflection ($r = .34$, $p < .05$), their predictive effect was not significant, however.

In the regression model for innovative work behaviour outside the classroom ($R^2 = .43$, $p < .001$), occupational learning explained the most variance ($\beta = .38$, $p < .01$). In addition, metacognitive knowledge was a significant predictor ($\beta = .35$, $p < .01$). Work experience contributed significantly only if analysed independently of other variables. The variables measuring professional performance did not explain a significant amount of variance in the two regression models.

Discussion

Innovations play an increasingly important role in work contexts such as vocational colleges. As the development of innovations always includes contributions of individuals, it is important to know what activities individuals carry out during their work in order to generate, promote, and realize ideas. In order to foster these activities, it is important to identify characteristics of teachers which are substantial prerequisites for these activities. Therefore, different aspects of vocational teachers' innovative work behaviour as well as their professional knowledge, professional performance, and professional development were investigated.

Large mean scores of most variables indicated a positive bias of the teachers' self-reports. The use of self-reports on work-related constructs may have provoked attempts to present oneself in a favourable light. Moreover, self-reports on performance may not have captured performance but only reflections about performance. Therefore, performance measures in which participants have to solve context-specific tasks based on realistic cases can be an alternative for future research. However, due to the exploratory character of the study and the greater insight this approach permits, self-reports were justifiable. The particularly large mean scores of professional knowledge and professional performance can be explained by teachers' professional self-concept. While knowledge and performance seem to be a natural part of teachers' self-conceptualizations, professional development and innovative work behaviour obviously are less pronounced, as their comparably lower means indicated. Hence, these aspects should be emphasized more in teacher education and further learning.

With regard to the development of the instrument, the factor analyses showed that the scales adequately represented the theoretically assumed structure of the constructs. However, some deviations from the theoretical conceptualizations occurred. With regard to workplace knowledge, the two empirically identified dimensions *needs of other persons* and *workplace constraints and affordances* have to be taken into account in future investigations. Taken together, the factor analyses provided some support for our operationalization of professionalism as a basis for further studies.

The second order factor analysis showed that the professionalism variables can be associated with general factors. These represented the occupational as well as the metacognitive and social dimension of professionalism. This finding emphasizes the complexity of the operationalization of professionalism. If the aim in an operationalization process is to include many variables, many different aspects such as relations to other constructs or the theoretical structure of professionalism can be investigated. A number of

different kinds of relations between variables can be identified. The correlation analyses confirmed that positive relations exist within the three constructs of professionalism as well as across the constructs. Professional knowledge, professional performance, and professional development obviously are interdependent constructs – within the common construct 'professionalism'.

In the operationalization of innovative work behaviour, a domain-specific approach was chosen that focused on innovative products and processes in the work context of vocational teachers. The advantage of this approach is that the relation to a specific work context is already included in the items. The downside is that items related to different tasks of innovative work behaviour tend to be very similar, which can cause methodological problems. Therefore, an alternative for future studies on innovative work behaviour can be a more general measure that focuses on concrete work activities. In order to relate work activities to innovation development and to a specific domain, context-specific cases and the activation of personal experiences with processes of innovation development might prove useful. With regard to the two scales that represented innovative work behaviour in this study, only the realization of ideas was included. However, since the realization of ideas is the last step of innovation development, this might be acceptable.

The correlation analysis showed which variables significantly relate to innovative work behaviour. Positive relations of background variables and of professionalism variables with innovative work behaviour were found. Based on these results, the regression analysis revealed which variables are most important in predicting innovative work behaviour. Regarding innovative work behaviour inside the classroom, age, metacognitive knowledge, reflection, and social expansion were the most important predictors. Age possibly is related with work experience and thus may help to develop innovations inside the classroom. With increasing age, teachers have more insight into student interests, characteristics of their future jobs, and routes to adapt one's teaching behaviour to changing circumstances. Reflection possibly is important for examining one's own experiences in order to use them for the development of innovations. Younger teachers may not be as capable as older teachers to reflect on their work. Consequently, they are less able to develop innovations. Social expansion can support the emergence of innovations inside the classroom. In particular in vocational education with its complex links to the labour market it has been claimed that learning environments have to take into account characteristics of future jobs (Messmann & Mulder, 2009).

Concerning innovative work behaviour outside the classroom, work experience, metacognitive knowledge, and occupational learning were most important. Vocational teachers with more work experience tend to be more devoted to the development of innovations outside the classroom. Possibly, a more elaborated perspective on their job as well as useful contacts inside and outside school were helpful here. These teachers possibly have routines available that help to use resources required for the development of innovations. Even more important were metacognitive knowledge and occupational learning. Metacognitive knowledge provides insight into one's work-related strengths and weaknesses and into strategies to cope with shortcomings that may be particularly useful to identify needs

and opportunities for changes. Engaging in occupational learning on-the-job and off-the-job can be an important resource for generating new ideas.

Taken together, the results support the idea that characteristics of professionalism are crucial to foster innovative work behaviour and the development of innovations in work contexts. Possibly, work experience and age of teachers strongly influence innovative work behaviour. However, the ascribed role of professional development shows that the picture is much more complex: Vocational teachers have to learn and have to be engaged in professional development activities on-the-job and off-the-job. To establish, expand, and improve social work contacts is part of this process, too. So far, research paid too little attention to the ability and willingness of subjects to continue learning during their whole professional life. As the metacognitive dimension of professionalism and the ascribed roles of metacognitive knowledge and reflection showed, teachers, teacher educators, and school leaders have to be simultaneously aware of many components of professionalism, in particular in complex contexts and eras of change.

Chapter 3

Innovative Work Behaviour in Vocational Colleges: Understanding How and Why Innovations are Developed[2]

Introduction

As a consequence of societal transformations such as economic development and technological specialization, the labour market and work environments are changing rapidly. These changes are particularly relevant for vocational colleges because they are expected to prepare students for future jobs. Vocational colleges function as a link between the general educational system and the labour market. This linking function is particularly important in Germany, since on average more than 60% of the students within one age group are entering the vocational system. However, this transition is difficult for three reasons. Firstly, it is difficult for young people to select an occupation and find apprenticeship training because of a shortage of training positions and because of new job profiles with higher job requirements that are replacing classic arts and crafts jobs. In addition, companies have high demands on apprentices such as being competent, motivated, communicative, flexible, or mobile. Secondly, the increased cognitive and cultural diversity of youngsters entering vocational colleges and their problems, needs, and goals make it more difficult to prepare all students adequately for their future jobs (BMBF, 2010). Finally, increased demands on vocational education to prepare students for future jobs and for life, lead to additional tasks for teachers such as providing guidance, facilitating reflection, collaborating with colleagues, and creating conditions for organizational learning (Attwell, 1997).

Vocational colleges and teachers must be responsive towards societal transformations to provide optimal learning opportunities and job preparation for students (Nijhof & Streumer 1994); therefore, innovations that help solving these problems and challenges are necessary. Innovations can be products or processes that are new and useful in a particular work context (Messmann, Mulder, & Gruber, 2010). To develop innovations that are adequate and sustainable in single schools, teachers are required to be innovators that search for applicable ideas and opportunities for change in their work context (Randi & Corno, 1997). Although the active involvement of teachers in the development of innovations was already claimed 40 years ago (Deutscher Bildungsrat, 1970), from a perspective of practice this claim is still not

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[2] This chapter is based on:
  Messmann, G., & Mulder, R. H. (2011). Innovative work behaviour in vocational colleges: Understanding how and why innovations are developed. *Vocations and Learning, 4*(1), 63–84.

self-evident for many teachers (Messmann *et al.*, 2010). However, if schools and educational administrators are interested in sustainable innovations that meet the requirements of local contexts, an emphasis on teachers as developers of innovations is required.

Consequently, a useful perspective to inform these deliberations is the research on innovative work behaviour. This research focuses on employees' contributions to innovation development and on the work activities they carry out to address work-related problems and challenges (De Jong & Kemp, 2003; Janssen, 2000; Scott & Bruce, 1994). The ideas employees develop to change and improve existing practices are an important part of these activities. This research perspective provides answers to the question *how* innovations are developed. In addition, these studies investigate factors that facilitate innovative work behaviour. However, the question *why* employees are activated to initiate innovation development is not fully addressed. To investigate these two aspects a study was conducted that aimed at finding out *how and why innovations are developed in the work context of vocational teachers.*

In the theoretical framework advanced here, characteristics of innovations, innovative work behaviour, and triggers for this behaviour are analysed theoretically. In the empirical section, a study is presented in which qualitative interviews on these topics were conducted with teachers in German vocational colleges. In the final section, the theoretical analysis and the empirical results are discussed to answer the addressed research question and to identify implications for practice and future research.

Characteristics of innovations in work contexts

This section examines different perspectives on *innovations* and provides a definition of the term to establish a premise for the further discussion. Based on this definition, innovations in schools, particularly in vocational colleges, will be investigated.

Perspectives on innovations

Research on innovations has its origins in economic sciences and is particularly linked to Schumpeter (1942) who argued that innovations can be described as a process of creative destruction. This term refers to an equilibrium model between phases of incremental innovations used by established firms as an entrance barrier against newcomers and phases of radical innovations that function as a gateway for entries into an industry (Dowling & Ruefli, 1992). Following this tradition, macro approaches were developed that use whole organizations as units of analysis. In these approaches, innovations are closely linked to economic growth and organizational success. Factors such as market dynamics, innovation management, and innovation diffusion are emphasized. Although contributions of individuals are not central in these approaches, social aspects of innovation processes are taken into account (Von Hippel, 1995).

In micro approaches on innovations that mainly stem from organizational psychology, individuals play an important role (Anderson, De Dreu, & Nijstad, 2004). Innovations are not merely seen as important for organizational functioning; they also lead to benefits for employees such as appropriate job demands, resources, communication, and job satisfaction (Janssen, 2000). Here, innovations are related to the intentional introduction and application

of new ideas, processes, products, or procedures within a particular unit of adoption (West & Farr, 1990). To promote and foster innovations at work, this research focused on individual and contextual determinants for successful implementation (Anderson *et al.*, 2004). Moreover, the generation of new ideas was investigated by research on creativity (Sternberg & Lubart, 1999), stating that "creativity is the ability to produce work that is both novel (...) and appropriate" (p. 3). At the same time, conceptual linkages between creativity and the innovation process were established by describing the latter as a two-component, non-linear process encompassing the development of new ideas followed by their application (West, 2002). By integrating these two components in a holistic approach, it can be understood how the creative efforts of employees contribute to the development of innovations in their work context, and why these innovations are successful or not within the wider organizational context.

Based on this analysis, we define innovations as *products or processes that are new and applicable for a certain individual, group, or organization and that are useful for the same or a different individual, group, or organization*. This definition takes into account that the meaning of an innovation depends on the unit of analysis. The decision to label products and processes as innovations is related to their use in a particular context in which it leads to a significant change of practice. Therefore, innovations are not limited to inventions or radical novelties but can originate from existing ideas as long as they are applicable and new for the particular unit of adoption and contain a redefinition of basic assumptions and goals (Messmann *et al.*, 2010).

Innovations in vocational colleges
In educational contexts and particularly in schools, innovations are useful products or processes that foster the quality and outcome of learning processes. Fullan (2007) argues that a successful innovation must take into account three dimensions: the use of new or revised materials, the use of new teaching approaches, and the alteration of pedagogical beliefs.

Research on innovations in schools has a strong focus on systemic innovations, large scale reforms or projects based on externally designed innovations. These approaches are important for the development of educational practice at large. For instance, in a comparative study in six countries, the Centre for Educational Research and Innovation of the OECD (2009) investigated innovations in vocational colleges from a systemic perspective. The main conclusion was that a systemic approach was helpful to enable and foster system-wide innovations. However, a complementary approach that focuses on innovations developed for the needs of a local context is required as well. A closer look at innovation processes within single schools would be helpful to understand how innovations are adjusted to the requirements of local contexts and how they function as solutions and improvements for local problems and challenges.

In addition, the focus of existing research is often limited to products and processes related to the classroom context (Geijsel, Sleegers, Van den Berg, & Kelchtermans, 2001). However, classrooms do not exist in a vacuum but are closely related to the wider context outside the classroom and also outside the school. The OECD-study (2009) identified several fields inside and outside the classroom in which innovations can take place. In addition, Hargreaves

(1997) emphasized that reculturing and restructuring schools as well as organizational learning are important facets of innovations in schools.

In vocational colleges, the context outside the classroom is particularly important (Mulder, 2004). Only if external factors, that is, characteristics of society, the labour market, and the school environment are taken into account, the complexity of real life problems can be integrated into the design of learning environments, which is important to provide adequate job preparation for youngsters. Two aspects have to be taken into account here: Firstly, learning environments must be related to competences that are required for the accomplishment of work tasks and contain opportunities for actual work experiences, because if learning environments are relevant for students' future jobs, students will perceive the learning process as meaningful and motivating. Secondly, learning environments must be related to students' needs, interests, and personal context, because if learning environments are personally relevant and optimally challenging for students this will also make their learning process meaningful and motivating. In order to develop learning environments that are job-oriented and student-oriented, collaboration between teachers as well as cooperation of schools and companies are essential to capture the complexity of real life work tasks. The vital collaboration with students is important here as well. If learning environments are developed within and for a specific context by the local actors such as teachers, school managers, or students, they are more likely to be relevant, meaningful and, thus, motivating for students (Messmann & Mulder, 2009).

In the analysis so far it has been proposed that a closer examination at the micro level of educational systems such as single schools can be helpful to gain insights into the relation between problems, challenges, and requirements of local contexts. This information is important to understand how individuals are involved in the development of innovations. These aspects will be analysed in the following sections.

Conceptualizing innovative work behaviour

In this section, the concept of *innovative work behaviour* is discussed as a perspective on innovation development that emphasizes the contributions of individuals and the importance of tying innovations to a specific context of use. Starting from tasks required for innovation development, a typology for the analysis of related work activities is proposed and then put into the context of vocational teachers' work.

Tasks required for innovation development

By describing four integrated tasks that must be accomplished to develop an innovation, Kanter (1988) offered a holistic approach that integrates the processes of creation and application of ideas. These tasks are idea generation, coalition building, idea realization, and transfer. Individuals play an important role for accomplishing these tasks. While the first three tasks refer to innovation development more specifically, the transfer task refers to the diffusion of a developed innovation to other contexts within or outside an organization. From the perspective of that new context, the transfer task refers to a separate process of innovation development with different contextual characteristics such as the persons involved and the resources available.

Studies based on this approach analysed the corresponding work activities of employees related to these tasks (Janssen, 2000; Scott & Bruce, 1994) and defined the sum of these activities as *innovative work behaviour*. Three activity dimensions that resemble Kanter's tasks are distinguished: *Idea generation* contains the production of new and useful ideas in a particular domain. *Idea promotion* involves the diffusion of ideas or developed innovations to other contexts. Furthermore, it includes finding allies and sponsors that can help to realize the idea. *Idea realization* is the production of a prototype or a model of the innovation that can be experienced by others.

However, most of the studies on innovative work behaviour did not contain a detailed analysis of employees' work activities but ended with an analysis of activity dimensions. What employees specifically do to accomplish the related tasks was not analysed. This aspect remained rather vague and was at most described theoretically. Therefore, little is known about specific actions and cognitions of employees that take place during the process of innovation development.

A typology of work activities

To fully understand innovative work behaviour, it is necessary to describe and analyse employees' work activities they carry out to generate, promote, and realize ideas. Therefore, information is required about what employees do to detect and analyse problems, identify opportunities for change, collect and come up with ideas, acquire necessary information, find support, work out examples, or experiment with prototypes. Also, to be able to analyse these activities, a conceptualization of innovative work behaviour must contain a clear typology of work activities. This typology includes two basic assumptions and spans a 2×2-matrix of interrelated activities (Table 1).

Table 1. Typology of work activities

| | | Type of activity | |
		Physical	Cognitive
Activity setting	Individual	*Individual physical activities*, e.g. reading a journal, making sketches	*Individual cognitive activities*, e.g. reflecting about an article or thinking out an idea
	Social	*Social physical activities*, e.g. discussing a problem with a colleague, giving input to a client	*Social cognitive activities*, e.g. reflecting about feedback, further thinking about an idea discussed

The first assumption refers to the distinction of two *types of activity* and implies that activities can be either overt or mental (Eraut, 2000; Simons & Ruijters, 2004). The first type of activity contains all *physical activities*, that is, everything that somebody is doing and that is observable by others. These physical activities lead to or are accompanied by the second type of activity that contains all *cognitive activities,* that is, all cognitive processes necessary either to reflect on physical activities and experiences in general or to generate new knowledge and ideas. The second assumption refers to the distinction of two *activity settings* and implies that activities can be carried out either solitarily or in a social setting (Kwakman, 2003; Meirink, Meijer, Verloop, & Bergen, 2009). Work activities carried out in a setting where one is not influenced by other persons are referred to as *individual activities*. Work activities carried out

in a setting that contains a direct interaction with others or where one is influenced by other persons are called *social activities*. In this typology, the individual is the unit of analysis and the activities of individuals are analysed.

Examples of *individual physical activities* are actions carried out for enquiry such as searching the internet, reading books, journals, or newspapers or actions carried out to elaborate on an idea such as making notes or sketches. *Individual cognitive activities* are either reflective actions such as thinking about an article in the news or a concept one has worked out previously, or, they may well be generative actions such as thinking about possible solutions for a problem or ideas for a new course design.

With regard to *social physical activities*, typical examples are talking to a colleague about experiences with a particular concept, discussing how a common work-related problem can be approached or which steps are necessary to realize an idea. They also can be interactions such as giving input to a client or receiving feedback from one's supervisor. *Social cognitive activities* can either be reflective activities such as thinking about the conversation with a colleague, the advice given to a client or the feedback received from one's supervisor; or they can be generative activities such as further thinking about a new perspective on approaching a problem that emerged during a discussion.

The typology advanced above is helpful to understand and analyse the complexity of work activities related to innovation development. In addition, the typology leads to a comprehensive definition that describes innovative work behaviour as *the sum of all physical or cognitive work activities employees carry out solitarily or in a social setting in order to generate, promote, and realize ideas that are new and applicable to their specific work context* (Messmann *et al.*, 2010).

Innovative work behaviour in vocational colleges
In existing research on innovations in schools, individual contributions are underrepresented. The focus instead privileges the investigation of drivers and barriers for the implementation of externally designed innovations (Geijsel *et al.*, 2001; OECD, 2009) with teachers considered as users of innovations. In this respect, Hargreaves (1997) noted that the "very language of implementation makes teachers mere tools of other people's purposes" (p. 110) which may also affect success and sustainability of innovations negatively. Therefore, a bottom-up approach that takes into account specific needs and conditions of local school contexts is required to address this shortcoming.

With the exception of few case studies that mention teachers as initiators of innovations (Pugh & Zhao, 2003), the development of innovations in schools has not been analysed from the perspective of single schools that deliberately takes into account teachers' work activities. Furthermore, research on innovations in vocational education has been underrepresented compared to general education (OECD, 2009). However, vocational teachers have important roles and tasks at all levels of a school including the development of innovations (Attwell, 1997). By acting on problems and challenges at work they may be able to find innovative solutions that fit to their context. Applying a micro perspective on innovation development in vocational colleges may be helpful to understand the creative and productive contributions of

teachers. Moreover, this perspective empowers teachers as crucial actors for the development of sustainable innovations in local school contexts.

In summary, it has been proposed in this section that an analysis of employees' work activities related to innovative ideas can be useful to understand how they respond to problems and challenges in their work context.

Triggers for innovative work behaviour

In this section, a theoretical conceptualization of *triggers* for innovative work behaviour is developed by taking a look at the interaction of opportunities and needs that exist in work contexts. This conceptualization will then be discussed for the context of vocational colleges.

Interaction of opportunities and needs

Studies on innovative work behaviour provided insight into determinants of this behaviour, but did not explain directly why persons initiate and become actively involved in innovation processes (Janssen, 2000; Scott & Bruce, 1994). However, insight into the causation of innovative work behaviour is important to understand why people either initiate and actively participate in innovation development, join and accept innovation processes, or remain passive and refuse innovations.

Kanter (1988) claims that the first step of any innovation process is the activation of persons that "sense or seize new opportunities" (p. 173) that exist in employees' work context. The work context contains multiple components such as colleagues, supervisors, clients, work tasks and related rules, organizational traditions as well as all material resources such as rooms, facilities, tools, and finances. Therefore, the scope of opportunities can range from a single workplace to a whole organization. Opportunities exist if a work context is characterized by an open climate with high expectations and possibilities to develop new things. For instance, strong support between colleagues, exchange between supervisor and subordinates, or the organizational culture can create opportunities (Choi, 2007; De Jong & Kemp, 2003). In addition, if a work context is characterized by problems and challenges that impede the accomplishment of work tasks, this can lead to increased opportunities as well (Smith, 2003). For instance, if an organization does not produce the expected outcomes, if clients are dissatisfied, or if the overall level of success is decreasing, this can lead to high work load, less autonomy, tensions between supervisor and subordinates as well as increased competition between colleagues. These conditions will affect the work of employees in this organization negatively and create opportunities for innovations. However, existing opportunities in one's workplace do not yet explain the decision to innovate.

Individuals must react to these opportunities, become interested, and develop a *need* for innovation to become active *innovators*. For instance, a strong need for job-related self-actualization can explain why employees seek opportunities for change and improvement (King, 1990). In addition, employees' attitude towards innovations can explain why they become interested, develop a sense of curiosity, become motivated and actively seek these opportunities (Morrison & Phelps, 1999). Moreover, personality characteristics have been proposed as antecedents of proactive work behaviour (Parker, Williams, & Turner, 2006). Furthermore, employees' need for job satisfaction and a felt responsibility can explain why

they seek opportunities to develop new things and act on problems and challenges in their work, the work of others, or the whole organization (Choi, 2007).

Opportunities and needs in vocational colleges
With regard to triggers for innovative work behaviour in vocational colleges, it is important to examine the opportunities that exist in the everyday work context of a school. One example from the classroom context is the various opportunities to develop new instructional materials. Problems with students due to high dropout or low motivation can create opportunities as well. Moreover, opportunities that exist in the context outside the classroom have become increasingly important. The decisions and activities in this context also influence the classroom context. For instance, the support of supervisors or colleagues enables opportunities for change in the classroom. In return, if social relations and exchange are less positive this can create opportunities as well. For example, when the amount of collegial exchange is low and competition is high, opportunities to improve this condition arise. With regard to characteristics of a school, the given resources and policies can also create opportunities. For instance, if teachers' work inside and outside the classroom cannot be accomplished smoothly due to a lack of resources or restricting policies, this will lead to opportunities for change and improvement. Taken together, the innovative capacity of a school is determined by the objective and subjective characteristics of the work context (Van den Berg, Vandenberghe, & Sleegers, 1999).

However, to explain why teachers become innovators we must take a look at their personal characteristics and at their reactions to the opportunities available. From an individual perspective, opportunities may either arouse teachers' interest, force them to pay attention, or remain unrecognized. In this respect, teachers' attitudes, experiences, and concerns as well as their personality may be important (Ghaith & Yaghi, 1997). With regard to the classroom context, a teacher will only explore opportunities for improvement of the learning environment if this facilitates the accomplishment of job-related goals and needs such as self-actualization or job satisfaction. In addition, whether or not a teacher reacts to problems with students is also influenced by these factors. Outside the classroom teachers' attitude towards professional development and the felt responsibility to participate in school development will determine whether opportunities are recognized or sought after.

It follows therefore, that to identify *how* and *why* innovations are developed in the work context of vocational teachers, a detailed analysis of teachers' *innovative work behaviour* and *triggers* for this behaviour is now required.

Method
Participants
The study was carried out in the German vocational system. A characteristic feature of this system is that it is a dual system in which students work for a company and spend part of their time in vocational colleges. Vocational teachers' work takes place almost exclusively at school; although a strong interaction between teachers and companies is part of the idea of this apprenticeship system, this is not often the case. The sample of the study consisted of 9 teachers from 6 different vocational colleges in Bavaria that each employs between 60 and 90

teachers. Four of the teachers were females. The teachers' average age was 45.44 years ($SD = 7.44$). The average work experience as a teacher was 16.11 years ($SD = 7.25$). The sample represented different perspectives from different domains such as engineering or commercial and administrative training. Moreover, different hierarchical levels of a school were represented: The teachers were either working as teachers ($N = 3$), as teachers and as members of the school administration ($N = 3$) or as teachers and as school leaders ($N = 3$). Teachers were selected as experts if they had been actively involved in the development of innovations. For instance, in this sample some teachers were involved in a state funded project where learning environments were designed that fit for the needs of youngsters without apprenticeship training. Other respondents had been members of a state administered institution responsible for developing and supporting school innovations. Furthermore, selected teachers could also nominate colleagues for interviews. In all cases, the crucial criterion was that the teachers had been actively involved in innovation development themselves.

Interviews and analysis

In structured interviews during the summer and fall of 2008, the respondents were interviewed about work activities and triggers related to innovation development. To establish a common understanding of *innovations* and *innovative work behaviour*, these terms were explained first. In the first section of the interviews, the teachers were asked to mention examples of innovations that they had experienced or developed themselves. The definition of innovations was used to validate whether the examples provided by the teachers could actually be considered innovations. The Critical Incident Technique (Flanagan, 1954) was applied by using these examples as anchors for the subsequent sections of the interviews. In the second section of the interviews, teachers were asked which work activities they had carried out to develop one of the innovations they had identified. Finally, the teachers were supposed to report what had triggered their work activities. The structuring of the interviews, the integration of explanations of the constructs, and the use of critical incidents were also meant to help the teachers gain access to implicit motives and attitudes that guided their behaviour.

   Each interview took place at school and lasted between 47 and 65 minutes. All interviews were digitally recorded and transcribed for analysis. A deductive qualitative content analysis (Mayring, 2000) was conducted using a category system derived from the research question and based on the theoretical framework. After a first round of coding the interview data, a formative examination of reliability including a revision of the category system was conducted. Subsequently, a summative examination of reliability including the final coding of the interview data was carried out. Frequencies were calculated to show how many teachers proposed a particular aspect.

Examples of innovations as critical incidents

The primary aim of this section is to provide examples of innovations the teachers' had experienced. These examples were used as critical incidents in the later interview sections in order to help teachers describe how and why the innovations had been developed. To find out

whether the examples were valid examples of innovations, it was identified whether these instances were consistent with our definition of innovations, that is, whether they were described as new, applicable and useful in relation to a specific work context. Three different contexts could be distinguished: the classroom context, the wider school context, and the context beyond the school. Table 2 contains the identified examples of innovations and a quote from the interviews. The frequencies show how many teachers mentioned the particular example; frequencies are also reported for the three distinguished contexts of innovations showing how many teachers identified an example for that context.

Of the identified examples, most examples were related to the classroom activities and interactions. Seven teachers referred to different aspects of *job and student orientation* as examples of innovations. For them, learning environments have to be developed in correspondence with students' needs and contain authentic job situations that help students to develop competences. The realization of this principle was considered an innovation because it had helped them to significantly improve the job preparation of students. Closely related to this principle, three teachers identified *team teaching* as an innovation because it helped to integrate different subjects. Similarly, some teachers referred to open forms of teaching such as *modularized curriculum* or *flexible duration of lessons* as innovations because they represented a holistic and realistic approach to teaching. In addition, one teacher proposed *portfolio assessment* as an innovation because it helped students to self-monitor their development. Taken together, these examples were considered innovations because they were consistent with our definition of innovations and were perceived by teachers as a significant improvement of their work.

Table 2. Examples of innovations in the work context of vocational teachers

Context	Innovation	Quote from an interview	f
Classroom (9)	Job and student orientation	"Students need learning techniques, problem-solving skills and of course professional competences that empower them to live their lives and that are useful in their jobs."	7
	Team teaching	"You are only able to work meaningfully or to learn if you and your colleagues also work together."	3
	Modularized curriculum	"Normally, the teacher has his curriculum that tells him specifically what to do. Now he only has a goal and has to plan the intermediate steps himself."	3
	Flexible duration of lessons	"I experienced the introduction of teaching that completely abolished 45-minute lessons."	2
	Portfolio assessment	"At the end of the school year when students have their map, they are proud of it. It's a little individual annual review. And suddenly it makes sense."	1
Wider school (7)	Collaborative work	"The implementation of a steering committee as a unit for communication and organization of innovation processes certainly was the most important innovation in the last years."	6
	Quality management	"We started with a bottom-up approach using internal guiding principles. At first the participation was good. But it got more difficult the more top-down the process was."	2
Beyond the school (7)	External cooperation	"The cooperation between schools and companies as a kind of transition management offers many opportunities."	7

Note. N = 9. *f* = frequency.

Moreover, the teachers identified products and processes outside the classroom, that is, in the *wider school context* or in the context *beyond the school* as innovations. For instance, six teachers referred to facets of *collaborative work*. To work collaboratively with colleagues, school leaders, or students on a regular basis was perceived as a significant improvement of work. In addition, collaboration was emphasized as a means to develop other innovations. Furthermore, *quality management* was identified as an innovation by two teachers. They perceived the introduction of a bottom-up quality management system as a useful tool for school development that was not only considered a characteristic of an open school culture but also a starting point for the development of other innovations. Regarding the context beyond the school, seven teachers advanced *external cooperation* between schools as well as between schools and companies or other educational institutions as innovations. For them, these relations had significantly benefitted students' transitions between schools and an adequate job preparation for students. Taken together, all examples of innovations in the context outside the classroom contained some form of social interaction that helped to improve the quality and outcomes of teachers' work and that functioned as a facilitator of other innovations.

Results

Vocational teachers' innovative work behaviour

On basis of a particular example of an innovation that was identified earlier in the interview, teachers were asked to describe how this innovation had been developed. The described dimensions of innovative work behaviour and the typology of work activities were used as guidelines. Table 3 presents the identified work activities and a quote from the interviews. The frequencies show how many teachers proposed a particular activity; frequencies are also reported for the three dimensions of innovative work behaviour, the activity setting, and the type of activity showing how many teachers identified an activity related to each category.

To begin with, both physical and cognitive activities were reported in the interviews. Physical activities were reported for all three dimensions of innovative work behaviour by all nine teachers. Cognitive activities were identified only for idea generation and realization by eight teachers.

Furthermore, the largest number of the identified work activities referred to *idea generation*. With regard to *individual activities*, seven teachers said that *using experiences* was important to analyse how problems can be dealt with differently or how routines can be changed. In addition, six teachers referred to *thinking* as a generic source for coming up with new ideas. Further to these cognitive activities, physical activities such as *enquiring* or *making sketches* were identified. Reading books, journals, and newspapers or searching the internet were identified as examples for enquiring. Also, five teachers proposed that once an initial idea was at hand, they made sketches to organize their thoughts and to further elaborate the idea.

In addition to individual activities, the teachers advanced several social activities relevant for idea generation. All teachers said that *communicating with colleagues* was important to discuss experiences, talk about possible ideas and negotiate different teaching approaches. In addition, references to communicating *in general* as well as to communicating *with the school*

leader, *with students* or *in private* were identified as sources of ideas. Some teachers emphasized that communicating was the most important activity for innovation development.

Table 3. Work activities of vocational teachers' innovative work behaviour

Dimension of IWB	Activity setting	Activity	Quote from an interview	f
Idea generation (9)	Individual (9)	Using experiences*	"The idea just comes, quite spontaneously, by using one's experiences."	7
		Thinking*	"I had an idea that I developed on my own and that I then brought to the school level."	6
		Enquiring	"I read a lot. Specifically, I did research about schooling in other states and about legal conditions."	3
		Making sketches	"When I write down the concept I turn into an analytic mode. It has to be verbalized in written from."	5
	Social (9)	Communicating ... with colleagues	"The whole process was strongly embedded into a team of teachers that worked in the same direction."	9
		... in general	"Talking, always talking and staying in contact. Communication is very important."	3
		... with the school leader	"During the school leader meeting I expressed my dissatisfaction with the procedure and said what had occurred to me."	4
		... with students	"Ideas often develop from a conversation – if you talk to colleagues or students."	1
		... in private	"I think it's beneficial to talk to somebody else about it every once in a while."	3
		Observing and listening*	"To see other conditions, to see, whether things are done the same way or differently is yet another source of ideas."	5
		Adapting ideas*	"Another source is the available possibilities one can draw from."	4
		Participating in training	"Professional training, for instance, from which I took many experiences."	2
Idea promotion (9)	Social (9)	Finding allies - colleagues	"Only if the colleagues are convinced of the meaningfulness, they are willing to deal with the organizational difficulties."	9
		- school leader	"At the school level I only had to make the school leader enthusiastic. His support was important."	7
		- students	"I want the students to cooperate with me. Together with them I want to push these ideas forward."	2
		Formulating goals	"Only if you have a goal, can you specify what you need to establish the innovation."	5
		Activating resources	"It starts with funding and continues with active support for the realization."	4
Idea realisation (8)	Individual (7)	Building a strategy of action*	"Then I have to organize the realization. Planning, realizing. A strategy."	4
		Assessing through reflection*	"I see if it worked and what the crucial aspects were. I compare my starting point with the result."	5
	Social (7)	Creating transparency	"Transparency for those colleagues not involved – to show them results and single steps."	6
		Adjusting the innovation	"Maybe the innovation didn't hit the nail on the head and one has to move a little to the right or the left, maybe one is too fast or too slow."	4
		Assessing through evaluation	"The perception of the innovation has to be measured somehow. For instance with a survey."	7

Note. N = 9. IWB = innovative work behaviour. f = frequency. An asterisk indicates that an activity is cognitive.

Furthermore, the teachers proposed less interactive social activities such as *observing and listening* or *adapting ideas* that provide access to existing ideas: To learn how others deal with a problem successfully or to adapt useful ideas from other contexts and develop them in one's own context were referred to as starting points of innovation development. Moreover, two teachers identified *participating in training* as a formal way of staying informed about new concepts and ideas.

For *idea promotion*, only social activities were reported. To promote an idea, the teachers proposed *finding allies* as important to gain support for enabling idea realization. Similar to idea generation, all teachers identified the crucial role of *colleagues* as allies. Colleagues can either be active supporters or followers of the innovations process. In addition, seven teachers referred to the *school leader* as an important ally. The school leader is in charge of useful contacts to other powerful actors in other schools, companies, educational administration, or politics and can therefore be a strong support for idea realization. Finally, two teachers said that *students* are important allies because they are able to collectively reject or empower the realization of ideas.

Closely related to finding allies, the teachers identified activities that are necessary to convince possible allies. Five teachers said that *formulating goals* was required to make an idea concrete and comprehensible. Only with clearly formulated goals other persons could understand the necessity and usefulness of the innovation. In addition, four teachers said that *activating resources* by communicating to allies what resources are required for idea realization was an important activity. In this respect, the financial, material, and personnel resources existing at a school as well as the possibilities of receiving grants from outside were reported. Moreover, taking care of legal conditions that may affect idea realization was identified.

Finally, for *idea realization* both individual and social activities were reported. These activities primarily referred to planning and monitoring processes. With regard to individual activities, four teachers advanced *building a strategy of action* that contains strategic information such as goals, steps, requirements, and resources. Moreover, five teachers said that *assessing through reflection* was important during the process of innovation development to find out whether activities and their outcomes were in line with expectations or standards.

In terms of social activities, six teachers identified *creating transparency* during the whole process as an important factor. For them, giving and offering information about specific goals and about the use of the innovation to other actors was crucial. Furthermore, the teachers proposed several factors that referred to monitoring the transformation of an idea into a prototype, model, or application. *Adjusting the innovation* to constraints of the context of development was identified as a requirement for success by four teachers. Furthermore, seven teachers said that *assessing through evaluation* was important to identify whether goals have been met or adjustment was necessary during the innovation process.

Triggers for the development of innovations
On basis of their description of work activities carried out during innovation development, the teachers were asked to name factors that triggered their innovative work behaviour. Contextual and personal factors were found. Contextual factors contained characteristics of

students and of the school. Personal factors referred to characteristics of teachers. Table 4 contains the identified factors and a quote from the interviews. The frequencies refer to the number of teachers that proposed a particular factor; frequencies are also reported for the three categories of factors showing how many teachers advanced a factor related to that category.

Regarding contextual factors, six teachers identified *characteristics of students* as triggers for innovations. For them, the problems and needs of students, particularly of those without apprenticeship training, created conditions that made adequate job preparation difficult and innovations necessary. With respect to *characteristics of the school*, six teachers said that the *scope of actions* at a school is crucial for the creation of opportunities for changes in existing structures and routines. At the same time, the teachers argued that a restricted scope of actions can trigger innovation development as well, because it activates schools and teachers to improvise and explore opportunities. Furthermore, four teachers identified the *organization of classes* as a factor that created room for innovations. Due to organizational problems, these teachers were not able to teach students adequately which also made changes necessary. In addition, some teachers said that a *lack of resources* and a *lack of communication* constrained their work, which created opportunities for innovations.

Table 4. Contextual and personal factors triggering innovative work behaviour

Category	Factor	Quote from an interview	*f*
Characteristics of students (6)		"Discipline problems, school fatigue, skipping school, not even registering for school. Basically pretty bad things."	6
Characteristics of the school (9)	Scope of actions	"Every school tries hard to offer good teaching – if one would only let them. That schools can try out things without any restrictions is a crucial factor for an innovation."	6
	Organization of classes	"The experience of teaching students without apprenticeship training only one day per week made people depressive and sick. We could feel that our work was pointless."	4
	Lack of resources	"I was dissatisfied because of a reduction of available resources."	2
	Lack of communication	"I become discouraged when the communication isn't there and people are insensitive to one another."	4
Perception of a problem		"I think that most of my colleagues develop ideas because they have to solve a problem. By approaching the problem the innovation develops."	7
Characteristics of teachers (8)	Job satisfaction	"Some colleagues are dissatisfied but want to remain capable of acting. And these are the colleagues that initiate innovation processes."	7
	Self-actualization	"I never leave this, I am never done. It is also boring to do the same things over and over again."	6
	Motivation	"The will for realization is important. It always takes persons that want to push things forward."	6
	Curiosity	"Basically it is also a form of curiosity that fosters the development of innovations."	2
	Openness	"It always requires a certain amount of openness. And I noticed that more experienced teachers are more capable of opening themselves."	5

Note. N = 9. f = frequency.

While the identified contextual factors referred to the necessity of innovations and to opportunities for innovation development, seven teachers said that the *perception of a*

problem was a crucial factor to develop a personal need for innovation and to trigger innovative work behaviour. Several *characteristics of teachers* were claimed as being closely related to teachers' perception of the work context. For instance, seven teachers identified *job satisfaction* as a trigger because it determines one's work behaviour: Those teachers who had reported that their teaching was constrained by problems, for instance with students or the organization of classes, also claimed that this experience was dissatisfying. Therefore, they developed a need to change and improve the existing situation at work. Moreover, six teachers said that *self-actualization* was a trigger for innovative work behaviour. For them, developing new things and continuously trying to update and improve work processes was important to accomplish this goal. In addition, the teachers emphasized that *motivation* and *curiosity* were necessary to become active in innovation development as well as to have the endurance to deal with the difficulties and barriers of innovation processes. Finally, five teachers identified *openness* as a personality characteristic that is required for innovative work behaviour because it makes teachers sensitive for exploring opportunities and for allowing conditions and procedures to change.

Discussion

The central goal of this article was to explore *how* and *why* innovations are developed at work. Therefore, structured interviews with vocational teachers were conducted to gain insight into the work activities they carried out during the development of an innovation and into factors that triggered these activities.

The Critical Incident Technique was used to link teachers' descriptions to their personal experiences with innovations. Therefore, examples of developed innovations were acquired at the beginning of the interviews. Teachers reported various products or processes that they had perceived as a significant improvement of their work. These examples differed in terms of the number of persons involved in the development of an innovation, the number of people affected by its use, and the novelty of the idea the innovation was based on. Moreover, examples of innovations inside and outside the classroom were reported. These examples showed the relevance of innovations in vocational colleges in relation to the outlined transformations in vocational education and its broader societal context. For instance, the examples of collaborative work and external cooperation outlined how the linking function between general education and the labour market can be fostered. The activation of these personal experiences helped teachers to increase their level of reflection on work activities and on triggers for their behaviour. As a result, one suggestion for future quantitative studies on innovative work behaviour is to use either specific examples of innovations or to activate personal experiences as anchors for measurement.

With regard to the question *why* innovations are developed, the interviews revealed several characteristics of the work context that created problems and challenges for one's work and therefore made innovations necessary. Several characteristics of students and of the school including social relations were identified. The *opportunities* created by these contextual factors, however, had to be recognized by the teachers.

In this respect, characteristics of teachers such as job satisfaction, self-actualization, motivation, or openness were proposed as factors that are closely related to teachers'

perceptions of their work context. Teachers reported that they developed a *need* for innovation because they were either responding to work-related problems and challenges or they were driven by an attitude to continuously develop in their job. One conclusion here is that although contextual factors help to understand opportunities for innovations, the motivation, the goals as well as the personality of teachers are responsible for triggering innovative work behaviour. Therefore, future research should address the role of teacher characteristics as antecedents of their innovative work behaviour.

With regard to the question *how* innovations are developed, the study provided useful insight into the complexity of various interdependent work activities carried out to develop an innovation. These work activities were related to the tasks that have to be accomplished for idea generation, promotion, and realization. Moreover, the results indicated that there are cross connections between the three dimensions of innovative work behaviour: Some of the reported work activities can be assumed to be carried out in parallel and for multiple purposes. For instance, building a strategy of action and discussing an idea with colleagues may be carried out in parallel, while the first one is related to idea realization and the latter one is related both to idea generation and promotion. Also, the three dimensions did not seem to follow a fixed sequence. Rather, innovation development was described as a non-linear and iterative process.

The typology of work activities proved useful for conducting and analysing the interviews. However, individual activities were only reported for idea generation and idea realization. Moreover, the majority of work activities reported by the teachers were social activities. Therefore, one assumption is that at least for vocational colleges, the development of innovations is a strongly social process. The teachers also reported more physical activities than cognitive activities which may be due to the fact that physical activities are easier to remember and to report. Cognitive activities such as thinking may also be considered a by-product of physical activities and therefore remain more implicit.

For *idea generation*, communicating, especially with colleagues, seemed to play an important role. However, the social negotiation of ideas may be based on individual enquiry or reflection. In addition, adapting ideas from external resources seemed to be important. This leads to the conclusion that the adaption of ideas from other work contexts is very important. Interestingly however, the teachers did not mention communicating with companies in relation to idea generation.

With respect to *idea promotion*, the importance of communicating with possible allies also became apparent. Activating allies seemed to be important either for their active participation in innovation development or for the provision of resources, permissions, or support of the idea. In addition, clear goals seemed to be helpful for accomplishing this task. This leads to the conclusion that collaboration at work and external cooperation are facilitative of innovation development.

Regarding *idea realization*, various activities to plan and monitor the realization seemed to be important. A strategy for realization seemed to be a crucial component of planning. Once a prototype of the innovation is in use, monitoring activities such as creating transparency, adjusting, and assessing seemed to be important. Taken together, the assumed

interdependence and simultaneity of the three dimensions of innovative work behaviour was visible in all interviews.

Moreover, many of the work activities identified in the interviews such as *using experiences*, *communicating*, *building a strategy of action*, and *assessing through reflection* referred to *reflection*, which leads to the assumption that reflection, both individually and in a social setting, is important for idea generation and idea realization. Furthermore, reflection is not only important for innovation development but also for professional development. Dealing with new ideas and changes is a knowledge-intensive process that can include unexpected experiences and throwbacks. By reflecting on these processes, employees may not only refine ideas but improve their competences. In research on workplace learning, the reflection on work experiences plays a particularly important role for the improvement of knowledge and performance (Boud, 2006; Van Woerkom, Nijhof, & Nieuwenhuis, 2002). From this perspective, the proposed typology of work activities can be reformulated as a typology of learning activities involving both physical and cognitive activities and carried out both in individual and social settings. A stronger consideration of reflective activities may thus be useful to integrate innovation development and professional development within the concept of innovative work behaviour.

Finally, some limitations of the study must be considered as well. In particular, the qualitative nature of the study and the small sample size must be taken into account when looking at the presented frequencies. These were meant to provide further information on the occurrence of the categories and should not be interpreted as generalizable findings. However, the study was a necessary first step for building hypotheses for more quantitative research. In addition, by using examples of innovations as critical incidents it was possible to gain insight into the relation between work activities and triggers for innovative work behaviour in specific work contexts.

In summary, it can be concluded that work contexts provide many opportunities for innovation development. However, individuals must recognize these opportunities to become active as innovators. Consistent with Kanter (1988), the mediating role of teachers' perceptions for triggering innovative work behaviour can be assumed as a hypothesis for future studies. To foster innovation development, teachers must, therefore, be encouraged to actively seek opportunities for change and improvement; if they become interested in such opportunities before problems at work occur, some of these problems may be prevented and goals can be accomplished more easily.

The study also showed that innovation development is a complex process that requires the collaboration of many individuals. In the domain of vocational colleges, teachers, school leaders, students, and companies have to interact in order to develop innovations. To foster the social aspects of innovative work behaviour it may be helpful to develop a structure of collaborative work at schools that establishes mutual support, trust, and flow of information. In relation to previous research, the results help to develop a more detailed picture of the work activities employees carry out to deal with problems and challenges at work and, hence, to disentangle the complex process of idea generation, promotion, and realization. With regard to future research, the work activities reported in the interviews provide a sound basis for a quantitative measurement of innovative work behaviour. In addition to existing instruments,

the results help to develop a measure that takes into account the concrete work activities carried out for innovation development. In all, the study helped to improve the understanding of how and why employees develop innovations at work. By focusing on needs and activities of individuals it was possible to find out more about how innovations can be sustained in local contexts and how innovative work behaviour contributes to professional development.

Chapter 4

Innovative Work Behaviour and Learning: A Theoretical Reconceptualization[3]

Introduction

Innovations are a crucial means for organizations to remain competitive, to maintain and improve the quality of their outcomes and, subsequently, to satisfy the needs of their customers. Furthermore, innovations are important to ensure the effectiveness of an organization's internal processes (Amabile, 1988; Anderson, De Dreu, & Nijstad, 2004; Damanpour & Gopalakrishnan, 2001; Farr & Ford, 1990; Kanter, 1988; Marinova & Phillimore, 2003; Molleman & Timmerman, 2003; Oldham & Cummings, 1996). Innovations are products or processes that are new for a particular organizational or work context and that help to maintain or improve the current state of this context. Because of the central role of innovations, organizations increasingly expect and need their personnel to contribute to the development of innovations. This includes activities such as rethinking existing values, assumptions, and strategies of work that are no longer appropriate as well as dealing with work-related problems and challenges pro-actively (Choi, 2007; Morrison & Phelps, 1999; Scott & Bruce, 1994; West & Farr, 1990).

For employees, innovations and the engagement in their development may have a positive impact on the conditions of work and work-related perceptions such as job satisfaction and well-being. Accordingly, it is crucial for organizations to take into account employees' needs and expectations which determine their engagement in innovation development. In addition, interpersonal conflicts as well as resistance against an innovation have to be carefully considered (Janssen, 2000, 2003, 2004; Janssen, Van de Vliert, & West, 2004). Furthermore, the active engagement in work-related processes of change may foster the continuous improvement of employees' work performance and the quality of their outcomes (Messmann & Mulder, 2011). For these reasons, it is of crucial value for organizations and for HRD to understand employees' contributions to innovation development in order to foster such behaviour, and to utilize this valuable resource for the long-term professional development of the personnel.

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[3] This chapter is based on:
Messmann, G., & Mulder, R. H. (submitted for publication). Innovative work behavior and learning: A theoretical reconceptualization.

The pivotal role of employees in processes of innovation development, not only as adopters and users but as the creative source of innovations, is increasingly acknowledged in the literature. For instance, in organizational psychological research, the sum of work activities employees contribute to the development of an innovation was integrated in the construct of innovative work behaviour (De Jong & Den Hartog, 2010; Janssen, 2000; Scott & Bruce, 1994) which is conceptually based on two-stage models of creativity and innovation (Amabile, 1988; Kanter, 1988; Oldham & Cummings, 1996; West, 2002). In various empirical studies, light was shed on individual and contextual factors that facilitate employees' innovative work behaviour as well as related constructs such as creative behaviour (Tierney, Farmer, & Graen, 1999; Zhou & Shalley, 2003), organizational citizenship behaviour (Choi, 2007), and taking charge (Morrison & Phelps, 1999). However, in the conceptualizations of these constructs it was hardly taken into account that, because employees' work behaviour is an aggregation of interdependent work activities carried out in a particular social and cultural work context, it is dynamic and context-bound in nature. These two characteristics however have important implications for operationalization and measurement as well as for understanding the opportunities employees' work behaviour holds for the development of competence and performance. This insight in turn is pivotal for fostering both the processes of innovation development and professional development in organizational practice (Messmann & Mulder, 2011). Hence, a theoretical conceptualization is required that adequately takes into account the dynamic and context-bound nature of employees' work behaviour and, thus, guides the investigation of work behaviour and its relationship to learning. Accordingly, the central question is: *What are the components of a theoretical conceptualization of work behaviour that integrates employees' contributions to innovation development with their professional development?*

For addressing this question, the following steps were taken: A literature search was carried out in order to analyse research on innovation: After briefly outlining different perspectives on innovation, it was concluded that a micro perspective is most adequate for addressing the role of individuals in the process of innovation development. Consequently, definitions of innovation that are consistent with this analytical perspective were examined and an operational definition of innovation was derived. In accordance with a micro perspective and the definition of innovation, the construct of innovative work behaviour was identified as an adequate theoretical approach for investigating individuals' contributions to innovation development. Starting from existing theoretical conceptualizations (De Jong & Den Hartog, 2010; Janssen 2000; Scott & Bruce, 1994), innovative work behaviour was then reconceptualized as a dynamic and context-bound construct. This reconceptualization considers that innovative work behaviour is characterized by a social and timely interdependence of work activities, partly consists of reflective activities, and contains opportunities for the development of employees' competence and performance.

In order to further establish the relation between employees' contributions to innovation development and their professional development, literature on organizational and workplace learning (Argyris & Schön, 1996; Ellström, 2001; Van Woerkom & Croon, 2008) was analysed. From this analysis it was concluded that reflection is a central mechanism for changing and improving work-related products and processes as well as employees'

competence and performance. In order to further elaborate on the role of reflection, approaches on learning from experience (Kolodner, 1992; Kolb, 1984) were analysed. This analysis led to the conclusion that the theoretical angle of experiential learning is consistent with a dynamic and context-bound conceptualization of innovative work behaviour. In the final section, it is then discussed how research and practice can benefit from the presented reconceptualization of innovative work behaviour as a dynamic and context-bound construct and the established relation between innovation and professional development.

Perspectives on innovation

In order to identify approaches that are suitable for investigating the role of individuals in the process of innovation development, a literature search was conducted. In this respect, King (1990) noted: "For the researcher making first contact with the literature on innovation, the most daunting feature of it is not its size – though it is undoubtedly very large – but its sheer diversity" (p. 15). This diversity is due to the many disciplines such as economics, management sciences, sociology, communication research, and psychology which investigated the process of innovation, its outcomes, and determinants both from a practical and a scientific perspective (Amabile, 1988; Anderson *et al.*, 2004; Kanter, 1983; Kirton, 1976; Marinova & Phillimore, 2003; Rogers, 2003; Zaltman, Duncan, & Holbeck, 1973; Zhou & Shalley, 2003).

An important starting point for research on innovation is the work of Schumpeter (1942). According to his equilibrium model of innovation, an economy is primarily driven by the impulse of novel goods, markets, and forms of organization that initiate a process of creative destruction. Based on his work, linear models of innovation such as technology and science push or need pull were developed. With time, increasingly complex models of innovation were developed that integrate the interaction and communication of actors in different organizational units and levels (Rogers, 2003; Zaltman *et al.*, 1973) or that investigate networks of organizations within systems of innovation (Freeman, 1991; OECD, 2009). Furthermore, structural transformations in organizations led to a stronger consideration of the micro level of innovation including an emphasis on individuals' role in the innovation process, a broader perspective on benefits, and a consideration of the relations between micro level behaviour and organizational macro structures that facilitate the engagement of individuals in the innovation process (Amabile, 1988; Anderson *et al.*, 2004; Kanter, 1988; West & Farr, 1990; Zhou & Shalley, 2003). Accordingly, for an understanding of individuals' immediate contributions to innovation development and the further implications for professional development, a micro perspective on innovation seems appropriate.

Defining innovation

In order to accomplish a definition of innovation that is consistent with a micro perspective on innovation, definitions that include a reference to the role of individuals were analysed and, accordingly, characteristics of innovation were derived.

A part of the definitions of innovation refers to innovation as an *outcome*. For instance, Rogers (2003, p. 12) and Zaltman *et al.* (1973, p. 10) similarly define an innovation as an idea, practice, object, or material artefact that is perceived to be new by an individual or other

unit of adoption. The role of individuals is to decide whether they want to adopt the innovation; the further adoption of the innovation by an increasing number of individuals or units is referred to as diffusion. While the creation of an innovation is neglected in these accounts, this aspect is included in definitions of innovation as a *process*. For instance, Kanter (1983, p. 20) and West and Farr (1990, p. 9) define innovation in a similar way as the intentional generation, introduction, acceptance, and implementation (or application) of ideas, processes, products, or services that are new, applicable, and beneficial for a particular unit of adoption.

From these definitions general characteristics of innovation can be derived. Firstly, the development of an innovation relies on *ideas* which are transformed into innovative outcomes (e.g. physical objects such as tools and devices; verbal or visual intellectual descriptions such as manuals; or specific practices, services, or procedures). Secondly, these ideas and innovative outcomes are characterized by the aspect of *novelty*, that is, their newness in the particular context of individuals who develop or use the innovation. For instance, if an employee switches jobs and transfers an innovative process from an old job to the new job, only some of the new colleagues may be familiar with the process while the rest may consider it an innovation (Farr & Ford, 1990; King, 1992). Thirdly, because ideas not only have to be generated but also need to be promoted and furthermore practically realized, innovations are characterized by a *social application component* (Janssen *et al.*, 2004; West & Farr, 1990). This characteristic implies that the success of an innovation is largely dependent on the perception of the social context in which it is developed. This means that the success of an innovation depends on how many organizational units and actors are affected, as how radical the innovation is perceived, and to which degree central tasks, strategies, and goals are challenged (Janssen *et al.*, 2004; Zaltman *et al.*, 1973). Fourthly, an innovation is characterized by an *intentionality to benefit* the social context. Hence, an innovation's usefulness for accomplishing a certain task, for satisfying someone's needs, for acting on new resources available, or for solving a pressing problem has to be anticipated by the recipients of the innovation. For instance, companies develop product innovations such as a new technology because they expect that these will satisfy market demands and needs of customers; or they change organizational structures because they assume that these will improve employees' job satisfaction and well-being (Damanpour & Gopalakrishnan, 2001).

Based on these theoretical considerations, an innovation is defined as the *generation, promotion, and realization of ideas for processes or products that are new, applicable, and potentially useful for addressing the problems or for improving the status quo of a particular work context of (groups of) individuals* (Messmann & Mulder, 2011; West & Farr, 1990)*.*

Reconceptualizing innovative work behaviour as a dynamic, context-bound construct
In the field of organizational psychology, several theoretical conceptualizations of employees' contributions to change and improvement at work that are consistent with a micro perspective on innovation were developed (Choi, 2007; Morrison & Phelps, 1999; Tierney *et al.*, 1999; Zhou & Shalley, 2003). Among these approaches, a conceptualization that is consistent with our definition of innovation and that particularly aims at disentangling the process of innovation development from the emergence of an idea to its transformation into a practically

relevant outcome is the construct of innovative work behaviour (Janssen, 2000; Scott & Bruce, 1994). Conceptually this construct is based on two-stage models of creativity and innovation (Amabile, 1988; Oldham & Cummings, 1996; West, 2002): In the *creative stage* problems are recognized and innovative ideas are generated at the individual level; in the *implementation stage* the innovative ideas are realized and applied in organizational practice.

The construct of innovative work behaviour integrates the creative stage and the implementation stage encompassed in these models and reformulates them as a set of interdependent *innovation tasks* required for innovation development (Kanter, 1988). The role of individual contributions is represented by the corresponding physical or cognitive *work activities* employees carry out solitarily or in a social setting to accomplish the prerequisite innovation tasks (Messmann & Mulder, 2011). Accordingly, the construct of innovative work behaviour emphasizes that individuals are the creative source of innovation development (Janssen *et al.*, 2004).

In studies on creative and innovative work behaviour (Amabile, 1988; De Jong & Den Hartog, 2010; Dorenbosch, Van Engen, & Verhagen, 2005; Janssen, 2000; Kanter, 1988; Kleysen & Street, 2001; Scott & Bruce, 1994; Tierney *et al.*, 1999) four prerequisite tasks for the development of an innovation emerged:

Opportunity exploration refers to the recognition and comprehension of problems and needs that create an opportunity for changing and improving products and processes in one's work context. This requires being attentive to one's work environment and keeping up with recent developments such as changes of organizational structures, events in other organizations, and new insights in one's field of work. *Idea generation* contains the activation of innovation development by creating and suggesting ideas for products or processes that are new, applicable, and potentially useful for approaching the identified problems, challenges, or niches for improvement that exist in a specific work context. This includes activities such as publicly addressing substantial work-related problems, critically examining predominant beliefs, and discussing the changes that are required to solve these problems. *Idea promotion* encompasses championing and legitimizing the ideas by convincing the social environment of the envisioned innovation, and building a coalition of allies that take over responsibility and provide necessary information, resources, and support. This comprises informing colleagues and supervisors and winning their support as well as negotiating with key actors and diffusing ideas across the boundaries of one's work context. *Idea realization* involves experimenting with one's ideas, creating a physical or intellectual prototype of the innovation, examining and improving its adequacy, and planning its strategic integration into organizational practice. This requires developing a hands-on example of the innovation in order to make others familiar with its details, examining outcomes for undesirable effects, and strategically planning its practical application in the work context.

Rather than representing a set of discrete stages, these tasks are mutually dependent, that is, although they partly build on each other they are also iteratively connected by feedback loops. For instance, on the one hand ideas have to address the opportunities explored, and promotion and realization rely on ideas that were already generated; on the other hand the promotion of an idea may also lead to new opportunities, and the realization of an idea may also lead to further but different ideas. Consequently, the outlined innovation tasks do not

automatically follow a linear sequence (Dorenbosch *et al.*, 2005) and individuals may be involved in the accomplishment of one or more of these tasks simultaneously and repeatedly (King, 1992; Scott & Bruce, 1994). Hence, the development of an innovation is a complex, iterative, and non-linear process, and innovative work behaviour represents a holistic construct composed of interdependent tasks and activities.

Based on these considerations and in accordance with our definition of innovation, innovative work behaviour is defined as *the sum of physical and cognitive work activities carried out by employees in their work context, either solitarily or in a social setting, in order to accomplish a set of tasks that are required to achieve the goal of innovation development* (Kanter, 1988; Messmann & Mulder, 2011; West & Farr, 1990).

However, as outlined above, previous studies (De Jong & Den Hartog, 2010; Janssen, 2000; Scott & Bruce, 1994) hardly took into account the dynamic and context-bound nature of innovative work behaviour: Innovative work behaviour is dynamic because of the complex relations between past work activities and outcomes, and the activities carried out in present and future. Furthermore, it is dynamic because it partly consists of social activities that are carried out collaboratively or that are affected by input and feedback of others. Furthermore, innovative work behaviour is context-bound because employees' work activities and outcomes become meaningful only in relation to the work context and the broader organizational context in which they are carried out and, accordingly, are determined by the characteristics of this context (Zhou & Shalley, 2003). Furthermore, contextual requirements will differ with respect to the innovation task one currently focuses on.

Both the dynamic and the context-bound nature of innovative work behaviour have implications not only for the development of innovations but also for employees' professional development. However, these implications may not always be explicit for employees. Therefore, *reflection* (Boud, 2006; Schön, 1983) on the entire process of innovation development becomes a necessary task for innovation development (Müller, Herbig, & Petrovic, 2009). At the same time, the reflection on ideas, activities, and outcomes also enables employees to continuously develop their competence and performance.

The role of work-related reflection for innovation and professional development
In order to further establish how the development of an innovation and the professional development of employees who contribute to innovation development are connected, literature on organizational and workplace learning was analysed. In particular, this analysis shows how during the development of an innovation, the reflection on work activities, corresponding outcomes, and feedback of others provides opportunities for refining the innovation and for improving one's competence and performance.

The relations between work performance and learning as well as between learning and innovation processes are well established in the fields of organizational and workplace learning. For instance, the relationship between the learning process of individuals in an organizational context and the learning process of the organization (Argyris & Schön, 1996; Cassell & Lee, 2007; Gieskes & Van der Heijden, 2004), the role of work activities as opportunities for informal learning (Eraut, 2000; Lohman, 2005, Torraco, 1999), and the further relationship between these aspects and innovation processes (Brown & Duguid, 1991;

Engeström, 1999; Fenwick, 2003; Hoeve & Nieuwenhuis, 2006; Molleman & Timmerman, 2003; Nonaka & Takeuchi, 1995; Van de Ven & Polley, 1992) were investigated.

A theoretical account that helps to understand how during processes of innovation development individuals assess their performance, the underlying strategies, expectations, and beliefs, and the corresponding outcomes, is provided by Argyris & Schön (1996). According to their theoretical approach, activities are guided by *theories of action*, which encompass strategic information about appropriate activities for achieving certain outcomes in certain situations. Furthermore, it is distinguished between *espoused theories* that are used by individuals to justify their activities and *theories-in-use* that actually but implicitly determine individuals' activities.

Reflection plays an important role in various ways, for instance, if unexpected situations are encountered, if activities do not lead to the expected outcomes, if unfamiliar tasks have to be accomplished, or if feedback leads to the awareness of incongruence between one's justifications and actual behaviour – all of which are situations that are likely to occur when innovative processes and products are introduced and applied.

One way of responding to such situations is *single-loop learning*: Mismatches are identified by a single reflection process and directly resolved by adapting one's activities within the range of accepted routines but without changing their underlying assumptions and justifications. However, if unfamiliar situations without available routines are encountered or if current justifications for one's activities can no longer be maintained, single-loop learning is inadequate.

In such situations *double-loop learning* is of advantage: By adding a second reflection process, it can be analysed whether a current course of action is inadequate and has to be renewed, whether values, assumptions, and justifications are incongruent with one's behaviour and should be altered, or how an unfamiliar situation may be approached for the first time. Van Woerkom and Croon (2008) refer to a general orientation towards double-loop learning as *critically reflective work behaviour*. This behavioural orientation integrates aspects such as openness for feedback, critique, and errors as well as collaboration and reflection, all of whom are important for dealing with unexpected situations, non-routine tasks, or faulty outcomes and, thus, can enhance innovation and professional development.

In addition to that, Ellström (2001) points out that from a practical standpoint single-loop and double-loop learning should be considered complementary and mutually dependent modes of working and learning: Single-loop learning represents an *adaptive learning* mode which is applied in work situations in which the task to be accomplished, the method to be chosen, and the results to be achieved are largely prescribed. Although such situations offer little or no room for developing new things, reflection on these situations provides opportunities for practicing and improving one's routines and performance standards. At the same time, the adaptive mode leads to an automation of work processes which frees resources for the *developmental learning* mode. This mode is relevant in less prescribed situations which may be unexpected or unfamiliar and which require additional reflection, improvisation, and the variation of old or the creation of new routines.

In conclusion, the theoretical approaches outlined above illustrated the importance of reflection for adapting and refining work activities, theories of action, and outcomes to

varying tasks, contexts, and requirements. The analysis further showed that an orientation towards critical reflection and double-loop learning may be particularly facilitative of innovation and professional development (Argyris & Schön, 1996; Van Woerkom & Croon, 2008), although in well-defined situations it may be advantageous to apply an adaptive course of action with only a single reflection loop and, in turn, save resources for situations that are more difficult, demanding, and susceptible for innovation (Ellström, 2001).

An experiential learning perspective on innovative work behaviour
After outlining the general importance of reflection for innovation and professional development, this section further explores the function of reflection as a genuine part of work behaviour by analysing approaches on experiential learning. In particular, this analysis shows that the reflection on work experiences leads to a facilitation and enhancement of individuals' work performance and outcomes, and that an experiential learning perspective is consistent with a dynamic, context-bound conceptualization of innovative work behaviour.

Two theories of experiential learning were considered consistent with a conceptualization of innovative work behaviour as a dynamic and context-bound construct, because they contain descriptions of how past experiences with an activity are related to the conduct of the same or a similar activity in present and future; how the adjustment to different task requirements and contextual conditions is accomplished; and how the reflection on experiences may lead to improved performance and outcomes.

An approach that helps to understand how the reflection on work experiences can be used for adapting to different work contexts and task requirements and for developing and trying out new solutions is Experiential Learning Theory (Kolb, 1984; Kolb, Boyatzis, & Mainemelis, 2001). Experiential Learning Theory (ELT) provides a holistic model of learning in a cyclic process of grasping and transforming experience: First, a *concrete experience* is made by carrying out an activity and producing a particular outcome. This experience represents the motivational source for *reflective observation*, which encompasses an examination of whether and how the activity and its outcome are different from previous experiences. Subsequently, an *abstract conceptualization* takes place in which the results of the reflection process are ordered and conclusions for adjusting, refining, or creating strategies, activities, and expectations for future situations are drawn. These revised or new theories of action are then put to the test by *active experimentation* which leads to a new experience that requires further reflection and, hence, renews the experiential cycle.

While ELT takes an activity-based perspective on learning from experience, a complementary approach that depicts the underlying cognitive reflection processes is the theory of Case-based Reasoning (Kolodner, 1983, 1992; Schank, 1999). Case-based Reasoning (CBR) describes how cases of past experiences are used for solving and explaining situations and problems in present and future. Cases are generalized episodes or scripts that result from a series of similar experiences and are dynamically stored in long-term memory as episodic memory organization packets. CBR involves four steps: (Aamodt & Plaza, 1994): *Retrieve* involves recalling cases that are most similar to a situation at hand. Next, *reuse* refers to interpreting the current situation based on a recalled case, examining similarities and deviances, and deriving a potential solution from the case. Subsequently, *revise* encompasses

adjusting this potential solution to the specific requirements of the new situation. Finally, after putting the solution into practice, *retain* involves reflecting on the process and outcome of the experience, examining whether the experience is congruent with stored cases and expectations, and updating the case library based on this analysis.

As the two theories are complementary in that they elicit activity-based and cognitive facets respectively, they can be integrated into a single, more exhaustive model of learning from experience (acronyms in brackets indicate the origin of each step):

(1) Encountering a new situation or problem in a particular context (CBR);
(2) Retrieving an experienced case that is similar to the current situation (CBR);
(3) Reusing and revising the recalled case for interpreting the current situation and for developing an adequate solution (CBR);
(4) Making a concrete experience by applying the solution (ELT);
(5) Reflecting on this new experience and comparing its process and outcomes with previous experiences (ELT, CBR);
(6) Abstracting generalized conclusions from the reflection process; retaining these abstract conceptualizations for future situations (ELT, CBR);
(7) Actively experimenting with the updated case in order to validate it for future situations (ELT).

This integrated model is consistent with a dynamic and context-bound conceptualization of innovative work behaviour and allows an adequate consideration of the implications this conceptualization holds for the process of innovation development and for employees' professional development. In particular, the integrated experiential learning model helps to understand how reflection throughout the entire process of innovation development enables employees to deal with the interdependencies of work activities and outcomes over time, to incorporate the activities of several collaborating individuals, and to adapt to the requirements of different innovation tasks and contextual conditions. Furthermore, because the development of an innovation is a complex, iterative, and non-linear process that is composed of interdependent tasks and activities, it is likely that during innovation development the experiential learning process as modelled above will be (re-)entered repeatedly and simultaneously at various points, in particular with increasing duration of innovation development and the number of persons involved.

For instance, an opportunity for developing an innovation may be explored when an employee encounters a substantial problem or an unfamiliar situation at work. Likewise, an opportunity may also result from an employee's reflective observation that a routine work activity lags behind work standards or personal expectations and has to be renewed or replaced. Furthermore, the generation of an idea may be the result of recalling a stored case and deriving a solution that is revised to the current situation. In addition, an initially formed idea for a new process or a product may also be the basis for a discussion with a friend at work or with a supervisor. These persons will probably recall own cases that can be reused; additionally, they may contribute their own conclusions about which basic aspects of activities, outcomes, and expectations are inadequate and have to change; also, they may make suggestions about how the current situation can be improved or solved accordingly. Subsequently, after a social encounter an employee may reflect on the differences between

his/her own observation of the situation and the observations of the friend and the supervisor. Additionally, the employee will retain the new information and update his/her own cases for future applications. The employee may also draw own conclusions about how to further revise the idea and eventually begin to realize the idea by actively experimenting with a prototypical version of the envisioned innovation. By reflecting on this experience, the employee will then be able to draw further conclusions about the appropriateness of the idea, the strategy applied, and the activities carried out so far. This reflection may lead to the conclusion that further support and information is inevitable for successfully realizing the innovation. Moreover, while thinking of a strategy to promote his/her idea, the employee may again recall previous episodes during which he/she successfully convinced colleagues of an idea…

These examples illustrate the complexity of the process of innovation development and the dynamic and context-bound nature of employees' innovative work behaviour. Most importantly, the examples emphasize the pivotal role of reflection for facilitating and enhancing employees' competence, performance, and outcomes during the entire process of innovation development.

Discussion

The aim of this article was to provide a theoretical conceptualization of employees' contributions to innovation development that takes into account the dynamic and context-bound nature of work behaviour as well as the implications of this very nature for professional development. This was accomplished by reconceptualizing innovative work behaviour as a dynamic and context-bound construct: Starting from a definition of innovation from a micro perspective (West & Farr, 1990), innovative work behaviour was defined as the sum of work activities employees carry out to accomplish a set of interdependent tasks required for innovation development (Dorenbosch *et al.*, 2005; Messmann & Mulder, 2011; Scott & Bruce, 1994).

From approaches on organizational and workplace learning (Argyris & Schön, 1996; Ellström, 2001; Van Woerkom & Croon, 2008) it was derived that the performance of work activities provides valuable opportunities for informal, on-the-job learning: If employees reflect on their work activities, the underlying strategies, expectations, and beliefs, as well as the subsequent outcomes, they can improve both their contributions to innovation development as part of organizational practice and their competence and performance as professionals. Furthermore, from approaches on experiential learning (Kolb, 1984; Kolodner, 1992) it was concluded that innovative work behaviour as a dynamic and context-bound construct can be considered a continuous process of reflection and learning from experience that leads to innovation as well as to professional development.

With respect to future research, a dynamic and construct-bound conceptualization of innovative work behaviour has important implications for operationalization and measurement: Firstly, because the development of an innovation relies on the contributions of individual employees, innovative work behaviour has to be operationalized and measured based on concrete work activities employees carry out to accomplish the outlined tasks required for innovation development. This was only partially accomplished in previous studies (De Jong & Den Hartog, 2010; Dorenbosch *et al.*, 2005). This approach is useful

because concrete work activities can be derived systematically from the conceptualization of innovative work behaviour, remain meaningful and interpretable even if considered separately from their corresponding innovation task, and can be directly assessed. Furthermore, the use of concrete work activities is advantageous over measurement at the level of abstract innovation tasks (Janssen, 2000; Scott & Bruce, 1994) which does not indicate to which concrete activity is being referred to.

Secondly, because innovative work behaviour is determined by characteristics of the context and because work activities are only meaningful in the context in which they are carried out, context-bound measurement has to be attained; this was not accomplished in previous studies (De Jong & Den Hartog, 2010; Janssen, 2000; Scott & Bruce, 1994). Accordingly, the assessment of work activities has to be tied to characteristics of the context they respond to. This can be accomplished by providing cases of innovation development as input for contextualization or by establishing a relation to an episode of innovation development in which employees had personally been involved in (Bauer & Mulder, 2010). Moreover, future studies should also investigate whether the tasks and activities required for innovation development vary across different types of innovations and across different domains.

Thirdly, because innovative work behaviour is dynamic and context-bound, the social context is important; in previous studies (De Jong & Den Hartog, 2010; Janssen, 2000; Scott & Bruce, 1994) the social implications of innovative work behaviour were not adequately considered. Employees' innovative work behaviour is not only embedded into this social context but also influenced by the dynamic relations to other individuals who also contribute to the development of the innovation at hand (Messmann & Mulder, 2011). Accordingly, operationalization and measurement have to include work activities carried out in a social setting (e.g. collaboratively discussing ideas) as well as an appraisal of the behaviour of employees' group of allies.

Fourthly, as the most central consequence of a dynamic and context-bound conceptualization of innovative work behaviour, investigations have to include reflection as a distinct innovation task; this also was not accomplished so far (De Jong & Den Hartog, 2010; Janssen, 2005; Scott & Bruce, 1994). As depicted in the framework of experiential learning outlined above, an operationalization of reflection has to take into account the essential role of reflection throughout the entire process of innovation development; for instance, for critically examining and refining ideas; for establishing relations between activities, underlying strategies, expectations, beliefs, and subsequent outcomes in past, present, and future and of the various individuals involved; for adjusting to requirements of different innovation tasks and contextual conditions; and for using work performance and outcomes for one's development as a professional (Messmann & Mulder, 2011).

With respect to practice, an understanding of employees' contributions to the process of innovation development is crucial for organizations to make good use of their employees' workforce. The theoretical reconceptualization of innovative work behaviour as a dynamic and context-bound construct aims at explaining these contributions. The further elaborations on the construct from a learning perspective provide insight into the inherent learning potential of innovative work behaviour and into possibilities to foster employees' professional

development. Accordingly, the insight from this article can be used by managers, HRD practitioners, and supervisors in all kinds of organizations to recognize the innovative potential of employees, for instance in organizational evaluation processes. Furthermore, knowledge about employees' innovative work behaviour is crucial for the appreciation of employees' new and controversial ideas, for providing adequate feedback on these ideas, for embedding them into an open dialogue at work and, ultimately, for fostering employees' professional development and their contributions to the development of innovations. Moreover, the learning perspective on innovative work behaviour can be used as a stimulus for the design of training that aims at fostering employees' competence and performance in processes of innovation development and their capability for continuing learning throughout the career. Finally, based on the insight from this article, employee selection processes and the assignment of tasks and projects can be optimized in order to create optimal conditions for employees and for organizations.

Chapter 5

Development of a Measurement Instrument for Innovative Work Behaviour as a Dynamic and Context-bound Construct[4]

Introduction

Innovations are crucial for organizations to ensure their effectiveness and competitive advantage. Hence, organizations increasingly expect and need their employees to contribute to innovation development. For employees, innovations and the engagement in their development may lead to improved work conditions, job-satisfaction, and well-being (Anderson, De Dreu, & Nijstad, 2004; Kanter, 1988; Scott & Bruce, 1994; West & Farr, 1990). Therefore, it is critical for organizations and for HRD to understand how innovations are developed and how employees' work behaviour is related to this process.

Innovations are new and potentially useful products or processes that are developed and applied in a particular work context in order to address problems or improve the status quo. This includes rethinking and changing underlying principles of organizational work. Employees' contributions to the development of innovations are referred to as innovative work behaviour which encompasses all work activities carried out in relation to innovation development (Messmann & Mulder, 2011; West & Farr, 1990). Conceptually this construct is based on organizational psychological research on creativity and innovation (Amabile, 1988; Anderson *et al.*, 2004; Kanter, 1988; Zhou & Shalley, 2003). In empirical studies innovative work behaviour was found to be determined by individual and contextual factors such as the perception of impact or supervisor support (Janssen, 2005). Two major characteristics of innovative work behaviour are its dynamic and context-bound nature. In previous studies (De Jong, 2007; Janssen, 2005; Scott & Bruce, 1994) the implications of these two aspects for measurement were neglected. For investigating their role in the facilitation of innovation development in organizational practice, they however have to be taken into account in measurement as well. Therefore, the question arises: *How can innovative work behaviour be measured as a dynamic and context-bound construct?*

This broad question is divided into three detailed questions: (1) *What are the criteria that a measurement instrument of innovative work behaviour has to meet?* A conceptualization of innovative work behaviour is presented that describes how its dynamic and context-bound

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nature is related to employees' professional development. Implications for operationalization and measurement are derived and applied in the development of a measurement instrument. To investigate whether the instrument meets methodological requirements, two studies, one in the industrial and one in the educational sector, wscere conducted. Two questions were addressed in the studies: (2) *Can the theoretically assumed dimensions of innovative work behaviour be identified empirically?* And, (3) *what are the psychometric properties of the instrument?* Finally, some directions on how research and practice can benefit from using this instrument are provided.

Theoretical framework

Conceptualization of innovative work behaviour

Innovative work behaviour is an explanatory construct for employees' contributions to innovation development and stems from organizational psychological models of innovation as a two-stage process encompassing a *creative stage* referring to problem recognition and the generation of ideas at the individual level, and an *implementation stage* referring to the championing and application of innovative ideas in organizational practice (Amabile, 1988; Oldham & Cummings, 1996; West, 2002). Building on these models, the construct of innovative work behaviour integrates both stages as a set of tasks and activities required for innovation development (Kanter, 1988). Regarding activities, these can be physical or cognitive and carried out solitarily or in a social setting (Messmann & Mulder, 2011).

From studies on creative and innovative work behaviour (Amabile, 1988; De Jong, 2007; Dorenbosch, Van Engen, & Verhagen, 2005; Janssen, 2005; Kanter, 1988; Kleysen & Street, 2001; Scott & Bruce, 1994; West & Farr, 1990) it is derived that innovation development requires the accomplishment of four tasks: *Opportunity exploration* refers to the recognition and comprehension of problems and needs in one's work context that create an opportunity for change and improvement. *Idea generation* contains the activation of innovation development by creating and suggesting ideas for products or processes that are new, applicable, and potentially useful for approaching the identified opportunities. *Idea promotion* encompasses championing the ideas by convincing the social environment of the envisioned innovation and building a coalition of allies that take over responsibility and provide necessary information, resources, and support. *Idea realization* involves experimenting with one's ideas, creating a physical or intellectual prototype of the innovation, examining and improving its adequacy, and planning its strategic integration into organizational practice.

These tasks partly build on each other (e.g. ideas have to address the opportunities explored; promotion and realization rely on the ideas already generated), but are also iteratively connected by feedback loops (e.g. the promotion of an idea may lead to new opportunities; the realization process may lead to further ideas) and, therefore, do not follow a linear sequence (Dorenbosch *et al.*, 2005). Regarding activities, individuals may be involved in the accomplishment of one or more of these tasks simultaneously and repeatedly (Scott & Bruce, 1994) which leads to a complex, iterative, and non-linear model of innovation development.

Moreover, because innovations are based on human activities and developed in a particular work context, innovative work behaviour is dynamic and context-bound: It is *dynamic*

because of the complex relations between employees' past work activities and outcomes and their activities in present and future which affect the process of innovation development as well as employees' professional development. It is *context-bound* because work activities and outcomes are influenced by contextual factors (Zhou & Shalley, 2003) and become meaningful only in relation to the work context in which they are carried out. However, the implications of the dynamic and context-bound nature of innovative work behaviour may not always be explicit.

Therefore, *reflection* on the process of innovation development becomes a fifth necessary innovation task. Research indicates that reflecting on ideas, strategies, activities, and outcomes contributes to the entire process of innovation development (Müller, Herbig, & Petrovic, 2009). Furthermore, by reflecting on work activities and outcomes employees can regulate and improve their professional performance (Van Woerkom, 2004). For instance, by reflecting on the outcomes of a present activity employees can improve their knowledge and skills for comparable future activities. Likewise, present activities can be carried out by reflecting on experiences with similar past activities.

Based on these considerations, innovative work behaviour as a dynamic and context-bound construct is defined as *the sum of physical and cognitive work activities carried out by employees in their work context, either solitarily or in a social setting, in order to accomplish a set of tasks that are required to achieve the goal of innovation development* (Kanter, 1988; Messmann & Mulder, 2011).

Operationalization of innovative work behaviour
In accordance with previous studies (De Jong, 2007; Dorenbosch *et al.*, 2005; Kleysen & Street, 2001) and the theoretical conceptualization outlined above*,* an operationalization of innovative work behaviour requires a specification of the work activities that have to be carried out to accomplish each of the described innovation tasks (see Table 2):

Opportunity exploration requires being attentive to one's work environment and keeping up with recent developments and events. This includes changes of organizational structures, events in other organizations, and new insights in one's field of work.

Idea generation includes publicly addressing substantial work-related problems, critically examining predominant beliefs, as well as expressing and discussing ideas for necessary changes regarding these problems.

Idea promotion comprises winning the support of colleagues and supervisors, keeping them informed about the ongoing process, negotiating with key actors about permissions and resources, and diffusing ideas within and across the boundaries of one's work context.

Idea realization requires developing a hands-on model or example of the innovation, making others familiar with its details, examining outcomes for undesirable effects, and planning its practical application in the work context.

Reflection encompasses assessing the progress of innovation development, evaluating activities and outcomes based on criteria for success, examining one's personal advancement during innovation development, and improving action strategies for future situations.

Criteria for measuring innovative work behaviour

A measurement instrument of innovative work behaviour as a dynamic and context-bound construct has to meet five criteria based on theoretical arguments and methodological requirements (Bauer & Mulder, 2010).

Firstly, innovative work behaviour has to be measured based on work activities (De Jong, 2007; Kleysen & Street, 2001) because (i) innovations result from human activities, (ii) work activities can be derived systematically from the conceptualization of innovative work behaviour, (iii) work activities remain meaningful and interpretable even if considered separately from their corresponding task, and (iv) work activities can be directly assessed while measurement at the task-level (Janssen 2005; Scott & Bruce, 1994) requires interpretation.

Secondly, measurement of innovative work behaviour has to be grounded in the context in which work activities are carried out; in previous studies (Janssen, 2005; Scott & Bruce, 1994) this was not realized. To attain context-bound measurement, domains have to be selected in which innovation development is possible and necessary. Several methods such as 'interview' or 'observation' can be used for context-bound measurement. However, these methods are time-consuming when large sample sizes are intended and can cause a bias in participants' behaviour. Questionnaires are a suitable method to obtain large sample sizes in a standardized way; context-bound measurement however is challenging here.

One way of attaining context-bound measurement is applying a Cases Approach (Bauer & Mulder, 2010), that is, to present participants with specific cases of innovation development which are provided by experts who ensure their comparability and validity in the particular domain. However, if the goal is to develop an instrument that can be flexibly applied in different domains, this approach is less useful.

Another possibility offers a Generalized Case Approach (GCA), that is, to present participants with a generalized case of innovation development and ask them to picture such a case in their current work context in order to ground the assessment of activities on this fictitious situation. By establishing a relation to participants' current work context, the room for interpretation is reduced and the comparability of responses increases.

Furthermore, context-bound measurement can be achieved with the Critical Incident Technique (CIT) (Flanagan, 1954), that is, to activate a personally experienced episode in which the requested activities were carried out so that participants can refer to their actual activities. Problems with memorization can be avoided by asking participants to refer to a recent episode. Furthermore, problems with lack of experiences or unwillingness to disclose experiences have to be considered. Moreover, to ensure the comparability of episodes, possible relations between background characteristics of the episodes and scores for innovative work behaviour must be analysed. In order to find out which technique is more adequate for enabling context-bound measurement, the GCA and the CIT have to be applied in the same study.

Thirdly, as an implication of the dynamic and context-bound nature of innovative work behaviour, its measurement has to include reflection as a distinct task; in previous studies (Janssen, 2005; Scott & Bruce, 1994) this was not accomplished. In line with the conceptualization of innovative work behaviour, this dimension emphasizes (i) that the

process of innovation development requires an element that integrates the multiple actors, activities, and outcomes involved (Messmann & Mulder, 2011) and (ii) that individuals develop as professionals when they deal with problems and work on ideas for change and improvement.

Fourthly, in line with the definition of innovative work behaviour, its measurement has to include the social aspects of innovation development, that is, the dynamic relations of actors in a work context (Messmann & Mulder, 2011). This leads to the requirements (i) to base measurement partly on activities carried out collaboratively or in a social setting and (ii) to include an appraisal of the behaviour of the participants' group of allies.

Finally, a measure of innovative work behaviour has to fulfil several aspects of validity: Regarding content validity, the instrument has to be developed based on the conceptualization and operationalization of innovative work behaviour. For construct validity, it has to be determined whether the theoretically assumed dimensions of innovative work behaviour can be identified empirically. For cross validity, the instrument must lead to comparable results in at least two domains. Finally, to determine criterion validity, relations of the measure to relevant criterion variables have to be consistent with theoretical considerations and results from previous studies.

Development of a measurement instrument of innovative work behaviour
In order to enable a valid context-bound measurement of innovative work behaviour, an introductory text describing the process of innovation development was constructed in line with our definition of innovation and innovative work behaviour. This introductory text was later used as input for establishing a relation to a particular context (CIT and GCA). As the focus was on the *process* of innovation development, a general description capturing both product and process innovations as outcomes was provided:

> In modern work contexts it is increasingly necessary to develop new ideas that lead to a significant change. These ideas are either newly created or derived from other contexts. Usually, several people are involved. The goal of this questionnaire is to find out what people do, when they are an active part of such a process of change that is aiming at one of the following goals:
> – Establishment of new routines,
> – simplification of work processes,
> – use of new materials and tools,
> – improvement of cooperation inside and outside the organization, and
> – creating new offers and services for clients.

Subsequently, participants were asked whether in the last three months they personally experienced a situation to which the introductory text applies to. Accordingly, they were separated into two groups:

In the group with personal experiences, the Critical Incident Technique was applied to establish a relation to the context of a personally experienced episode of innovation development. Additional questions on the *status of the process*, the number of *persons involved*, the *duration of the process*, the number of *goals achieved*, and the *prognosed goals*

to be achieved were asked to assist in recalling the episodes. These data were later used to examine the comparability of episodes.

In the group without personal experiences, the Generalized Case Approach was applied. Under this condition, participants had to relate the introductory text to their current work context and imagine a situation that meets the characteristics described in the introductory text.

In accordance with the operationalization of innovative work behaviour and the criteria for measurement, questionnaire items were developed. Measures of innovative work behaviour were scanned for items containing a description of work activities. Three instruments (De Jong, 2007; Dorenbosch *et al.*, 2005; Kleysen & Street, 2001) were identified and taken as starting point for the construction of new items. In order to enable a valid dynamic measurement of innovative work behaviour, items representing reflective as well as social activities were included. After several revisions, an item-pool containing 35 items was created.

All participants had to assess how adequately these 35 statements described their behaviour on a 6-point Likert scale. The CIT-subsample was asked to refer to their actual behaviour during the personally experienced episode of innovation development. If they had reported that other persons were involved, they were asked to provide additional information on this group's behaviour (CITGroup). The GCA-subsample was asked to state how they would behave in the fictitious situation they pictured based on the introductory text.

Relations between innovative work behaviour and criterion variables
For criterion validation, two variables covering the individual and contextual level were selected based on theoretical considerations and results from previous studies. As innovative work behaviour consists of interrelated tasks, consistent results for all dimensions were expected.

Impact is the felt ability to affect strategic, administrative, and operating processes and outcomes at work (Janssen, 2005; Spreitzer, 1995) and facilitates innovative work behaviour by increasing the belief in being capable of realizing an envisioned innovation. In two separate studies, significant correlations between impact and overall innovative work behaviour (.30, Janssen, 2005; .64, Knol & Van Linge, 2009) were found.

Supervisor support refers to the perception of psychological and physical assistance by one's supervisor (De Jong, 2007) and fosters innovative work behaviour by enabling employees to deal with feelings of uncertainty and perform more task-oriented. In several studies, significant correlations between supervisor support and overall innovative work behaviour (.17, Basu & Green, 1997; .16, De Jong, 2007; .36, Janssen, 2005) were reported.

STUDY 1

Method

Sample and data collection
The sample consisted of employees in a German automotive supply company (Maier, 2010). The company was selected because employees' work was knowledge-intensive and non-routine and included the expectation to deliver high quality as well as develop product

innovations and innovative processes in the management and administrative sector. One thousand seven hundred and thirteen employees were invited by email to participate in the study and to answer the online questionnaire. Of 352 completed questionnaires (response rate = 20.6%), 17 cases were excluded because of missing data ($N = 335$). The sample contained two subsamples for the CIT ($N = 154$) and the GCA ($N = 181$). In addition, $N = 140$ participants of the CIT-sample also provided information on group behaviour (CITGroup).

With respect to background characteristics of participants, no differences between the subsamples were found. Concerning *gender*, 14% were female. Regarding *age*, 44% were between 30 and 39 years old; 41.2% were between 40 and 49 years old; 7.7% were below 30; and 7.2% were over 50. In terms of *education*, 82.6% had a higher education degree. With regard to *tenure*, 62.9% worked for the company between 3 and 12 years; 34% for over 12 years; and 3.1% for less than 3 years. Furthermore, 20.7% were in a *management* position. Finally, regarding *organizational function*, 74.2% worked in R&D, 16.4% in support and central functions, and 9.4% in production or other functions. As some background characteristics were assumed to be related to innovative work behaviour, differences due to these variables were analysed.

Measures

Innovative work behaviour was measured with the developed instrument as described above. *Impact* was assessed with Spreitzer's (1995) 3-item scale ($\alpha = .90$). *Supervisor support* was measured with a 7-item scale taken from Janssen (2005) ($\alpha = .93$). As the scales of both criterion variables were in English, the items were translated into German and furthermore re-translated into English to ensure the adequacy of the translation. The response format for all scales was a 6-point Likert scale, ranging from 1 ('does not apply at all') to 6 ('fully applies').

Analyses

Exploratory factor analyses (principal axis; promax and varimax rotation) were conducted to determine construct validity. Data for the three subsamples (CIT, GCA, and CITGroup) were investigated separately. To select items for factor analyses, the Kaiser-Meyer-Olkin-Coefficient ($KMO > .60$), the Measure of Sample Adequacy ($MSA > .60$), Bartlett's Test on sphericity, and item correlations ($r < .80$) were calculated. Factors were extracted according to the Kaiser-criterion and the Scree-test. Items were excluded in case of theoretically inconsistent or statistically insufficient factor loadings ($\lambda < .40$; $\lambda_1 > .40$ and $\lambda_2 > .40$; $\lambda_1 < .50$ and $\lambda_2 > .30$; $\lambda > .90$) in all three factor analyses.

To analyse the adequacy of items, mean scores, standard deviations, item difficulties ($.20 < p_i < .80$), and item distributions (Kolmogorov-Smirnov test, skewness < 2, kurtosis < 7) were examined. *T*-tests were carried out to compare the scores for the three subsamples. Correlations between the item scores for the CIT and the CITGroup were analysed. To analyse the measurement scales resulting from exploratory factor analyses, Cronbach's α ($\alpha > .60$), mean item correlations ($MIC > .30$), and discriminatory power ($r_{it} > .30$) were inspected. Mean scores, standard deviations, correlations, and distributions of variables formed by averaging individual item scores were examined subsequently. Moreover, analyses of variance (ANOVA) were carried out to control for mean differences due to background

characteristics of participants and of the personally experienced episodes. Finally, to determine criterion validity, correlations between innovative work behaviour and criterion variables were analysed.

Results

Regarding exploratory factor analyses, the Kaiser-criterion and the Scree-test led to either five (CIT, CITGroup) or four factors (GCA), both with an oblique and an orthogonal rotation. Models with two or three factors were also tested, but were not meaningfully interpretable. Seven items were excluded due to insufficient factor loadings in all three factor analyses. In the 5-factor-solutions all theoretically assumed dimensions were represented. However, *idea realization* was represented by only three items. In the 4-factor-solution, *idea realization* was not represented; the corresponding items were instead associated with *idea generation* and *idea promotion*. Among all solutions, the 5-factor-solution for the CIT (Table 2) was most appropriate regarding the number of item-factor-associations and insufficient factor loadings.

Concerning item analysis, the mean scores for the CIT (3.31–5.13) were higher than for the GCA (3.28–4.77) and the CITGroup (2.97–4.55). Significant correlations between corresponding items of the CIT and the CITGroup (.27–.74) were found. Item difficulties were, with four exceptions (.80–.83), within the recommended range. Furthermore, although the items were not normally distributed, their skewness and kurtosis were below critical values.

Regarding further analyses at scale level, the CIT-data were used because factor analyses had indicated the best content validity for these data. With respect to scale analysis (Table 1), values of Cronbach's α and mean item correlations indicated good internal consistency and homogeneity. The items' discriminatory power (.51–.72) was within the recommended range. Furthermore, scale correlations (.45–.60) indicated medium relations between the measurement scales. Finally, although the scales of *idea generation* and *idea realization* were not normally distributed, their skewness and kurtosis were below critical values.

Table 1. Scale characteristics of the measurement instrument of innovative work behaviour

Dimension	M	SD	n items	α	MIC	OE	IG	IP	IR
Opportunity exploration (OE)	3.99	1.10	4	.76	.44	—			
Idea generation (IG)	4.95	.87	5	.85	.52	.45**			
Idea promotion (IP)	4.73	.96	5	.83	.49	.57**	.60**		
Idea realization (IR)	4.82	.93	3	.78	.54	.51**	.52**	.60**	
Reflection (RE)	4.19	.95	7	.86	.47	.59**	.52**	.60**	.50**

Note. **p < .01. Results for the CIT (*N* = 154) are presented.

Concerning differences due to background characteristics, participants in a *management* position had higher scores for *opportunity exploration* and *idea promotion*. Furthermore, if the *duration of the process* was longer, the scores for *idea generation* and *idea promotion* were higher. In addition, if the number of *goals achieved* was higher, scores for *idea generation* were higher. Moreover, regarding criterion validity, significant correlations of overall *innovative work behaviour* and its five dimensions with *impact* (.14–.35) and *supervisor support* (.27–.40) were found.

Table 2. Items, factor structure, and item characteristics of the measurement instrument of innovative work behaviour

Item	Study 1				Study 2			
	Factor	λ	*M*	*SD*	Factor	λ	*M*	*SD*
1. Keeping oneself informed about the *organization's / school's* structures and processes.	—	—	4.44	1.33	OE	.73	4.99	1.06
2. Exchanging thoughts on recent developments with one's *clients / colleagues*.	OE	.47	3.84	1.58	—	—	5.00	1.01
3. Keeping oneself informed about the latest developments *within the company / at one's school*.	OE	.68	4.17	1.37	OE	.77	5.07	.96
4. Keeping oneself informed about new concepts/insights within one's professional field.	OE	.70	4.70	1.13	OE	.55	5.15	.90
5. Keeping oneself informed about new developments *in other organizations outside the company / at other schools or in companies*.	OE	.65	3.31	1.62	OE	.53	4.54	1.34
6. Expressing personal evaluations of a problem.	IG	.75	5.13	1.04	—	—	4.91	1.06
7. Examining predominant beliefs critically.	—	—	4.86	1.11	IG	.49	4.74	1.07
8. Addressing the things that have to change directly.	IG	.55	5.00	1.15	IG	.59	4.92	1.07
9. Expressing new ideas.	IG	.84	5.04	1.07	—	—	5.01	1.01
10. Asking critical questions.	IG	.75	5.07	1.03	IG	.62	4.87	.98
11. Suggesting improvements on expressed ideas.	IG	.60	4.54	1.31	IG	.57	4.88	1.03
12. Addressing key persons who provide necessary permissions and resource allocation.	IP	.63	4.73	1.38	IP	.56	4.82	1.35
13. Promoting new ideas to colleagues in order to gain their active support.	IP	.51	4.73	1.22	IP	.79	4.63	1.22
14. Promoting new ideas to the supervisor in order to gain her/his active support.	IP	.83	4.65	1.35	IP	.57	4.55	1.41
15. Promoting the application of the new solution within one's work context.	IP	.61	4.80	1.11	IP	.70	4.61	1.19
16. Making plans how to put an idea into practice.	IP	.65	4.75	1.19	—	—	4.95	.96
17. *Reporting regularly on the progress of the realization of ideas. / Keeping colleagues informed about the progress of the realization of ideas.*	—	—	4.37	1.33	IP	.68	4.59	1.19
18. *—/ Convincing others of the importance of a new idea or solution.*	—	—	—	—	IP	.68	4.73	1.15
19. Introducing colleagues to the application of a developed solution.	IR	.45	4.88	1.12	IP	.58	4.61	1.13
20. Testing evolving solutions for shortcomings when putting ideas into practice.	IR	.63	4.68	1.15	IG	.63	4.51	1.20
21. Analysing evolving solutions on unwanted effects when putting ideas into practice.	IR	.80	4.90	1.07	IG	.75	4.74	1.09
22. Identifying possible triggers for change.	RE	.54	4.35	1.27	—	—	4.51	1.10
23. Assessing the progress while putting ideas into practice.	RE	.42	4.21	1.29	RE	.44	4.41	1.17

Table 2. (continued)

24.	Defining criteria of success for the realization of the idea.	—	—	4.12	1.40	RE	.68	4.30	1.27
25.	Systematically reflecting on recently made experiences.	RE	.58	4.34	1.26	RE	.63	4.46	1.20
26.	Naming newly acquired knowledge.	RE	.74	4.23	1.33	—	—	4.44	1.13
27.	Evaluating one's behaviour on basis of one's attitudes.	RE	.62	4.28	1.22	—	—	4.78	1.11
28.	Mentioning possible strategies of action for comparable future situations.	RE	.53	4.05	1.45	—	—	4.49	1.18
29.	Expressing how one's skills have improved through experiences.	RE	.80	3.87	1.33	—	—	4.12	1.23
30.	*Visualizing ideas. / Visualizing one's ideas graphically.*	—	—	4.45	1.30	RE	.41	2.95	1.62

Note. A 6-point Likert scale (1 = 'does not apply at all', 6 = 'fully applies') was used. $N = 154$ (study 1); $N = 265$ (study 2). For both studies, results for the CIT are presented. OE = opportunity exploration; IG = idea generation; IP = idea promotion; IR = idea realization; RE = reflection. Italic printing indicates changes between study 1 and 2. As factors were correlated, factor loadings for the oblique rotation are displayed. Of the 37 constructed items, altogether 7 items (6 original items and 1 additional item from study 2) from each of the five dimensions were never associated with a factor and, therefore, are not part of the final instrument presented in this table.

STUDY 2

Method

Sample and data collection

The sample consisted of teachers in 15 German vocational colleges. The colleges were selected because they were involved in developing innovations aiming at improvement of instruction and interaction at school (cf. Messmann & Mulder, 2011). One thousand sixty teachers were invited by email to participate in the study and to answer the online questionnaire. With the same participants, two repeated data collections were carried out after two and four months for the purpose of investigating the facilitation of innovative work behaviour based on longitudinal data. From these cases, CIT-data on innovative work behaviour were included if they were based on episodes that had taken place after the previous data collections.

Of 343 completed questionnaires in the first data collection (response rate = 32.4%), 50 cases were excluded because of missing data ($N = 293$). From the repeated data collections, 60 cases were included for factorial validation ($N = 353$). For confirmatory factor analysis, remaining missing values were imputed using the EM-algorithm. The sample contained two subsamples for the CIT ($N = 205 + 60$) and the GCA ($N = 88$). In addition, $N = 248$ cases of the CIT-sample also contained information on group behaviour (CITGroup). Furthermore, analyses of variance (ANOVA) showed no differences between schools regarding scores for innovative work behaviour.

With respect to background characteristics of participants, no differences between the subsamples were found. Concerning *gender*, 41.5% were female. Regarding *age*, 27.4% were between 30 and 39 years old; 33.5% were between 40 and 49 years old; 2.7% were below 30; and 36.5% were over 50. In terms of *education*, 65.3% had completed regular teacher training at university; 17.6% were trained as specialist subject teachers; and 14.9% had become teachers after obtaining a different higher education degree, or after job training (2.3%). With

regard to *tenure*, 40.3% worked as teachers between 3 and 12 years; 50.9% for over 12 years; and 8.8% for less than 3 years. Furthermore, 17.6% were in a *management* position. Finally, in terms of the *teaching subject*, the sample contained teachers for 'commercial and administrative training' (36.8%), 'nutrition and domestic economy' (19%), 'metal engineering' (18.2%), 'electrical engineering' (8.7%), 'health' (5.8%), 'constructional engineering' (5%), 'agrarian economy' (2.5%), 'wood engineering' (2.1%), 'hygienics' (1.7%), and 'chemistry, physics, and biology' (0.4%). Regarding type of employment, for 90% being a teacher was their *main job*; 5.2% had an additional side job; and for 4.8% it was their side job. Furthermore, 75.2% worked *full-time*. Similar to study 1, it was later examined whether these variables were related to innovative work behaviour.

Measures

For measuring *innovative work behaviour*, a revised version of the developed instrument containing 37 items (two additional items were constructed because of the results from study 1) was used. Of the original items, eight items were improved. Furthermore, the wording of the introductory text and of the items was slightly adapted to teachers' work context. The scales measuring *impact* ($\alpha = .86$) and *supervisor support* ($\alpha = .94$) were identical to study 1.

Analyses

To cross-validate the instrument, the analytical procedures of study 1 were repeated. Additionally, a confirmatory factor analysis was conducted to compare models specified based on theoretical considerations and results of exploratory factor analyses. Multi-dimensional models of innovative work behaviour were specified both with a hierarchical second order factor and with correlated factors. Alternatively, a one-dimensional model of innovative work behaviour was examined. As the Mardia-test indicated multivariate non-normality, Maximum Likelihood (ML) estimation with a Bollen-Stine bootstrap correction was used to test the models. To evaluate the model-fit, the χ^2-test statistic, the χ^2/df ratio (< 2), the *CFI* ($> .97$), the *RMSEA* ($< .05$), and the *SRMR* ($< .05$) were examined. To compare the models, χ^2 difference tests were conducted (Schermelleh-Engel, Moosbrugger, & Müller 2003).

Results

Regarding exploratory factor analyses, the Kaiser-criterion and the Scree-test led to four factors for the CIT, the CITGroup, and the GCA, both with an oblique and an orthogonal rotation. Factor solutions with fewer factors were not meaningfully interpretable. Twelve items were excluded due to insufficient factor loadings in all three factor analyses. In these solutions, *idea realization* was not represented separately; the corresponding items were instead associated with *idea generation* and *idea promotion*. Furthermore, *reflection* was only represented by four items. Among all solutions, the 4-factor-solution for the CIT (Table 2) was most appropriate regarding the number of item-factor-associations and insufficient factor loadings.

Concerning confirmatory factor analysis, only the CIT-sample was large enough for these analyses. Multi-dimensional models with five and four factors (models with fewer factors were not supported by the results of the exploratory factor analyses) were specified. The results (Table 3) showed that the multi-dimensional models were more appropriate than the alternative 1-factor-model: For all multi-dimensional models an exact model fit and fit-indices within the recommended range were found while for the 1-factor-model no exact model-fit and less favourable fit-indices were found. Moreover, results of the χ^2 difference tests indicated that 4-factor-models were more appropriate than 5-factor-models. The differences between hierarchical and correlated models of innovative work behaviour however were marginal. In addition, the fit-indices of all multi-dimensional models were very similar.

Table 3. Model-test and fit-indices for the measurement models of innovative work behaviour

	χ^2	df	p	χ^2/df	CFI	RMSEA	SRMR
1-factor-model	282.96	104	.00	2.72	.89	.08	.06
5-factor-model (hierarchical)	192.82	114	.20	1.69	.96	.05	.04
5-factor-model (correlated)	180.65	109	.22	1.66	.96	.05	.04
4-factor-model (hierarchical)	155.32	100	.40	1.55	.97	.05	.04
4-factor-model (correlated)	153.40	98	.37	1.57	.97	.05	.04

Note. Results for the CIT ($N = 265$) are presented. *CFI* = Comparative-Fit-Index; *RMSEA* = Root Mean Square Error of Approximation; *SRMR* = Standardized Root Mean Square Residual; *df* = degrees of freedom.

Concerning item analysis, the mean scores for the CIT (4.12–5.15) were higher than for the GCA (4.03–4.95) and the CITGroup (4.03–4.68). Significant correlations between corresponding items of the CIT and the CITGroup (.42–.72) were found. Item difficulties were, with five exceptions (.80–.83), within the recommended range, although in most cases larger than .70. Furthermore, although the items were not normally distributed, their skewness and kurtosis were below critical values. Item 30 was excluded because of inadequate item properties.

Regarding further analyses at scale level, the CIT-data were used because factor analyses had indicated the best content validity for these data. With respect to scale analysis (Table 4), values of Cronbach's α and mean item correlations indicated good internal consistency and homogeneity. The items' discriminatory power (.45–.70) was within the recommended range. Furthermore, scale correlations (.47–.62) indicated medium relations between the measurement scales. Finally, although the scales were not normally distributed, their skewness and kurtosis were below critical values.

Table 4. Scale characteristics of the measurement instrument of innovative work behaviour

Dimension	M	SD	n items	α	MIC	OE	IG	IP
Opportunity exploration (OE)	4.94	.82	4	.76	.44			
Idea generation (IG)	4.78	.78	6	.83	.44	.51**		
Idea promotion (IP)	4.65	.92	7	.87	.48	.47**	.62**	
Reflection (RE)	4.39	1.00	3	.76	.52	.52**	.62**	.61**

Note. **p < .01. Results for the CIT ($N = 265$) are presented.

Regarding differences due to background characteristics, participants in a *management* position had higher scores for all dimensions of *innovative work behaviour*. Furthermore, if being a teacher was participants' *main job*, they displayed higher values for *opportunity*

exploration. Likewise, teachers working *full-time* scored higher on *reflection*. Moreover, if the *status* of episodes was 'in progress', participants' scores for *opportunity exploration* and *idea promotion* were higher. Also, if the *duration of the process* was longer, participants had higher scores for *opportunity exploration*. Finally, if the number of *goals achieved* was higher, scores for all dimensions of *innovative work behaviour* were higher. Likewise, the larger the number of *prognosed goals to be achieved* was, the higher were the scores for all dimensions of *innovative work behaviour*. Moreover, with respect to criterion validity, significant correlations of overall *innovative work behaviour* and its four dimensions with *impact* (.31–.32) and *supervisor support* (.21–.44) were found.

Integration of findings
This section answers the three research question addressed in the introduction based on the theoretical considerations and empirical findings described throughout the article.

Criteria for measuring innovative work behaviour
For achieving content validity, three interrelated steps were taken: Firstly, a conceptualization of innovative work behaviour was derived from theories of creativity and innovation (Amabile, 1988; Kanter, 1988; Scott & Bruce, 1994; West & Farr, 1990), and workplace learning (Van Woerkom, 2004). Innovative work behaviour was conceptualized as a dynamic and context-bound construct consisting of tasks and activities carried out by employees in their work context. Innovative work behaviour refers to a partly social-interactive process and includes reflection about work activities and outcomes. Secondly, the dimensions of innovative work behaviour were operationalized in close connection with previous studies (De Jong, 2007; Janssen, 2005; Scott & Bruce, 1994) and the theoretical conceptualization. Thirdly, from the conceptualization of innovative work behaviour criteria for measurement were derived (Bauer & Mulder, 2010): Measurement had to be based on work activities and grounded in work contexts; the Critical Incident Technique and the Generalized Case Approach were applied to account for participants with and without experiences with innovation development. Furthermore, measurement had to contain social activities, an assessment of the behaviour of one's allies, and reflection as a distinct dimension. In addition, methodological requirements for the validation of the instrument were established. Based on these three pillars, the measurement instrument was developed.

Empirical identification of the theoretically assumed dimensions
The two studies provided initial evidence for construct validity and cross validity. In both studies the dimensions opportunity exploration, idea generation, idea promotion, and reflection were empirically identified. However, idea realization was only identified for the CIT and the CITGroup in study 1. In addition, only three items representing idea realization were associated with a factor in both studies. Moreover, the results of the confirmatory factor analysis were slightly in favour of a 4-dimensional model which however may be connected to the findings regarding idea realization. Finally, both studies consistently showed that the CIT led to the most theoretically and statistically sound results, while case-based

measurement and measurement of group behaviour led to insufficient item-factor-associations and overlapping factors.

Regarding the items measuring innovative work behaviour, the dimensions opportunity exploration, idea generation, and idea promotion were mainly represented by the same and an appropriate number of items in both studies. With the exception of idea realization, no items were associated with different factors in both studies. However, some items were not associated with a factor in one of the studies. In particular, only two reflection-items were associated with the corresponding factor in both studies.

Psychometric properties of the measurement instrument

Satisfactory results for the quality of the instrument were found. With one exception, all items proved adequate in both studies. Furthermore, both studies revealed that, although item difficulties were mainly within the recommended range, most items were rather difficult. With respect to the measurement techniques applied, higher scores for the assessment of actual behaviour than for the assessment of expected behaviour were found in both studies. Likewise, own behaviour led to higher scores than group behaviour. The assessments of own and group behaviour were also positively related which indicated that no specific distribution of tasks and activities had occurred. Also, higher item scores were found for the teacher sample. Furthermore, reliability of the scales was indicated by satisfactory values for internal consistency, homogeneity, and discriminatory power. In addition, consistent with the conceptualization of innovative work behaviour, medium relations between the measurement scales were found in both studies.

Regarding relations between background characteristics of participants and the measurement of innovative work behaviour, higher scores for participants in a management position were found in both studies. The results of study 2 also showed higher scores if a job was participants' main job and if they were working full-time. Hence, these variables have to be taken into account as far as sampling is concerned. Moreover, with respect to the comparability of the personally experienced episodes, in both studies higher scores were found with increasing duration of innovation development and with an increasing number of goals achieved. In addition, the results of study 2 revealed higher scores with an increasing number of prognosed goals to be achieved and when innovation development was still in progress. Hence, these variables which characterize quantitative differences between episodes have to be controlled for when applying the Critical Incident Technique for measuring innovative work behaviour. Finally, both studies provided evidence for the criterion validity of the instrument. Consistent with theoretical considerations and results of previous studies, positive relations of impact and supervisor support with all scales of innovative work behaviour were found.

Discussion

The aim of this article was to investigate the development and validation of a measurement instrument of innovative work behaviour as a dynamic and context-bound construct. This was accomplished by measuring innovative work behaviour based on work activities (De Jong, 2007; Kleysen & Street, 2001) and grounded in employees' work context (Bauer & Mulder,

2010). The latter was achieved with the Critical Incident Technique (Flanagan, 1954) which was advantageous over a Generalized Case Approach. Furthermore, the instrument acknowledged the social character of innovative work behaviour by including social activities and an assessment of the behaviour of one's allies (Messmann & Mulder, 2011). Finally, it emphasized the importance of reflection for innovation development and for individuals' professional development (Müller *et al.*, 2009; Van Woerkom, 2004).

The results of both studies provided initial evidence for the reliability and validity of the developed instrument as a measure of innovative work behaviour. The instrument measures innovative work behaviour with four scales representing opportunity exploration, idea generation, idea promotion, and reflection, which is, with the exception of idea realization, consistent with the outlined theoretical conceptualization. For measurement, items associated with a particular factor in both studies simultaneously (see Table 2) should be used. However, based on the results of the two studies recommendations for further improvement and validation can be given in order to optimize the instrument:

Firstly, construct validity is limited by problems encountered with idea realization: Although a factor for this dimension was found in study 1, the corresponding scale (items 19, 20, 21) could not be cross-validated in study 2 which may partly be due to the small number of items for this dimension. In order to ensure the content validity of this dimension, the instrument has to be revised by constructing additional items for idea realization. However, the results of study 2 also showed that idea realization is related to idea generation and promotion which points to the interdependence of the five innovation tasks which in part may be accomplished by the same work activities (Messmann & Mulder, 2011). Hence, the relations between these dimensions should be paid attention to when constructing new items and taken into account in further investigations.

Secondly, cross validity is limited by a number of items that were only associated with a factor in one of the studies. These items should be revised to ensure the adequate representation of all dimensions of innovative work behaviour. Especially with respect to reflection, several items related to the reflection on knowledge and skills (items 26–29) were not associated with the corresponding factor in study 2. It seems that only innovation-specific reflection can be considered an innovation task while reflection related to the improvement of competence and performance may be a consequence of innovative work behaviour. Furthermore, as some items were rather difficult, additional information about the context and the goal of an activity should be integrated. Consequently, to answer the open questions raised by both studies, to validate a revised version of the instrument, and to accomplish the goal of flexible applicability, the instrument should be further applied and examined in different professional domains.

Finally, although evidence for criterion validity was provided by consistent relations between all dimensions of innovative work behaviour and both individual and contextual criterion variables, relations with other variables such as supervisor or peer ratings of innovative work behaviour and relations with ratings of innovative outcomes should be considered to ensure the validity of the developed self-report measure.

In closing, an understanding of employees' contributions to innovation development is crucial for organizations to make good use of and foster this valuable resource (Zhou &

Shalley, 2003). The research presented provides insight into the construct of innovative work behaviour which aims at explaining these contributions. It therefore holds important implications for future research and for organizational practice:

With regard to research, this contribution emphasized that innovative work behaviour should be conceptualized and measured as a dynamic and context-bound construct. It thus pointed out the importance of including the social-interactive and the reflective facets of innovation development in the measurement of innovative work behaviour. Furthermore, measuring the construct with context-bound work activities carried out to accomplish a set of tasks required for innovation development seems promising. Regarding reflection, we found that innovation-specific reflection can be considered such an innovation task. With respect to reflection on competence and performance, the specific relations between innovative work behaviour and employees' professional development need to be further analysed. Moreover, the instrument should be used to study the interplay of individual and contextual characteristics in facilitating innovative work behaviour.

With regard to practice, the measurement instrument can be used by managers, HRD practitioners, and supervisors in all kinds of organizations to recognize and assess employees' innovative work behaviour. For instance, the instrument can be applied in organizational evaluation or employee selection processes. In this respect, a measure of innovative work behaviour can be used to identify innovative employees, understand how and when employees are innovative, give them supportive feedback on their ideas and, ultimately, foster innovation development in organizational practice. Furthermore, the outlined conceptualization of innovative work behaviour as a set of tasks required for innovation development can be used for the design of training aimed at enhancing employees innovation-specific competence and, hence, their performance during processes of innovation development.

Chapter 6

Facilitating Vocational Teachers' Innovative Work Behaviour: Effects of Social Support and the Mediating Role of Individual Perceptions and Motivation[5]

Introduction

Innovations are important for organizations to enhance internal processes and the quality of outcomes, to satisfy customers, and to remain competitive (Amabile, 1988; Kanter, 1988; Marinova & Phillimore, 2003; Oldham & Cummings, 1996). Accordingly, organizations increasingly expect their employees to contribute to innovation development (Anderson, De Dreu, & Nijstad, 2004). Innovations are new and potentially useful products or processes that address the problems and challenges of a particular work context and help to maintain or improve the current state of this context (West & Farr, 1990). For employees, the contribution to innovation development may positively influence work conditions, job satisfaction, and well-being (Janssen, 2000), and the development of work performance, productivity, and outcomes.

In vocational colleges, innovations are important to enhance the quality of education and to provide a good job preparation for students that includes acquiring job-related skills, career competences, and the capacity to sustain learning (OECD, 2009, 2010). Due to the close connection of the German vocational system to societal, economic, and technological developments, and its dual (i.e. work-based and school-based) organization (Hippach-Schneider, Krause, & Woll, 2007), innovative instructional environments and work processes derived from real jobs are required to provide a good fit between the school and the work context. For teachers, the engagement in innovation development may enhance their work inside and outside the classroom, and provide opportunities for accomplishing job-related goals. However, in order to accomplish a sustainable practical impact, innovations have to be developed in accordance with the goals and needs at a particular school and by the people working and learning there (Messmann & Mulder, 2011).

Innovative contributions by employees such as vocational teachers are referred to as innovative work behaviour which encompasses all work activities carried out in relation to innovation development (Scott & Bruce, 1994). Conceptually innovative work behaviour is

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[5] This chapter is based on:

Messmann, G., & Mulder, R. H. (submitted for publication). Facilitating vocational teachers' innovative work behavior: Effects of social support and the mediating role of individual perceptions and motivation.

based on psychological models of creativity and innovation (Amabile, 1988; Kanter, 1988; West, 2002; Woodman, Sawyer, & Griffin, 1993). Empirical studies provided insight into various determinants of innovative work behaviour including individual differences, motivation, job characteristics, and social support (Hammond, Neff, Farr, Schwall, & Zhao, 2011). Furthermore, because innovations are based on individual activities in a particular work context, innovative work behaviour is dynamic and context-bound (Messmann & Mulder, 2012). For organizations such as vocational colleges, insight into the process of innovation development and its determinants is valuable for deriving practical steps to enhance employees' contributions to this process. Therefore, the central question is: *Which individual and contextual characteristics facilitate vocational teachers' innovative work behaviour?*

As there is little insight into vocational teachers' innovative work behaviour, this contribution draws on findings from previous research in other domains (Hammond *et al.*, 2011; Shalley, Zhou, & Oldham, 2004; Zhou & Shalley, 2003) and on the Theory of Planned Behaviour to develop and test a model of facilitating factors for vocational teachers' innovative work behaviour. Finally, some directions for future research and for practice in vocational colleges are derived from the study.

Innovative work behaviour as a dynamic, context-bound construct

The construct of innovative work behaviour (Janssen, 2000; Scott & Bruce, 1994) is conceptually based on psychological models of creativity and innovation as a two-stage process (Amabile, 1988; West, 2002; Woodman *et al.*, 1993): The *creative stage* encompasses problem recognition and the generation of ideas while the *implementation stage* contains the promotion and practical application of ideas. Innovative work behaviour integrates the two stages as a set of *tasks* required for innovation development (Kanter, 1988). Furthermore, innovative work behaviour encompasses the physical and cognitive *work activities* employees carry out solitarily or in a social setting to accomplish these tasks (Messmann & Mulder, 2011). In studies on innovative work behaviour (De Jong & Den Hartog, 2010; Dorenbosch, Van Engen, & Verhagen, 2005; Kleysen & Street, 2001) four prerequisite tasks for innovation development emerged:

Opportunity exploration refers to the recognition and comprehension of problems and needs that represent an opportunity to change and improve processes and products in one's work context. This comprises being attentive to one's work environment and keeping up with recent developments such as changes of organizational structures, events in other organizations, and new insights in one's field of work. *Idea generation* entails the activation of innovation development by creating new, applicable, and potentially useful ideas that approach identified opportunities for innovation. This includes activities such as publicly addressing substantial work-related problems, critically examining predominant beliefs, and discussing changes required to solve these problems. *Idea promotion* requires convincing others of the envisioned innovation and building a coalition of allies that takes over responsibility and workload, and that provides access to information, resources, and support. This involves informing and winning the support of colleagues and supervisors, negotiating with key actors, and diffusing ideas across the boundaries of one's work context. *Idea*

realization encompasses experimenting with one's ideas and creating a prototype or hands-on example of the innovation for making others familiar with its details. Moreover, it entails improving the adequacy of the innovation by examining outcomes for undesirable effects, and strategically planning its application and integration into organizational work practice.

These tasks partly build on each other but are also iteratively connected by feedback loops and, therefore, do not follow a linear sequence (Dorenbosch *et al.*, 2005). Furthermore, activities may contribute to multiple tasks, and employees may be involved in the accomplishment of several of these tasks simultaneously and repeatedly (Scott & Bruce, 1994). Therefore, innovative work behaviour is a holistic construct composed of interdependent tasks and activities embedded into the complex, iterative process of innovation development.

Moreover, because innovations build on contributions of individuals in their work context, innovative work behaviour is dynamic and context-bound (Messmann & Mulder, 2012): Innovative work behaviour is *dynamic* because it partly consists of social activities that are carried out collaboratively or that are affected by feedback of others. And it is dynamic because of the complex relations between past work activities and outcomes and activities carried out in present and future. Furthermore, innovative work behaviour is *context-bound* because employees' work activities and outcomes are meaningful only in relation to a particular work context and, consequently, are determined by characteristics of this context.

The dynamic and context-bound nature of innovative work behaviour has implications for innovation development and for employees' professional development which, however, may not always be explicit for employees. Therefore, *reflection* emerges as a further task that is required throughout the entire process of innovation development and for linking all other innovation tasks. Research indicates that reflecting on ideas, strategies, activities, and outcomes positively contributes to innovation development, in particular concerning collaborative activities (Müller, Herbig, & Petrovic, 2009; West, 2000). Furthermore, reflection also enables employees to regulate and improve their professional performance (Van Woerkom, 2004). For instance, if employees reflect on the outcomes of an activity they can improve their performance of comparable future activities. Likewise, the performance of current activities can be facilitated by reflecting on similar past activities (Kolb, Boyatzis, & Mainemelis, 2010; Kolodner, 1997).

According to these considerations, innovative work behaviour as a dynamic and context-bound construct is defined as the sum of physical and cognitive work activities carried out by employees in their work context, either solitarily or in a social setting, in order to accomplish a set of tasks required for achieving the goal of innovation development (Kanter, 1988; Messmann & Mulder, 2011; West & Farr, 1990).

Facilitation of innovative work behaviour

In previous research, considerable consensus about relevant individual and contextual determinants of creative and innovative work behaviour was accomplished (Hammond *et al.*, 2011; Shalley *et al.*, 2004; Zhou & Shalley, 2003). However, only part of these studies addressed the conceptually broader construct of innovative work behaviour (Hammond *et al.*, 2011). Furthermore, most of the existing studies focused on employees in companies (Axtell,

Holman, Unsworth, Wall, Waterson, & Harrington, 2000). By contrast, research on innovative work behaviour in educational institutions such as vocational colleges is scarce (Messmann & Mulder, 2011). Moreover, existing studies on innovative work behaviour neglected its holistic nature which implies that an investigation of facilitating factors for innovative work behaviour should address the construct as a whole. Likewise, only part of the studies included mediating mechanisms among independent variables (Maier, Streicher, Jonas, & Frey, 2007; Noefer, Stegmaier, Molter, & Sonntag, 2009). Finally, previous studies did not systematically use an underlying theory of human behaviour as a basis for guiding the investigation of determinants of innovative work behaviour.

An empirically well-established theory that fits the definition of innovation and innovative work behaviour is the Theory of Planned Behaviour (TPB; Ajzen, 1991; Armitage & Connor, 2001): Firstly, because TPB is concerned with explaining the determination of intention formation and behaviour, it is an adequate framework for investigating determinants of innovative work behaviour. Secondly, because TPB considers the level of behavioural control, it can be applied to situations and tasks that are particularly difficult and unfamiliar such as innovation development. Thirdly, because TPB includes intention as an antecedent of behaviour, it fits the intentionality to benefit included in innovation and innovative work behaviour (West & Farr, 1990).

The role of self-directed individual perceptions

TPB proposes two determinants of intention formation and behaviour that refer to self-directed individual perceptions. To begin with, TPB states that the more favourable one's *attitude towards behaviour* is, the more likely the behaviour is performed (Ajzen, 1991). Regarding innovative work behaviour, a favourable attitude depends on the attribution of a positive value to innovation, and on the personal evaluation, that employees' contributions are essential for innovation development. Accordingly, a positive attitude towards innovative work behaviour should depend on employees' *felt responsibility* which refers to the belief to be personally obligated to contribute to constructive change (Morrison & Phelps, 1999). Thus, felt responsibility should facilitate innovative work behaviour by the mediating process of favourable evaluations of the engagement in innovation development and the corresponding expectation of positive outcomes such as satisfaction and feelings of accomplishment (Choi, 2007; Parker, Wall, & Cordery, 2001). This assumption is supported by the finding that employees who felt responsible for constructive change were more likely to actually take charge and perform proactive, change-oriented work behaviour (Choi, 2007; Fuller, Marler, & Hester, 2006; Morrison & Phelps 1999).

Hypothesis 1: Felt responsibility will have a positive effect on innovative work behaviour.

Furthermore, TPB states that the more confident an individual is about having sufficient volitional control over an intended behaviour, the more likely the behaviour is performed (Ajzen, 1991). As mentioned above, *perceived behavioural control* is particularly relevant if difficult or unfamiliar tasks such as the development of innovative products or processes have to be accomplished.

Conceptually, an internal and an external factor of perceived behavioural control are distinguished (Ajzen, 2002): The internal factor is represented by *self-efficacy* which refers to an individual's confidence in being able to perform a behaviour competently. Self-efficacious employees invest more effort, are more persistent, and make more innovative contributions such as critically addressing problems, suggesting new ideas, or promoting alternative solutions (Amabile, 1988; Spreitzer, 1995). In several empirical studies it was demonstrated that self-efficacious employees were more likely of taking charge (Morrison & Phelps, 1999) and performing creatively (Choi, 2004). Furthermore, employees made more innovative contributions if they felt competent to perform broad, proactive activities (Axtell *et al.*, 2000), if they were positive about their job-related development (Noefer *et al.*, 2009), and if they were confident about doing their jobs well (Knol & Van Linge, 2009; Spreitzer, 1995).

Hypothesis 2: Self-efficacy will have a positive effect on innovative work behaviour.

Moreover, the external factor of perceived behavioural control is represented by an individual's belief to have sufficient control over environmental constraints when performing a behaviour (Ajzen, 2002). This perception of controllability is mirrored in employees' perceived *impact* which refers to the felt influence on socio-political processes required for achieving desirable strategic, administrative, or operating outcomes at work (Ashfort, 1989; Spreitzer, 1995). Consequently, if employees perceive that their contributions at work make a difference, they should also put more effort into developing innovative ideas (Janssen, 2005). Regarding empirical support, several studies demonstrated that employees who perceived to have influence on work processes and outcomes were more likely to contribute to the development of innovations (Janssen, 2005; Knol & Van Linge, 2009; Spreitzer, 1995).

Hypothesis 3: Impact will have a positive effect on innovative work behaviour.

The role of social support
TPB proposes that intention formation and behaviour can be predicted by a favourable *subjective norm* which is determined by the perceived social pressure, expectation, or appreciation to perform the behaviour (Ajzen, 1991). A favourable subjective norm towards innovative work behaviour implies that the social work environment signalizes that change and improvement are appreciated and that organizational members' contributions to innovation development are requested, welcomed, or rewarded. Accordingly, instances of social support represent a central factor for enhancing creative and innovative work behaviour (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Oldham & Cummings, 1996).

One source of social support is the available psychological and physical assistance offered by one's supervisor (Yukl, 1989). Regarding innovative work behaviour, *supervisor support* refers to the appreciation and guidance, and the information, resources, and socio-political support that is provided throughout the entire process of innovation development (Kanter, 1988; Oldham & Cummings, 1996). By conveying a sense of confidence in employees' abilities and by allowing mistakes, supervisor support enables employees to accept feelings of uncertainty, perform task-oriented, and assert their innovative ideas (Janssen, 2005).

Empirical results consistently support the assumption that employees who felt supported by their supervisor were more likely to perform creative and innovative behaviour at work (Basu & Green, 1997; Janssen, 2005; Oldham & Cummings, 1996).

Hypothesis 4: Supervisor support will have a positive effect on innovative work behaviour.

Furthermore, the work climate is an important source of social support. A *supportive climate* for innovation refers to "the expectation, approval, and practical support of attempts to introduce new and improved ways of doing things" (West, 1990, p. 318). Accordingly, if the behaviour of others and the system of informal organizational rules are characterized by openness for innovation, this provides individuals with a behavioural guideline in favour of contributing to innovation development (Hammond *et al.*, 2011; Hunter, Bedell, & Mumford, 2007; De Jong & Kemp, 2003). Regarding empirical evidence, several studies demonstrated that employees who perceived their work climate as approving and supportive of innovation made more efforts to put their innovative ideas into practice (Axtell *et al.*, 2000; De Jong & Kemp, 2003; Scott & Bruce, 1994, West & Anderson, 1996).

Hypothesis 5: Supportive climate will have a positive effect on innovative work behaviour.

The relationship between individual perceptions and social support
With respect to the link between social support and innovative work behaviour, self-directed individual perceptions may provide an underlying explanatory mechanism. Firstly, a social work environment in which innovative ideas are generated frequently may create an implicit psychological contract that increases employees' felt responsibility to equally contribute to innovation development (Ramamoorthy, Flood, Slattery, & Sardessai, 2005). Secondly, a social work environment that is open for new ideas, provides feedback, and allows mistakes may enable employees to attribute successful, promising outcomes internally and insufficient outcomes externally which, in turn, should bolster employees' self-efficacy (Martinko, Harvey, & Dasborough, 2011). Thirdly, a social work environment that appreciates and supports efforts to develop innovative ideas may positively affect employees' belief in having an impact on work-related processes and outcomes (Janssen, 2005). Furthermore, empirical studies provide support for these mediating effects of felt responsibility, self-efficacy, and impact (Choi, 2004, 2007; Fuller *et al.*, 2007; Noefer *et al.*, 2009).

Hypothesis 6: The facilitative effect of social support on innovative work behaviour will be mediated by self-directed individual perceptions.

The role of intrinsic motivation
According to TPB, the central determinant of behaviour is an individual's *intention* to perform the behaviour. Individuals' behavioural intention encompasses all motivational factors related to the behaviour (Ajzen, 1991). In models of creative and innovative work behaviour (Amabile, 1988; Ford, 1996; Woodman *et al.*, 1993) these motivational factors play a crucial role for enabling creative individuals to actually and persistently realize their

creative potential in practice. Particularly individuals' *intrinsic motivation* that arises from positive reactions to a task such as interest, involvement, curiosity, satisfaction, or positive challenge (Amabile, 1996) is considered important for initiating and sustaining innovative contributions (Amabile, 1988; Hammond *et al.*, 2011; Tierney, Farmer, & Graen, 1999). Amabile (1985) found that intrinsic motivation facilitates individuals' divergent thinking and, thus, enables them to explore different solutions and approaches to a task or situation. Furthermore, several studies provide empirical support for the importance of intrinsic motivation as an antecedent of creative and innovative work behaviour (Maier *et al.*, 2007; Oldham & Cummings, 1996; Schwennen, Streicher, Jonas, & Krämer, 2007; Tierney *et al.*, 1999).

Moreover, intrinsic motivation is considered an underlying explanatory factor for the facilitative effect of individual and contextual characteristics on employees' creative and innovative work behaviour (Hammond *et al.*, 2011; Shalley *et al.*, 2004; Zhou & Shalley, 2003). The facilitative effect of contextual characteristics can be explained by the support these characteristics provide for individuals' innate psychological needs and, thus, for fostering their intrinsic motivation for a task or behaviour (Ryan & Deci, 2000). For instance, if the social work environment provides room for suggesting innovative ideas and enables the recognition of personal accomplishments during innovation development, this may enhance employees' feelings of autonomy and competence and, hence, their intrinsic motivation for innovation. Furthermore, the facilitative effect of self-directed individual perceptions can be explained by their ability to sustain intrinsic motivation in situations without sufficient social support (Reeve, 1996). For instance, self-efficacious and influential employees who feel responsible for promoting an idea may remain motivated to promote the idea even if some colleagues reject the idea. However, although many studies used intrinsic motivation for innovation as an underlying explanatory factor, only few studies tested this effect empirically (Vinarski-Peretz & Carmeli, 2011; Maier *et al.*, 2007; Shin & Zhou, 2003). Hence, this study examines whether intrinsic motivation mediates the effect of self-directed individual perceptions and social support on innovative work behaviour.

> *Hypothesis 7:* Intrinsic motivation will be an antecedent of innovative work behaviour and mediate the effects individual and contextual characteristics.

Method

Sample and data collection

The study was conducted with teachers in German vocational colleges in the state of Bavaria. Vocational colleges were selected as an adequate domain to study innovative work behaviour because of the important role innovations play in these institutions. Records of all Bavarian vocational colleges were scanned for colleges that were presently or in the near past involved in the development of innovative instructional environments and work processes. The participation in federal innovation initiatives and the distinction with innovation awards were used as indicators of innovative vocational colleges.

Between February and July 2010, 1060 teachers in 15 vocational colleges were invited by email to participate in the study and to answer an online-questionnaire. A longitudinal design

including three points of measurement conducted at intervals of two months (i.e. T1, T2, and T3) was accomplished. At T1, data on innovative work behaviour, individual and contextual characteristics, and participants' background characteristics were collected. The repeated data collections only included innovative work behaviour. As the measurement of innovative work behaviour required personal experiences with innovation development (which applied to 69.2% of all participants), the actual sample population encompassed 734 teachers.

At T1, $N = 239$ questionnaires were completed (response rate = 32.6%). $N = 95$ of the original participants took part in at least one of the repeated measurements, that is, $N = 79$ teachers at T2 (response rate = 10.8%) and $N = 66$ teachers at T3 (response rate = 9.0%). To compensate for the smaller size of the longitudinal sample, cross-sectional and longitudinal analyses were combined. Regarding missing values, multiple imputation (MI) and maximum likelihood (FIML) procedures were applied (Graham, 2009).

Table 1. Background characteristics of the participants

Variable	Category	N
Age*	—	44.47 (9.75)
Gender	Female	83
	Male	134
Education	Teacher training at university	153
	Trained specialist subject teacher	32
	Entering teacher training after university studies	14
	Alternative entry after university studies	14
	Alternative entry after job training	4
Tenure*	—	16.11 (10.52)
Management	Yes	41
	No	173
Teaching subject	Metal engineering	40
	Electrical engineering	22
	Constructional engineering	8
	Wood engineering	5
	Chemistry, physics, and biology	1
	Hygienics	4
	Commercial and administrative training	69
	Health	14
	Nutrition and domestic economy	36
	Agrarian economy	5
Main job	Main job	202
	Main job with additional side job	11
	Side job	6
Full-time	Yes	172
	No	48

Note. $N = 239$ (cross-sectional sample at T1). *Means and standard deviations are reported in years.

Regarding participants' background characteristics, *age*, *gender*, *education*, *tenure*, involvement in *management*, *teaching subject* and the type of employment (*main job*, *full-time*) were included (Table 1). Intra-class correlations of $\rho < .05$ indicated that observations did not depend on school membership. In addition, an ANOVA showed no mean differences between schools. Furthermore, T-tests showed higher scores of innovative work behaviour for participants in the longitudinal section. Non-parametric tests additionally showed that the participation in the longitudinal section was significantly higher for female teachers and with increasing duration of the innovation process, and significantly lower for teachers of

'chemistry, physics, and biology', 'hygienics' and 'commercial and administrative training'. Finally, as a requirement for the social activities encompassed in innovative work behaviour, the teachers stated on a 6-point Likert scale that they were used to working collaboratively with colleagues ($M = 4.25$, $SD = 1.40$).

Table 2. Items and scale characteristics of the measure of innovative work behaviour

Dimension	Items	α
Opportunity exploration	Keeping oneself informed about the school's structures and processes. Keeping oneself informed about the latest developments at one's school. Keeping oneself informed about new concepts/insights within one's professional field. Keeping oneself informed about new developments at other schools or in companies.	.72
Idea generation	Examining predominant beliefs critically. Addressing the things that have to change directly. Asking critical questions. Suggesting improvements on expressed ideas. Testing evolving solutions for shortcomings when putting ideas into practice.* Analysing evolving solutions on unwanted effects when putting ideas into practice.*	.82
Idea promotion	Addressing key persons who provide necessary permissions and resource allocation. Promoting new ideas to colleagues in order to gain their active support. Promoting new ideas to the supervisor in order to gain her/his active support. Promoting the application of the new solution within one's work context. Keeping colleagues informed about the progress of the realization of ideas. Convincing others of the importance of a new idea or solution. Introducing colleagues to the application of a developed solution.*	.88
Reflection	Assessing the progress while putting ideas into practice. Defining criteria of success for the realization of the idea. Systematically reflecting on recently made experiences.	.75
Innovative work behaviour	*Overall scale*	.83

Note. $N = 239$ (cross-sectional sample at T1). A 6-point Likert scale (1 = 'does not apply at all', 6 = 'fully applies') was used. *These items originally represented the dimension 'idea realization'.

Measures

Innovative work behaviour was assessed with a questionnaire consisting of 20 items and four subscales (i.e. opportunity exploration, idea generation, idea promotion, and reflection) measuring concrete work activities related to innovation development; idea realization is represented by three items but not by a separate subscale (Table 2). In line with a holistic conceptualization of innovative work behaviour, an overall score of innovative work behaviour is computed. Furthermore, the measurement of work activities is grounded in respondents' work context by applying the Critical Incident Technique (Flanagan, 1954): An introductory text derived from the definitions of innovation and innovative work behaviour is used as basis for contextualization. Next, respondents are requested to recall an episode of innovation development in their work context in which they were recently involved. To assist in recalling this episode, additional questions about the episode (i.e. *status of process*, *persons involved*, *duration of process*, *goals achieved*, and *goal prognosis*) are asked. Subsequently, for measuring innovative work behaviour participants have to state on a 6-point Likert scale, ranging from 1 ('does not apply') to 6 ('fully applies'), whether 20 statements about work

activities adequately describe their behaviour during the personally experienced episode of innovation development (Messmann & Mulder, 2012).

All independent variables were measured with existing scales used in previous studies on innovative work behaviour (Table 3). As the scales were only available in English, items were translated into German and then re-translated by a different person to ensure the adequacy of the translation. Identical to innovative work behaviour, the response format for these scales was a 6-point Likert scale. Exploratory factor analyses (principal axis; varimax rotation) were conducted to analyse the uniqueness of scales measuring conceptually related constructs. In case of insufficient factor loadings (i.e. weak loadings or cross-loadings) items were excluded. To determine internal consistency, Cronbach's α was analysed for each scale. Subsequently, variables were formed by averaging the individual item scores of each scale.

For the measurement of *felt responsibility*, a 5-item scale taken from Morrison and Phelps (1999) was used. *Self-efficacy* and *impact* were measured with two 3-item scales developed by Spreitzer (1995). Furthermore, *intrinsic motivation* was assessed with a 5-item scale developed by Tierney *et al.* (1999). In a factor analysis a distinct factor for each construct was determined; two responsibility-items and one motivation-item with insufficient factor loadings were removed from further analyses. Moreover, s*upervisor support* was assessed with a 7-item scale taken from Janssen (2005). *Supportive climate* was measured with an 8-item scale taken from De Jong and Kemp (2003). Again, a distinct factor for each construct was extracted; three climate-items with insufficient factor loadings were removed from further analyses.

Table 3. Scale characteristics of the measures of individual and contextual variables

Variable	Sample items	*n* items	*A*
Felt responsibility	I feel a personal sense of responsibility to bring about change at work.	3	.64
Self-efficacy	I am confident about my ability to do my job.	3	.78
Impact	I have significant influence over what happens in my department.	3	.86
Supervisor support	My supervisor is willing to support me when I have a valuable idea.	7	.93
Supportive climate	People at my work are always moving towards the development of new answers.	5	.87
Intrinsic motivation	I enjoy improving existing processes or products.	4	.84

Note. N = 239 (cross-sectional sample at T1). A 6-point Likert scale (1 = 'does not apply at all', 6 = 'fully applies') was used.

Analyses

Means and standard deviations of all variables were analysed (Table 4). A general linear model was computed to identify longitudinal changes of innovative work behaviour. Correlations were analysed for substantial relations between independent variables and innovative work behaviour, and for strong inter-correlations ($r > .60$) among independent variables. ANOVAs were conducted to identify effects of background characteristics on innovative work behaviour.

For hypothesis testing with cross-sectional data, structural equation modelling (SEM) was applied (Muthén & Muthén, 2010). Robust maximum likelihood estimation (MLR) for non-normal data was used. For evaluation of model fit, standard fit indices and cut-off criteria were used (Schermelleh-Engel, Moosbrugger, & Müller, 2003). Standardized regression coefficients and the amount of variance explained were examined to analyse effects.

A confirmatory factor analysis was conducted for specifying a measurement model; based on results of exploratory factor analyses and scale analyses at least three items were selected as indicators of each latent variable; for reasons of parsimony, item parcels were formed for innovative work behaviour by averaging the scores of items with similar focus and substantial inter-correlations (Little, Cunningham, Shahar, & Widaman, 2002). In addition, modelling innovative work behaviour with a hierarchical factor provided a good model fit. Subsequently, a structural model was estimated to test hypotheses 1 to 5. Furthermore, after separately analysing all possible mediation effects, two mediation models were specified to test hypotheses 6 and 7. Finally, an advanced model that integrated the identified direct and indirect effects was estimated.

For hypothesis testing with longitudinal data, the cross-sectional procedures were repeated to broaden the available evidence. Due to the smaller size of the longitudinal sample, path modelling was applied. Furthermore, the effects of the advanced model were compared longitudinally with separate scores of innovative work behaviour for each point of measurement.

Results

Descriptive statistics and correlations

Regarding innovative work behaviour, mean scores indicated that the teachers carried out each of the prerequisite innovation tasks (Table 2). Furthermore, the use of an overall score for innovative work behaviour was supported by results of the confirmatory factor analysis and significant inter-correlations of subscales. In addition, the general linear model showed a slight decrease of scores for innovative work behaviour ($F(2, 52) = 3.13$, $p < .10$), which may be explained by an increase in workload during critical periods of the school year (in which the repeated measurements were conducted).

Regarding independent variables, mean scores showed that the teachers felt responsible for change, considered themselves competent for their jobs, and perceived to have an impact on work processes and outcomes. The teachers also perceived adequate support for innovation by their supervisor and the work climate, and were intrinsically motivated for contributing to innovation development. Furthermore, all independent variables were significantly correlated with innovative work behaviour (Table 4). Finally, three background characteristics (i.e. management, goals achieved, and goal prognosis) explained mean differences of innovative work behaviour.

Hypothesis testing

A measurement model including five predictor variables and innovative work behaviour was specified with cross-sectional data (felt responsibility was not included because of substantial inter-correlations with independent variables and comparably low scale reliability; hence, hypothesis 1 was not tested). Indices of model fit indicated a well fitting model ($\chi^2_{(415)} = 469.83$, $p = .03$, $\chi^2/df = 1.10$; *NNFI* = .97; *CFI* = .98; *RMSEA* = .02 with 90% C.I. .01–.03, *pCLOSE* = 1.00; *SRMR* = .06). In a further step, relevant background characteristics were included as categorical variables; these variables, however, did not significantly contribute to the model.

Table 4. Correlations between individual variables, contextual variables, and innovative work behaviour

	M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Felt responsibility	4.98	0.77	——									
2. Self-efficacy	5.27	0.66	.48**									
3. Impact	4.30	1.16	.44**	.33**								
4. Supervisor support	4.43	1.09	.41**	.25**	.38**							
5. Supportive climate	4.23	0.93	.21**	.17*	.23**	.53**						
6. Intrinsic motivation	4.85	0.84	.63**	.42**	.31**	.32**	.16*					
7. Opportunity exploration	4.84	0.81	.27**	.28**	.32**	.21**	.15*	.32**				
8. Idea generation	4.71	0.76	.38**	.25**	.34**	.34**	.29**	.37**	.46**			
9. Idea promotion	4.54	0.96	.38**	.23**	.38**	.42**	.29**	.39**	.47**	.53**		
10. Reflection	4.10	1.00	.30**	.15*	.35**	.32**	.32**	.38**	.49**	.55**	.61**	
11. Innovative work behaviour	4.60	0.72	.41**	.28**	.43**	.41**	.33**	.45**	.74**	.78**	.83**	.85**

Note. *p < .05, **p < .01. N = 239 (cross-sectional sample at T1).
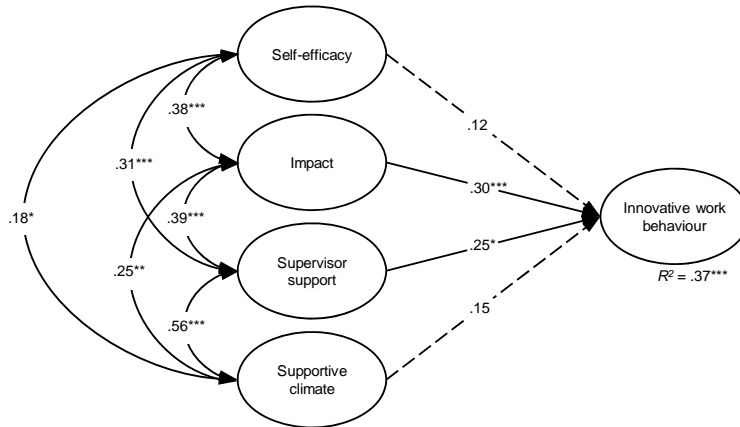
Figure 1. Standardized estimates for the hypothesized model of individual and contextual determinants of innovative work behaviour (measurement part omitted).

Note. *p* < .05, **p* < .01, ***p* < .001. *N* = 239 (cross-sectional sample at T1). All factor loadings are statistically significant at *p* < .001. Model fit: $\chi^2_{(310)}$ = 330.54, *p* = .20, χ^2/df = 1.07; *NNFI* = .99; *CFI* = .99; *RMSEA* = .02 with 90% C.I. .00–.03, *pCLOSE* = 1.00; *SRMR* = .06.

For testing hypotheses 2 to 5, a structural model including self-efficacy, impact, supervisor support, and supportive climate as predictors of innovative work behaviour was estimated. An adequate fit was determined for this model (Figure 1). As hypothesized, impact and supervisor support significantly predicted vocational teachers' innovative work behaviour. By contrast, non-significant contributions of self-efficacy and supportive climate were found. Regarding supportive climate, the absence of a significant effect may be explained by the substantial inter-correlation and, thus, the shared variance with supervisor support, which indicated that in the teachers' work context, supervisor support is a determinant of an innovative work climate.
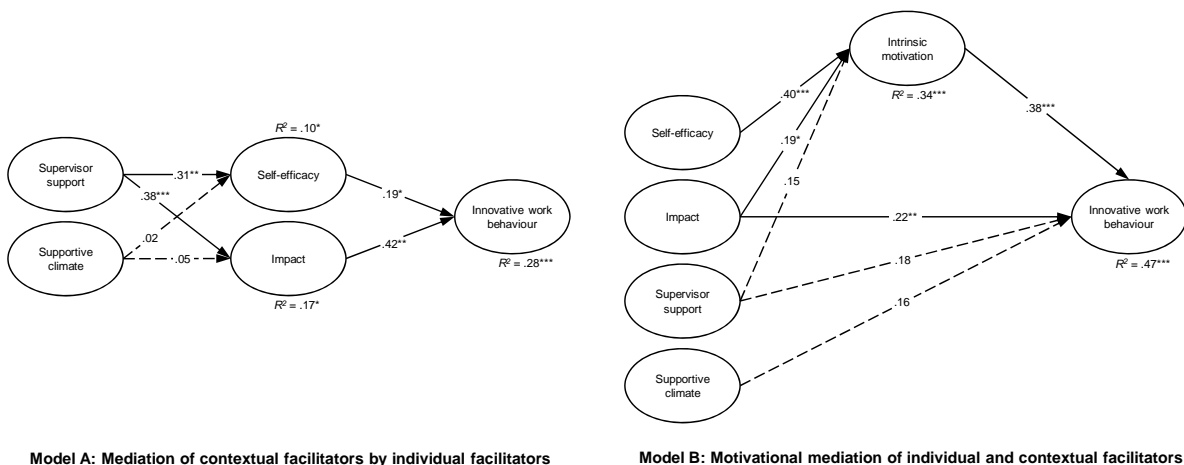

Model A: Mediation of contextual facilitators by individual facilitators   **Model B: Motivational mediation of individual and contextual facilitators**

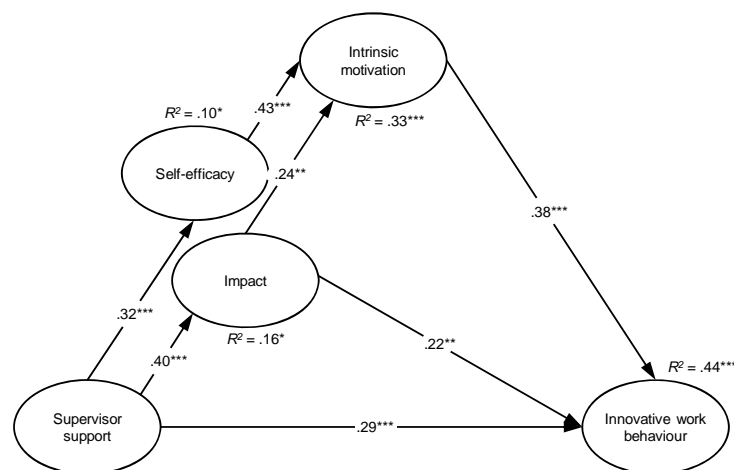**Figure 2.** Standardized estimates for the hypothesized mediation models of individual and contextual determinants of innovative work behaviour (measurement part omitted).

Note. *p* < .05, **p* < .01, ***p* < .001. *N* = 239 (cross-sectional sample at T1). All factor loadings are statistically significant at *p* < .001. Fit of model A: $\chi^2_{(312)}$ = 348.11, *p* = .08, χ^2/df = 1.12; *NNFI* = .98; *CFI* = .98; *RMSEA* = .02 with 90% C.I. .00–.03, *pCLOSE* = 1.00; *SRMR* = .08. Fit of model B: $\chi^2_{(388)}$ = 426.17, *p* = .09, χ^2/df = 1.10; *NNFI* = .98; *CFI* = .98; *RMSEA* = .02 with 90% C.I. .00–.03, *pCLOSE* = 1.00; *SRMR* = .05.

Moreover, the analysis of mediation effects indicated that self-efficacy was fully mediated by intrinsic motivation. By contrast, supportive climate was not mediated by intrinsic motivation. Subsequently, two mediation models which provided a good fit to the data were estimated for testing hypotheses 6 and 7 (Figure 2). Regarding hypothesis 6 (Model A), significant indirect effects were found for supervisor support but not for supportive climate. This result, however, is consistent with the close relationship between supervisor support and supportive climate in the context of the current study. Regarding hypothesis 7 (Model B), significant indirect effects were found for impact and self-efficacy (which was fully mediated), but not for supervisor support and supportive climate.

Finally, the estimated advanced model which integrated the identified direct and indirect effects provided a good fit to the data (Figure 3). As no significant effects of supportive climate had been found, this variable was not included. As a consequence, the effect of supervisor support became significant.

Figure 3. Standardized estimates for the advanced, cross-sectional mediation model of individual and contextual determinants of innovative work behaviour (measurement part omitted).

Note. *$p < .05$, **$p < .01$, ***$p < .001$. $N = 239$ (cross-sectional sample at T1). All factor loadings are statistically significant at $p < .001$. Model fit: $\chi^2_{(312)} = 359.67$, $p = .03$, $\chi^2/df = 1.15$; *NNFI* = .98; *CFI* = .98; *RMSEA* = .03 with 90% C.I. .01–.04, *pCLOSE* = 1.00; *SRMR* = .06.

With respect to a replication of the findings with longitudinal data, the direct and indirect effects of the estimated path models were mainly consistent with those of the cross-sectional models. An integration of these effects in an advanced path model is depicted in Figure 4; fit indices indicated a good fit of this model. The major difference of this longitudinal model is that perceived impact is not included because of a non-significant effect that was determined for this variable. Furthermore, supervisor support and supportive climate are both included in the model, with supportive climate directly predicting innovative work behaviour and the effect of supervisor support being mediated by self-efficacy and intrinsic motivation. In addition, a non-mediated effect of supportive climate on self-efficacy was found. Moreover, a longitudinal comparison of the advanced path model with separate scores of innovative work behaviour for each point of measurement showed that the identified effects were stable over time.
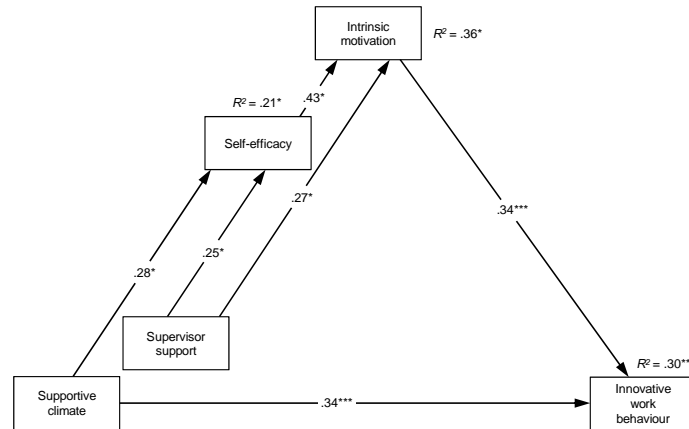
Figure 4. Standardized estimates for the advanced, longitudinal mediation model of individual and contextual determinants of innovative work behaviour (saturated path model based on manifest variables).
Note. $*p < .05$, $***p < .001$. $N = 95$ (longitudinal sample); for independent variables T1-scores are used; for the dependent variable the averaged score for T2 and T3 is used. Model fit: $\chi^2_{(3)} = 3.20$, $p = .36$, $\chi^2/df = 1.07$.

Integration of findings

As the hypotheses were tested cross-sectionally and longitudinally with different sample sizes and modelling techniques, this section carefully integrates the results as complementary sources of information regarding the investigated effects.

To begin with, although hypothesis 1 could not be tested, significant correlations of felt responsibility with vocational teachers' intrinsic motivation and innovative work behaviour were found in consistence with the theoretical assumptions (Choi, 2007). Furthermore, the results consistently showed that self-efficacy facilitated innovative work behaviour indirectly by its mediating motivational effect. Accordingly, although rejecting hypothesis 2, this result provides support for hypothesis 7. Likewise, the cross-sectional model provided support for hypothesis 3, which predicted that vocational teachers who perceive to have impact on work processes and outcomes perform more innovative work behaviour (Janssen, 2005). In addition, in support of hypothesis 7, perceived impact facilitated vocational teachers' innovative work behaviour indirectly by bolstering their intrinsic motivation. However, as non-significant effects of impact were determined in the longitudinal analyses, the conclusions regarding this variable require further testing.

Furthermore, as predicted by hypothesis 4, a facilitative effect of perceived supervisor support on vocational teachers' innovative work behaviour was found in the cross-sectional model (Basu & Green, 1997). In accordance with hypothesis 6, this effect was partly due to the mediating processes of enhancing teachers' self-efficacy (Noefer *et al.*, 2009) and impact (Choi, 2007). In addition, in the longitudinal model supervisor support facilitated vocational teachers' innovative work behaviour indirectly by increasing self-efficacy and intrinsic motivation (Maier *et al.*, 2007), which supports hypothesis 6 and 7. Moreover, a facilitative effect of supportive climate on vocational teachers' innovative work behaviour, as predicted by hypothesis 5, was found in the longitudinal model (De Jong & Kemp, 2003). However, a non-significant effect in the cross-sectional model and no intervening mechanisms were determined for supportive climate. Accordingly, compared to supervisor support the results

provided less evidence for the facilitative effect of supportive climate. It has to be considered, however, that in vocational teachers' work context supervisor support and supportive climate may represent complementary expressions of social support, which impairs the separation of effects.

Finally, as became apparent above, the results consistently provided support for hypothesis 7. Vocational teachers' intrinsic motivation was the most important antecedent of innovative work behaviour and, additionally, represented a mediating process for the facilitative effects of self-efficacy, impact, and supervisor support.

Discussion

The aim of this study was to investigate individual and contextual determinants of vocational teachers' innovative work behaviour. Based on previous research (Hammond *et al.*, 2011) and TPB (Ajzen, 1991), a model was developed and tested. According to this model, the most important antecedent of vocational teachers' innovative work behaviour is their intrinsic motivation for innovation, which depends on their perceptions of self-efficacy, impact, and supervisor support and, in turn, mediates the facilitative effects of these variables on innovative work behaviour. In addition, the effect of supervisor support is mediated by self-efficacy and impact. Moreover, feeling influential and socially supported also stimulates vocational teachers' contributions to innovation development directly. TPB proved to be useful as an underlying theory for guiding this research and the findings of the study mainly corresponded with TPB. In addition, the findings regarding the mediating effect of self-directed individual perceptions offered insight into further underlying mechanisms (Martinko *et al.*, 2011). However, some critical issues of the study which provide directions for future research have to be addressed.

Firstly, the proposed research model was not tested completely as felt responsibility could not be included. Furthermore, the relationship between supervisor support and supportive climate impaired hypothesis testing. In the current study, the perceived work climate may have been partially determined by frequent interactions of vocational teachers with their supervisor. Regarding future studies it should be considered, however, that in other work contexts the two variables may be detached from each other, for instance, if interactions with the supervisor hardly occur at employees' workplace. Moreover, characteristics of jobs tasks and measures of innovative outcomes should be included.

Secondly, due to low response during repeated measurements a combined cross-sectional and longitudinal approach became necessary. This strategy seemed useful as the cross-sectional approach provided an adequate sample size and allowed SEM, and the longitudinal approach enabled causal inferences and provided a remedy for problems with self-report data. However, the results of both approaches differed slightly and, therefore, some conclusions require further examination. In addition, future studies should include longitudinal data of independent variables to allow testing alternative explanations such as reversed effects. Moreover, to further prevent problems with self-reports, alternative approaches for obtaining data on innovative work behaviour such as scenario techniques with open response format should be considered.

Thirdly, regarding the generalization of findings, it has to be taken into account that, although the results were consistent with previous research, the conclusions are based on a single study in vocational teachers' work context. As this context is characterized by the duplicity of working inside and outside the classroom, there may be differences to other fields such as the industrial or the service sector. Accordingly, the model should be validated in additional work contexts. Furthermore, the conclusions may be limited to the specific sample that was selected. As there was little insight into vocational teachers' innovative work behaviour, innovative vocational colleges and vocational teachers experienced in innovation development were chosen to enable measurement based on critical incidents. Therefore, it has to be further analysed whether the results are transferable to less innovative schools and less experienced vocational teachers.

With respect to practical implications, the study contributes to an understanding of innovation from a micro perspective and gives advice on how the development of innovations as a response to problems and needs at work can be fostered by facilitating vocational teachers' innovative work behaviour: Firstly, the pivotal role of intrinsic motivation as an antecedent of innovative work behaviour can be used as starting point for practical steps to foster vocational teachers' motivation for innovation development, for instance, by establishing collaborative work structures at school. Secondly, supervisors and employees in vocational colleges should pay attention to their role as providers of social support: By appreciating innovative ideas and embedding them into an open dialogue, and by taking an innovative approach oneself, innovative contributions of others can be encouraged. Thirdly, by enabling subordinates and colleagues to develop confidence in their competences, and by enhancing their impact on work processes and outcomes, their innovative work behaviour can be bolstered and sustained, even in difficult or unpleasant situations or if external support is not available.

Consequently, by realizing these aspects in practice, vocational teachers' innovative work behaviour and the development of innovations in vocational colleges can be fostered which, in turn, is crucial for an adequate job preparation for students (OECD, 2009, 2010). Moreover, the implications of the study can be used in all kinds of educational organizations to support employees' contributions to innovation development as well as to secure and improve the quality of education.

Chapter 7

General Discussion and Reflections

The aim of this thesis was to contribute to an understanding of the nature and facilitation of vocational teachers' innovative work behaviour as a key element for the development of innovations in vocational colleges. Two research tasks that are required for achieving this goal were identified in the beginning. These tasks were (1) to develop a sound theoretical conceptualization of innovative work behaviour as basis for measuring the construct and for finding out whether vocational teachers performed innovative work behaviour in their work context; and (2) to provide insight into the facilitation of vocational teachers' innovative work behaviour as a prerequisite for innovation development in vocational colleges. The two tasks were approached by five (empirical and theoretical) contributions with different but complementary methodological approaches and from domain-specific as well as general analytical perspectives on innovative work behaviour.

The aim of this final chapter is to discuss how the conceptualization, measurement, and facilitation of vocational teachers' innovative work behaviour were approached in the five contributions of this thesis and how the main findings of each contribution can be integrated. This general discussion will then be used as starting point for reflections on (1) directions for future research on innovative work behaviour and (2) implications for practice, particularly in vocational colleges.

Main findings

This thesis provided insight into three major aspects: Firstly, it was illustrated how innovative work behaviour can be measured as a dynamic, context-bound construct by grounding measurement on work activities employees have carried out in their work context during an episode of innovation development and by integrating the social and reflective components of innovation development. By this means, the process of innovation development was linked to employees' professional development.

Secondly, the studies with vocational teachers showed that innovations and individual contributions to their development represent a practically relevant aspect in vocational colleges and in vocational teachers' work context for tackling problems and challenges inside and outside the classroom and for providing adequate job preparation for students.

Thirdly, the thesis provided insight into possibilities to facilitate vocational teachers' innovative work behaviour by identifying factors that trigger the initiation of innovation development and factors that foster work activities during the development of an innovation. The initiation of innovative work behaviour was driven by an interaction of contextual problems and opportunities with vocational teachers' personal goals and needs. The

performance of innovative work behaviour was determined by characteristics of professionalism as well as by vocational teachers' intrinsic motivation, the available social support, and vocational teachers' self-directed individual perceptions. In the following sections, these conclusions are discussed in detail with respect to each of the single contributions of this thesis.

Conceptualizing and measuring innovative work behaviour
Insight into conceptualization and measurement was provided by the first two studies in vocational colleges (Chapter 2 and 3), the theoretical analysis (Chapter 4), and the contribution depicting the development and test of a measurement instrument (Chapter 5).

To begin with, in the initial questionnaire study with vocational teachers innovative work behaviour was operationalized and measured with respect to vocational teachers' contributions to the development of specific innovative products and processes in vocational colleges, both inside and outside the classroom. The aim of this operationalization was to take into account that innovations are bound to a particular work context in which they are developed and applied. Accordingly, a domain-specific measurement instrument of innovative work behaviour was accomplished which measured vocational teachers' concrete work activities during innovation development. The contextualization of these work activities was realized by integrating domain-specific references to innovations in vocational colleges in the item formulations. This, however, turned out to be problematic because items that were associated with different innovation tasks but that contained similar references to an innovation (e.g. 'generating' versus 'using' methods that take into account characteristics of students' future jobs) were strongly related to each other. Therefore, it was concluded that a general measure of innovative work behaviour with domain-*un*specific item formulations (i.e. without references to a particular innovation) which can be adapted to different work contexts may be more adequate. In order to enable the context-bound measurement of work activities, the use of context-specific cases and the activation of personal experiences with innovation development were considered as possible approaches for contextualization.

Furthermore, the explorative interview study with vocational teachers provided complementary, domain-specific insight into the complex relationships among prerequisite tasks for innovation development and the corresponding work activities of employees that are encompassed in innovative work behaviour (Kanter, 1988; Scott & Bruce, 1994). Accordingly, the results of the study were helpful for enabling the context-bound measurement of vocational teachers' work activities related to innovation development. In addition, they represented an important resource for the interpretation of findings of later quantitative studies on the facilitation of innovative work behaviour. In particular, the results of the study showed that the interviewed teachers were engaged in accomplishing several innovation tasks, sometimes in parallel, and that some of the reported work activities contributed to multiple innovation tasks. In addition, a fixed task sequence was not identified; rather, the teachers described innovation development as a process of repeatedly criss-crossing the prerequisite innovation tasks (Dorenbosch, Van Engen, & Verhagen, 2005; Scott & Bruce, 1994). Moreover, the interviewed teachers described the generation, promotion, and realization of ideas as a strongly social-communicative process. In fact, only for idea

generation activities were reported that were carried out solitarily. Furthermore, the teachers reported several activities related to the entire process of innovation development that contained reflection. These activities were carried out to advance the process of innovation development as well as to adapt and improve one's own contributions to this process. With respect to the conceptualization of innovative work behaviour, it was concluded from this domain-specific insight that the development of an innovation is a complex, non-linear, and iterative process and that the contributions of individual employees at least partially are social and reflective in nature.

In accordance with the first two studies, the subsequent goal was to advance existing conceptualizations and approaches for measuring innovative work behaviour (Janssen, 2000; Scott & Bruce, 1994). With respect to the theoretical conceptualization of innovative work behaviour, the starting point for theorizing was that the development of an innovation is based on work activities of individual employees such as vocational teachers. From the finding that the relation of vocational teachers' work activities to the process of innovation development was rather complex, it was derived that innovation development should not be viewed as a sequence of separate stages (West, 2002) but as a set of interdependent innovation tasks (Kanter, 1988). Furthermore, it was concluded that employees' engagement for the generation, promotion, and realization of ideas that address work-related problems and challenges holds important resources for professional development. This may include acquiring, combining, and creating new knowledge as well as refining and advancing one's performance of work activities, the corresponding outcomes, and the underlying strategies, expectations, and beliefs. The view of innovative work behaviour as a source of professional development was further supported by the finding that vocational teachers' innovative work behaviour contained reflective activities. These reflective activities enabled them to establish relations between work activities, underlying assumptions, and outcomes across time which, in turn, provided opportunities for improving the innovation and for developing as professionals (Van Woerkom, 2004). Furthermore, this view was also supported by the finding that vocational teachers' innovative work behaviour partly encompassed social components such as input and feedback of others and collegial interactions that provided additional resources for innovation and professional development. From this substantial role of reflective and social activities for innovation development it was derived that innovative work behaviour is a complex construct that is timely and socio-culturally bound to the particular work context in which an innovation is developed.

Based on all these considerations, innovative work behaviour was reconceptualized as a dynamic, context-bound construct that encompasses social activities and reflection as an additional innovation task that is required throughout the entire process of innovation development. Moreover, it was illustrated how the reflection on work experiences such as performance aspects, underlying assumptions, and outcomes during innovation development provides opportunities for informal, experiential learning at work (Argyris & Schön, 1996; Kolb, 1984; Kolodner, 1992). Drawing on the theoretical conceptualization of innovative work behaviour as a dynamic, context-bound construct, conditions for measurement were derived and a measurement instrument was developed. Accordingly, measurement was based on concrete work activities (De Jong & Den Hartog, 2010) and grounded in the particular

work context in which the activities were carried out (Bauer & Mulder, 2010). This was accomplished by applying the Critical Incident Technique (Flanagan, 1954) and activating personal experiences with innovation development. This approach was advantageous over using generalized cases for contextualization. In addition, using an introductory text about innovation development proved to be a useful strategy for contextualization. Furthermore, the social and reflective character of innovative work behaviour was taken into account by including social activities and an assessment of the innovative work behaviour of one's group of allies; and by including reflective activities during innovation development that represented reflection as an additional innovation task. Finally, the analysis of the instrument's factor structure and psychometric properties based on two empirical studies, one with employees of an automotive supply company and one with vocational teachers, provided satisfactory results and a sound basis for further investigating the facilitation of vocational teachers' innovative work behaviour.

Facilitating innovative work behaviour
Insight into the facilitation of vocational teachers' innovative work behaviour was provided by the first two studies (Chapter 2 and 3) as well as by the main study of this thesis (Chapter 6), which were all conducted in vocational colleges.

To begin with, the initial questionnaire study with vocational teachers provided insight into the role of professionalism as a prerequisite for innovation development. The results showed that the teachers contributed to the development of innovations although they performed less innovative work behaviour inside than outside the classroom. Furthermore, the study supported the assumption that in vocational teachers' work context a certain level of professional knowledge and performance is required for performing innovative work behaviour. However, the most important prerequisite of vocational teachers' innovative work behaviour was their engagement in professional development activities. Moreover, when different dimensions of knowledge, performance, and development were compared, it turned out that the metacognitive and the social dimension of professionalism including metacognitive knowledge, reflection on professional performance and development, and the expansion of social relations were more important predictors of innovative work behaviour than the occupational dimension of professionalism.

Moreover, the explorative interview study provided detailed insight into mechanisms that motivated teachers to initiate the development of an innovation. Based on the findings of the interviews, it can be concluded that the teachers' perception of an opportunity for innovation arose from an interaction of contextual and individual characteristics. On the one hand, contextual characteristics such as limited scope of action, lack of resources and communication, and problems with students posed problems and challenges for teachers' work. On the other hand, these contextual perceptions interacted with vocational teachers' job-related goals such as satisfaction and self-actualization which the teachers sought to achieve by contributing to innovation development. In addition, vocational teachers' dispositions such as motivation and curiosity activated their engagement for change and improvement, and their general openness for development on their jobs. From these findings it was concluded that an interactionist perspective (Woodman, Sawyer, & Griffin, 1993) on

the initiation of innovation development that includes contextual and individual characteristics may be promising for further investigating the facilitation of vocational teachers' innovative work behaviour.

Finally, in the main study of this thesis a model of facilitating factors for vocational teachers' innovative work behaviour was developed in accordance with previous research (Hammond, Neff, Farr, Schwall, & Zhao, 2011) and using the Theory of Planned Behaviour (Ajzen, 1991) as theoretical basis. According to the resulting model that was tested, vocational teachers contributed to all of the tasks required for innovation development. The performance of innovative work behaviour depended strongly on vocational teachers' intrinsic motivation for innovation. In addition, perceptions of impact and social support by the supervisor and the work climate stimulated vocational teachers' contributions to innovation development. Moreover, the teachers' intrinsic motivation for innovation also provided an underlying explanatory mechanism for the facilitative effect of self-directed individual perceptions and social support. Vocational teachers were more intrinsically motivated for engaging in innovation development if they felt self-efficacious and perceived to have an impact on work processes and outcomes, and if they felt supported by their supervisor. Furthermore, the study also indicated that supervisor support facilitates innovative work behaviour as a consequence of the ability of supervisor support to reinforce teachers' sense of self-efficacy and impact. After having illustrated the main findings of this thesis, some reflections on directions for research and implications for practice will be presented.

Directions for research

The contributions of this thesis hold several implications for future investigations of innovative work behaviour. Firstly, the studies conducted to develop and test a measure of innovative work behaviour as a dynamic, context-bound construct provided insight for the further optimization of the measurement instrument. To begin with, additional items should be integrated into the instrument in order to adequately represent all five dimensions of innovative work behaviour. In addition, the factor structure should be validated in further professional domains to enable the instrument's flexible applicability across domains. Furthermore, although the findings indicated that measurement based on actual, experience-based behaviour is advantageous over measurement based on hypothetical, case-based behaviour, the latter approach should be further explored in order to enable an assessment of the 'innovativeness' of employees without prior experiences with innovation development. Also, relations with further criterion variables such as innovative outcomes and supervisor or peer ratings of innovative work behaviour should be investigated. Regarding the latter, the consideration of additional data sources for measuring innovative work behaviour could also be beneficial for preventing problems with self-report data.

Secondly, because this thesis represents a first attempt to studying facilitating factors for vocational teachers' innovative work behaviour and as the results showed that innovations are of practical relevance for vocational colleges, more studies in this domain should be carried out to deepen the insight provided by the thesis. To begin with, the findings regarding triggers of innovative work behaviour provided by the interview study should be investigated quantitatively to achieve a substantiated understanding about the initiation of innovation

development. Moreover, the tested model of facilitating factors for vocational teachers' innovative work behaviour should be used as a starting point for further examination of the model and for integration of additional determinants of innovative work behaviour. In this respect, the use of the Theory of Planned Behaviour (Ajzen, 1991) as a theoretical basis is beneficial for deriving and integrating further variables as indicators of vocational teachers' attitude towards innovative work behaviour, the corresponding perceived behavioural control, and the subjective norm towards contributing to innovation development that is established by the social work environment. Likewise, the identified mediation effects of perceived self-efficacy, impact, and intrinsic motivation (Janssen, 2005; Martinko, Harvey, & Dasborough, 2011; Reeve, 1996; Ryan & Deci, 2000) point to underlying explanatory mechanisms that can also be used to derive potential determinants of vocational teachers' innovative work behaviour. In addition, although determinants of creative behaviour (Shalley, Zhou, & Oldham, 2004; Zhou & Shalley, 2003) and innovative work behaviour (Hammond *et al.*, 2011) were studied extensively, more integrative research is still required. Moreover, the implications of the dynamic, context-bound nature of innovative work behaviour for employees' professional development should be analysed empirically. In this respect, the theoretical angle provided by theories of experiential learning (Kolb, 1984; Kolodner, 1992) provides a sound basis for investigating the social and reflective character of innovative work behaviour and the links between the processes of innovation and professional development.

Thirdly, the findings of the thesis also hold implications for research on innovative work behaviour beyond vocational colleges. To begin with, investigations of innovative work behaviour should be carried out with teachers in the general education system as individual contributions to innovation development have not been considered adequately in this domain. The findings of this thesis regarding triggers and facilitating factors for innovative work behaviour provide a starting point for such investigations. However, it has to be taken into account that the required individual contributions to innovation development may differ to some degree as general education is less directly linked to students' future jobs. Likewise, the problems, challenges, and innovations required in these schools may differ as well. Moreover, the findings of this thesis also point to directions for research on innovative work behaviour in professional domains other than vocational or general education. In this respect, the study with employees' of the automotive supply company showed that the amount and the determinants of their contributions were similar to the findings with vocational teachers. Furthermore, the use of an underlying theory (Ajzen, 1991) as basis for guiding research provides a useful strategy for investigations of innovative work behaviour. Likewise, the consideration of underlying explanatory mechanisms (Choi, 2004, 2007; Maier, Streicher, Jonas, & Frey, 2007; Noefer, Stegmaier, Molter, & Sonntag, 2009) deepens existing insight into the facilitation of innovative work behaviour and should therefore be taken into account in future research. Finally, the relationship between innovative work behaviour and professional development also represent a relevant topic for investigations in all kinds of professional domains.

Practical implications

In addition to directions for research, the contributions of this thesis hold several practical implications for fostering innovative work behaviour and innovation development in vocational colleges. These implications may either refer to structural conditions at the organizational level, to interactions at the level of the social work environment, or to dispositions and perceptions at the individual level.

Firstly, from the conceptualization of innovative work behaviour as a dynamic, context-bound construct, structural conditions at the organizational level can be derived. As the development of an innovation partly requires carrying out social and reflective activities, it is important that school management establishes organizational structures and tasks that enable exchange and collaboration among multiple actors at and beyond vocational colleges. This may include the establishment of teaching teams, the initiation of quality management processes, and the formation of steering committees with specific responsibilities for school development. In addition, this relates to the establishment of external cooperation with schools and companies aiming at the development of innovative learning environments based on real jobs, meeting students' interest and needs, and facilitating their transition into the labour market. Furthermore, for accomplishing the prerequisite tasks for innovation development access to support structures including information (e.g. data, expertise, technical knowledge, political intelligence, technical knowledge, socio-political knowledge), resources (e.g. time, funding, materials, rooms), and socio-political backing (e.g. support by a member of the school management who negotiates with key actors and prevents threats from outside) has to be available (Kanter, 1988). Furthermore, if during innovation development vocational teachers have access to these forms of support this enhances their perception of impact on processes and outcomes at vocational colleges (Janssen, 2005). In addition, these supportive structural conditions for innovation have to be endorsed and legitimized by educational administration, politics, and a legal framework that enables and facilitates the development of innovations in and by vocational colleges.

Secondly, several implications for fostering contributions to innovation development at the level of the social work environment can be derived from the findings of the studies. To begin with, all practitioners at vocational colleges (i.e. school management and vocational teachers) have to pay attention to their role as providers of social support for innovation by showing openness and appreciation for innovative ideas of colleagues, subordinates, and supervisors. Furthermore, social support is also a facilitating factor for enhancing co-workers' intrinsic motivation for innovation as a central antecedent of innovative work behaviour. Intrinsic motivation can be fostered by supporting the perceptions of autonomy, competence and relatedness during innovation development (Ryan & Deci, 2000). Accordingly, vocational teachers should provide room for autonomous decisions and flexible accomplishment of tasks; give constructive feedback on ideas, performance, and outcomes during innovation development; and offer assistance and collaboration for generating, promoting, and realizing ideas. Moreover, attention should be paid to the interplay between social support and self-directed individual perceptions in facilitating innovative work behaviour. By providing social support for contributions to innovation development as illustrated above, vocational teachers can enhance their co-workers' confidence in their competences as well as their perception of

impact on work processes and outcomes. This, in turn, facilitates their co-workers' performance of innovative work behaviour and bolsters and sustains their intrinsic motivation for innovation, for instance in situations when social support is not available (Reeve, 1996). In addition to actively supporting individual contributions to innovation development, one's own innovative work behaviour plays an important role for facilitating co-workers' innovative work behaviour. By contributing to innovation development oneself, a supportive work climate is created which provides a behavioural guideline that is facilitative of innovative work behaviour (Ajzen, 1991; West, 1990).

Thirdly, several implications for fostering one's own innovative capacity can be drawn from the contributions of this thesis. To begin with, the studies illustrated that reflection and social interaction on-the-job are important components of vocational teachers' professionalism. These components provide means for enhancing the process of innovation development and for developing as a professional teacher. Accordingly, continuous reflection on social and structural conditions at school as well as on work tasks, performance, and outcomes throughout the entire process of innovation development is important to explicate problems and opportunities for innovation which otherwise might remain unrecognized. Likewise, social exchange and collaboration are important to generate and improve ideas and to achieve support for the promotion and realization of ideas. Consequently, the importance of continuing education on-the-job throughout the career has to be emphasized in teacher education and professional training, as well as encouraged by supervisors and colleagues in teachers' work practice. In a further step, the incorporation of professional development into vocational teachers' professionalism sets the stage for a flexible view on teachers' work practice that allows errors and multiple perspectives and solutions, and that enables transparency, collaboration, and learning on-the-job. Moreover, formal training can facilitate one's own contributions to innovation development. On the one hand, training provides a source of ideas for addressing specific problems and challenges in one's work context. On the other hand, training can provide knowledge about the process of innovation development and address strategies for generating, promoting, and realizing ideas. The conceptualization of innovative work behaviour as a dynamic, context-bound construct that was elaborated throughout this thesis provides a basis for the design of training that explicates the complexity of socio-political processes underlying innovation development, and thus, enables vocational teachers to realize their ideas at work.

Beyond work practice in the domain of vocational colleges, this thesis holds implications for practice in all kinds of organizations as most findings address work processes and characteristics that have a broad relevance for work practice. Nevertheless, a generalization of the findings has to be done carefully. With regard to applying the results to other general education settings, differences to the characteristics of vocational education which particularly aims at learning for jobs (OECD, 2010) have to be taken into account. With respect to applying the findings to non-educational domains, several organizational characteristics have to be considered with respect to their consistency with work practice in vocational colleges. Therefore, the findings of this thesis are of particular value for organizations that are characterized by knowledge-intensity, dynamic content, and high qualification requirements

and that are similar in size, organizational complexity, and the specific kind of employee-client-interactions.

Furthermore, the theoretical conceptualization of innovative work behaviour as a dynamic, context-bound construct provides a sound basis for understanding individual contributions to innovation development. This understanding is necessary at all organizational levels to create facilitative structures and tasks; to identify innovative employees and their contributions to innovation development; to provide adequate social support for innovation development; to improve one's own innovative capacity by reflective activities on-the-job and in formal training; and ultimately, to enhance the development of innovative products and processes. Furthermore, knowledge about the reflective and social components of innovative work behaviour is important for an understanding of the opportunities individual contributions to innovation development hold for improving work conditions, for accomplishing job-related goals, and for developing as a professional.

While innovations are often associated with uncertainty, risk, or conflict and, thus, with connotations that prevent from innovating (Janssen, Van de Vliert, & West, 2004), this thesis claims that the benefits of innovative work behaviour overweigh these negative connotations. By contributing to the development of innovative products and processes not only immediate problems and challenges in work practice can be tackled but employees can improve their work performance and outcomes and become more flexible in dealing with work-related problems and challenges.

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Summary

The goal of this thesis was to contribute to an understanding of the nature and facilitation of vocational teachers' innovative work behaviour as a key element for the development of innovations in vocational colleges. Innovative work behaviour encompasses all physical and cognitive work activities employees carry out in their work context, either solitarily or in a social setting, to accomplish a set of tasks required for the development of an innovation. Innovations are new and potentially useful products or processes that address the problems and challenges of a particular work context and help to maintain or improve the current state of this context. Five prerequisite tasks for innovation development, that is, opportunity exploration, idea generation, idea promotion, idea realization, and reflection are distinguished. In this thesis a theoretical conceptualization of innovative work behaviour as a dynamic, context-bound construct is presented. This conceptualization advances previous work by taking into account the timely and socio-cultural interdependence of employees' work activities, the fundamental relation of work activities to a particular work context, and the importance of reflective and social work activities for innovation and professional development.

The thesis encompasses five empirical and theoretical contributions that complementarily investigate the measurement and facilitation of innovative work behaviour. In particular, it is illustrated how innovative work behaviour can be measured as a dynamic, context-bound construct by grounding measurement on work activities employees have carried out in their work context during an episode of innovation development and by integrating the social and reflective components of innovation development. Furthermore, the studies with vocational teachers showed that innovations and individual contributions to their development represent a practically relevant aspect in vocational colleges and in vocational teachers' work context for tackling problems and challenges inside and outside the classroom and for providing adequate job preparation for students. Finally, insight is provided into possibilities to facilitate vocational teachers' innovative work behaviour. In this respect, it seemed that in vocational colleges the initiation of innovative work behaviour is driven by an interaction of contextual problems and opportunities with vocational teachers' personal goals and needs. In addition, findings indicated that the performance of innovative work behaviour is determined by characteristics of professionalism as well as by vocational teachers' intrinsic motivation, their self-directed individual perceptions, and the available social support. The accomplishments of each of the five contributions can be summarized as follows:

In an initial questionnaire study with vocational teachers (Chapter 2), characteristics of professionalism were investigated as predictors of innovative work behaviour. The results of the study indicated that although professional knowledge and performance are required for performing innovative work behaviour, the engagement in professional development activities is a more important prerequisite. In addition, the metacognitive and the social dimension of

professionalism including metacognitive knowledge, reflection on professional performance and development, and the expansion of social relations were more important than the occupational dimension. Regarding measurement, the results indicated that a domain-specific approach to measuring vocational teachers' innovative work behaviour was not adequate, and that a general approach to measuring the construct that can be flexibly adapted to different domains is more useful. In this respect, context-specific cases and personal experiences with innovation development were considered as possibilities to enable contextualization.

The second study (Chapter 3) represents an explorative interview study with vocational teachers who provided detailed insight into the development of innovations in their work context. In particular, the study focused on tracing the work activities vocational teachers carried out during the development of an innovation, and on exploring factors that triggered the initiation of the teachers' contributions to innovation development. The study indicated that vocational teachers' innovative work behaviour is embedded into a complex, non-linear, and iterative process of innovation development, and that the work activities the teachers contributed to innovation development are partially social and reflective in nature. With respect to determinants of innovative work behaviour, the results showed that the decision to act on an opportunity for innovation on the one hand depends on vocational teachers' perception of problematic or challenging contextual characteristics such as limited scope of action, lack of resources and communication, and problems with students. On the other hand these contextual characteristics have to interact with activating individual characteristics such as curiosity, motivation, and openness as well as job-related goals such as job satisfaction and self-actualization.

The third contribution of this thesis (Chapter 4) is a theoretical analysis that aimed at working out a conceptualization of innovative work behaviour as a dynamic, context-bound construct that encompasses social and reflective activities, and that links individuals' contributions to innovation development to their professional development. In particular, it is illustrated how employees may acquire, combine, and create new knowledge as well as refine and advance their work performance, the corresponding outcomes, and the underlying strategies, expectations, and beliefs by reflecting on the work activities they carry out in relation to innovation development. Furthermore, the implications of this conceptualization of innovative work behaviour for informal learning at work were elaborated by establishing relations to theories of experiential learning.

Based on the theoretical conceptualization of innovative work behaviour as a dynamic, context-bound construct, a measurement instrument was developed and applied in two studies, one with employees of an automotive supply company and one with vocational teachers (Chapter 5). The developed instrument measures innovative work behaviour based on concrete work activities grounded in a particular work context and based on a personal experience with innovation development. Social activities as well as reflection as a distinct innovation task were included in the instrument. According to the results of the two validation studies, the instruments' factor structure and psychometric properties were satisfactory and in line with theoretical considerations.

The fifth contribution of this thesis (Chapter 6) presents a quantitative, longitudinal questionnaire study with vocational teachers. In this study a model of facilitating factors for

vocational teachers' innovative work behaviour was developed and tested. Based on the Theory of Planned Behaviour as theoretical basis and taking into account previous research on creative and innovative work behaviour, the study provides insight into vocational teachers' individual and contextual characteristics as determinants of their innovative work behaviour. Intrinsic motivation for innovation was found to be a key antecedent of vocational teachers' innovative work behaviour. In addition, perceptions of impact and social support by the supervisor and the work climate stimulated vocational teachers' performance of innovative work behaviour. Furthermore, intrinsic motivation was a mediating factor for the facilitative effects of social support and self-directed individual perceptions. In this respect, the study showed that vocational teachers were more intrinsically motivated for engaging in innovation development if they felt self-efficacious, perceived to have an impact on work processes and outcomes, and felt supported by their supervisor. In addition, teachers' self-directed individual perceptions mediated the facilitative effect of supervisor support.

From the five contributions of this thesis, directions for research as well as practical implications are drawn (Chapter 7). With respect to research, recommendations for the optimization of the instrument including the refinement of items, the validation of the instrument in other professional domains, the further exploration of approaches for contextualization, and the inclusion of additional criterion variables such as innovative outcomes and supervisor or peer ratings of innovative work behaviour are given. Also, further studies on facilitating factors for vocational teachers' innovative work behaviour should be carried out to deepen and extend the insight provided by this thesis. This includes the quantitative investigation of triggers for innovation development, the further examination and extension of the tested model of facilitating factors for vocational teachers' innovative work behaviour, and the empirical analysis of the relations between innovation and professional development as an integrated process of experiential learning. Moreover, the findings of this thesis are of value for research on innovation beyond vocational colleges. This includes the validation of the findings with teachers in the general education system as well as in non-educational domains. In this respect, the use of an underlying theory as basis for guiding research and the consideration of underlying explanatory mechanisms provide useful strategies for deepening the insight into the facilitation of innovative work behaviour.

With regard to practice, recommendations for fostering innovative work behaviour and innovation development in vocational colleges at the level of the organization, the social work environment, and the individual level are given. At the organizational level, structural conditions that enable exchange and collaboration among multiple actors at and beyond vocational colleges should be established and access to information, resources, and socio-political support should be provided. Both aspects however have to be endorsed and legitimized by educational administration, politics, and a legal framework that enables and facilitates the development of innovations in and by vocational colleges. At the level of the social work environment the pivotal role of social support is elicited. This includes showing openness and appreciation for innovative ideas as well as supporting co-workers' self-efficacy, impact, and intrinsic motivation for innovation. In addition, attention should be paid to the role of one's own innovative work behaviour as a guideline for facilitating other teachers' contributions to innovation development. At the individual level, vocational teachers can improve their innovative capacity by continuously reflecting on social and structural

conditions, work tasks, performance, and outcomes in order to explicate problems and opportunities for innovation; and by engaging in social exchange and collaboration to generate and improve ideas and to achieve support for the promotion and realization of ideas. Furthermore, vocational teachers can enhance their innovative capacity by participating in formal training that provides ideas for addressing specific problems and challenges at work; or by taking part in training that offers insight into the process of innovation development and into specific strategies for generating, promoting, and realizing innovative ideas.

Finally, these practical implications for vocational colleges are also valuable for general education settings as well as for non-educational domains. However, the specific characteristics of a particular domain such as the level of knowledge-intensity, qualification requirements, size, complexity, and kind of employee-client-interaction have to be taken into account before generalizing the insight provided by this thesis. Furthermore, the findings of this thesis contribute to a general understanding of innovative work behaviour which is required at all organizational levels to create facilitative organizational structures, to provide adequate social support, to improve one's own innovative capacity, and to enhance the development of innovations and professionals.

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