

# Teacher professional learning and development in the context of educational innovations in higher education

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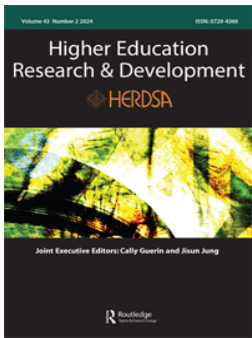
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## Teacher professional learning and development in the context of educational innovations in higher education: A typology of practices

Tim M. Stevens <sup>a</sup>, Indira N.Z. Day <sup>b</sup>, Perry J. den Brok <sup>c</sup>, Frans J. Prins <sup>b</sup>, Hanneke J.H.E. Assen <sup>d</sup>, Marlies ter Beek <sup>e</sup>, Gunter Bombaerts <sup>f</sup>, Remco Coppoolse<sup>g</sup>, Petra H.M. Cremers <sup>h</sup>, Rik Engbers <sup>i</sup>, Madeleine Hulsen <sup>j</sup>, Rachelle J.A. Kamp <sup>k</sup>, Jur J. Koksma <sup>i</sup>, Kariene Mittendorff<sup>d</sup>, Jan Riezebos <sup>m</sup>, Roeland M. van der Rijst <sup>n</sup>, Margje W. J. van de Wiel <sup>o</sup> and Jan D. Vermunt <sup>a</sup>

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### ABSTRACT

Higher education (HE) is engaged in a variety of educational innovations, as well as professional development initiatives (PDIs) to support teachers in attaining the required expertise. To improve teacher professional learning and development (PLD) and innovation processes, it is important to understand whether, how and why different PLD practices work for different innovations, contexts and populations. However, research is characterized by descriptive, single case studies and lacks a common framework to relate research findings. To address this shortcoming, this study collected and compared a wide variety of cases to develop a typology of practices. The results showed that educational innovations and teacher PLD were typically configured in three ways: (1) the focus is on implementing a new form of education and teacher learning is used as a means to this end, (2) the focus is on teachers' professional learning and the educational innovations are spin-offs, and (3) the focus is on stimulating innovations and teacher learning is a side-effect.

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These types of configurations differed regarding the educational innovation, required teacher expertise, professional development initiatives, teacher learning, and outcome measures. The typology serves as a framework that may help to reflect on practices, bridge disciplines, and formulate hypotheses for future research.

## 1. Introduction

Higher education (HE) is constantly innovating to ensure high-quality curricula that address the changing needs of students, labour markets, and society. Challenge-based learning, futures literacy, and blended learning are only a few examples of such innovations. These innovations typically ask teachers to take up new teaching roles or tasks, and thus require teacher professional learning and development (PLD). A variety of professional development initiatives (PDIs) are taking place to support teachers' PLD in the context of innovations, such as lesson studies, innovation funds and learning communities (Day et al., 2022; Latif, 2017; Tassone et al., 2021; Vanhanen et al., 2001).

There is a comprehensive field of research that aims to understand the effectiveness of PDIs in HE by studying the relations between specific PDI features and outcomes. Review studies have resulted in refined conceptualizations and theoretical models (e.g., de Rijdt et al., 2013; Ilie et al., 2020; Steinert et al., 2016; Stes et al., 2010). However, the results of these reviews have been ambiguous and sometimes contradictory, plausibly because of the wide variety of incentives that are studied as PDIs and the disparate information in the articles under review (Amundsen & Wilson, 2012; Ilie et al., 2020; Steinert et al., 2016). Overall, scholars agree that effectiveness depends on the internal connection between PDI features, and that results are strongly context-dependent (Amundsen & Wilson, 2012; Ilie et al., 2020; Stes et al., 2010). To address this issue, Amundsen and Wilson (2012) developed a framework to differentiate types of practices based on the goal of a PDI, the processes and activities, and the evidence collected. However, they point out several limitations of their study. First, the study was based on a review of published literature and articles often lacked important information for a comparative analysis. Second, they 'missed many diverse and interesting examples of educational development practice' (p. 113). Third, most articles studied the impact of PDIs on outcomes without considering teachers' learning processes. In addition to this, we note that Amundsen and Wilson (2012) did not take into account how the PDI related to the wider educational context, such as the educational innovation. This is problematic because some interventions that have been studied as PDIs, such as innovation grants for teachers, may not have PLD as a primary focus at all. Moreover, innovations introduce an extra dimension to PLD, where teachers do not just need to improve their teaching skills but may need to take up new tasks or roles (Day et al., 2022; van Dijk et al., 2020).

The literature about teacher PLD in the context of educational innovations specifically is sparse and characterized by descriptive single case studies (Day et al., 2022). These cases range from a mandatory four-month workshop for training biomedical teachers in Problem-Based Learning (Vanhanen et al., 2001) to a 'festival' with voluntary activities to form a community of practice around Technology Enhanced Learning (Latif, 2017) and thus differ in terms of context, objective, intervention, and outcome measures.

Moreover, these studies often lack information about aspects that are essential for understanding how and why different PLD practices work for different innovations and populations (Day et al., 2022). In conclusion, there is no common framework to compare cases and the information provided in articles is limited.

Hence, the aim of the present study is to identify different types of practices based on how teacher PLD and educational innovation are related in current HE practices. More specifically, the present study collected and cross compared primary data from a wide variety of cases in The Netherlands to develop a typology of practices. This typology shows how innovation and teacher PLD are typically configured (in terms of goals, interventions and outcomes), and how these types of configurations differ on key features regarding the educational innovation, the required teacher expertise, the PDI, teacher learning, and outcome measures. The typology serves as a framework that may help to reflect on practices, bridge disciplines, and formulate hypotheses for future research.

## 2. Conceptual framework

Although the term educational innovation is widely used in research and practice, there is no commonly acknowledged definition (Kopcha et al., 2016; Tassone et al., 2021; Walder, 2014). In general, innovation is defined as a deliberate change process, in contrast to routine developments and improvements based on regular procedures (Kopcha et al., 2016; Walder, 2014) and requires some form of behaviour change (Littlejohn et al., 2019; Walder, 2014). Accordingly, we consider educational innovations as changes in the educational environment that ask teachers to adopt new tasks or roles. Hence, in this study we use a contextual conceptualization of educational innovation that is connected to teacher PLD: whether a change can be considered an educational innovation depends on whether the envisioned change requires teachers to change their teaching practices in that context.

The university teacher expertise framework (*UNITE*) by van Dijk et al. (2020) helps to specify the expertise that is necessary in the context of educational innovation. They differentiate between improvements of basic teaching tasks ('better task performance'), and changes that involve taking up new tasks ('ability to carry out a greater variety of tasks' and 'larger sphere of influence'). Educational innovations tend to require the latter. However, the required teacher expertise may also be defined in terms of taking up new roles, such as the teacher as diagnostician, challenger, or activator (Vermunt & Verloop, 1999). In the present study we use the generic concept of expertise in line with van Dijk et al. (2020) to focus on the required performance of teachers that is needed for the innovation, but leave room for different theoretical perspectives on its conditions or constituents.

The teacher expertise that is required for educational innovations asks for PDIs. Although studies use different concepts for PLD (staff, educational, instructional, or academic development) (Amundsen & Wilson, 2012), review studies concerned with PLD in HE have identified similar types of PDIs, such as workshops; seminars and programs; grants; consultation; resource materials, and colleagues helping colleagues (Ilie et al., 2020; Levinson-Rose & Menges, 1981; Steinert et al., 2016; Stes et al., 2010; Weimer, 1991). In the present study we define PDIs as activities explicitly designed for teachers' PLD (Merchie et al., 2018). These activities may be integrated into a coherent arrangement as a singular PDI or offered separately (as optional activities for different teachers).

Together the arrangement of activities can be characterized as a learning program (a planned sequence of learning activities designed to attain learning objectives, such as a course, program or training) or a learning community (a planned and structured exchange among teachers, such as teacher learning teams). Key features of the PDI are participation (type of participants, type of enrolment and the selection of participants) and the PDI intensity (the duration of the PLD and total time investment) (de Rijdt et al., 2013; Ilie et al., 2020; Steinert et al., 2016; Stes et al., 2010). Besides PDIs, teacher PLD may be supported by PD support services, such as educational support and teacher coaching, and PD facilities and resources, such as grants and infrastructure.

Vermunt (Vermunt, 2013; Vermunt et al., 2019) posits that many existing models of teacher PLD are ‘black box’ models, i.e., they assume that participating in a well-designed PDI leads to teacher outcomes without taking teacher learning processes into account. Therefore, it is essential to also consider teacher learning activities and processes. Teacher learning activities are the activities that teachers undertake (e.g., self-study, making assignments, applying teaching methods, evaluating own teaching practices, exchanging with peer teachers). The learning process describes how teachers learn, such as learning by doing research (i.e., research-based learning), learning from experiences in practice (i.e., practice-based learning), learning by applying concepts in practice (i.e., application-oriented learning), learning by making sense through reflection, integration and deep processing (i.e., transformative or meaning-oriented learning) (see e.g., Bakkenes et al., 2010; Vermunt & Endedijk, 2011), or unintended learning (i.e., implicit learning) (Eraut, 2000). Finally, inspired by the two-axis model of Elmore (2000), we posit that teacher learning can be predominantly individual or collective, and predominantly learner-centred or trainer-centred.

Reviews concerned with teacher PLD in HE have shown that outcome measures in case study research vary considerably depending on the goal of the intervention. Based on previous review studies, four categories of outcome measures can be distinguished: the impact on teachers (such as teachers’ knowledge, beliefs, attitudes), the impact on teaching practices (changes in teachers’ behaviour that become apparent in practice, such as using new tools or teaching methods), the impact on students (ranging from student perceptions to learning results), and impact on the organization (such as new policies, teaching tools, working groups) (Levinson-Rose & Menges, 1981; Steinert et al., 2006; Stes et al., 2010).

The research question that the present study aims to address is: How are teacher PLD and educational innovation related in current HE practices? More specifically, the aim is to identify different types of configurations and identify how these types of configurations differ on key features regarding the educational innovation, the required teacher expertise, the PDI, teacher learning, and outcome measures.

### 3. Methods

#### 3.1. Research design: comparative case study

A comparative case study was conducted to investigate teacher professional learning in the context of educational innovations. The goal was not generalization to other or larger settings based on ‘statistical generalization’ (Yin, 2009) (i.e., representativeness of

samples), but analytic generalization, in which theory was used as a template against which to compare the empirical results. This means that rich data about relevant aspects of PLD and innovation practices from a wide variety of cases were collected, and that the comparative analysis focused on developing meaningful classifications (empirically evident and theoretically sound).

### **3.2. Data collection**

The case selection focused on acquiring a wide variety of cases on the five dimensions described in the conceptual framework: the educational innovation, required teacher expertise, professional development initiatives, the teacher learning activities and processes, and the outcome measures. A call for case contributions was distributed across the 20 institutions that were part of the research consortium that was funded with a grant for the present study. The call included a form with instructions and open text entries to gather information about each dimension. In order to collect relevant case information, the form included definitions and demarcations (e.g., what is considered a case and what not), general instructions and probing questions for each text entry. A condition for inclusion was that the educational innovation required teacher PLD in the respective context. This means that routine educational improvements that merely involved 'better task performance' (van Dijk et al., 2020) were discarded (e.g., University Teaching Qualification programs), as well as cases with missing values. In total, 33 adequate case descriptions were submitted, which represented all the 20 institutes that were invited for contributions. Based on selection criteria (i.e., case definition and boundaries) and saturation (i.e., maximum variance on each aspect), two cases were merged into one case, and one case was split into two cases.

### **3.3. Data analysis**

An iterative content analysis was conducted on the 33 case descriptions: generating emergent codes based on sensitizing concepts (Bowen, 2006) and grouping codes into overarching categories based on existing theories (see conceptual framework). The resulting analytical framework was operationalized in an Excel sheet with 30 open and multiple-choice questions (with single and multiple answer options), for the analysis of each case (see Appendix).

The Excel answer sheet was used to analyze each case. As a validity test, each case was analyzed by two researchers to reach joint agreement: researchers independently analyzed multiple cases (answering the 30 questions based on the information in the submitted case description forms), and then compared their results to validate the analysis of each case. Dissimilarities were discussed to understand the cause of the difference in interpretation and based on this understanding the information in the case description form was adapted to ensure that it was complete (information was provided on all dimensions) and unambiguous (information was interpreted similarly across coders).

Finally, a comparative analysis was conducted to identify similarities and differences across the cases. The most overarching categorization and most meaningful conceptualization for understanding the relation between teacher PLD and educational



innovation (transcending the five dimensions) was used to classify cases and study co-occurring features. The aim was to provide in-depth descriptions of each type, using both relative frequencies (co-occurrences of features) from the Excel data, and quotes from the case documentation for thick descriptions (for meaningful interpretations in context).

#### 4. Results

Three types of configurations were identified that reflected how educational innovations and teacher PLD were related; (1) the focus is on implementing a new form of education and teacher learning is used as a means to this end, (2) the focus is on teachers' professional learning and the educational innovations are spin-offs, and (3) the focus is on stimulating innovations and teacher learning is a side-effect.

Each type was related to features of the educational innovation, the required teacher expertise, PDI features (participants, type of enrolment, PDI format, PD support, intensity), teacher learning (regulation of learning and learning processes), and outcome measures (impact on teachers, education, students and the organization).

Features not related to these types were: the main driver of the innovation (external, top-down, bottom-up), the main PDI form (learning program or learning community), the focus on either individual or collective learning, and the methods used for evaluation (data sources, type of analysis).

In the following three paragraphs an in-depth description of each type is provided following the five dimensions of our conceptual framework. The description focuses on the characterizing features of the type (features that cases within the type have in common), but also portrays relevant varieties within each type (differences between cases) (Table 1).

**Table 1.** Typology of teacher professional development and innovations in higher education: three types of configurations and their features.

	Implementing a new form of education ( $n = 15$ )	Supporting teachers' PLD ( $n = 9$ )	Stimulating innovations ( $n = 9$ )
Educational innovation	Predefined	Open	Open or conditions are defined
Required expertise	Applying new teaching skills	Developing new work-related skills	Developing and applying work-related and teaching skills
PDI Participants	Teachers (junior/medior) of a course, study program, faculty or institution	Teachers (senior) of an institution or multiple institutions	Teachers or education staff of a faculty, institution or multiple institutions
PDI Type of enrolment	Mandatory, targeted or open subscription	Voluntary, but selection of participants	Voluntary, but selection of proposals for innovations
PDI Format	Multiple PDIs, targeting different groups of teachers	Singular PDI format, but unique learning journey for each teacher	Singular PDI format, but unique innovation trajectory for each teacher
PD Support	Education support and personal coaching	Personal coaching, No education support	Education support, No personal coaching
PD Intensity	Low (20–100 h, less than 6 months)	High (>100 h, more than 1 year)	Medium (20–100 h, 6–12 months)
Regulation of learning	Trainer-centred	Learner-centred	Learner-centred
Learning process	Application-oriented learning	Research-based learning	Implicit learning Practice-based learning
Outcome measures	Impact on teaching practice	Meaning-oriented learning	Impact on teacher learning and the organization
		Impact on teacher learning and the organization	Impact on the organization



#### 4.1 Implementing a new form of education

In fifteen cases the focus was on implementing a new form of education and teacher PLD was used as a means to this end. In almost all of these cases (fourteen), the educational innovation was predefined and the PDI aimed to help teachers develop the required teaching skills to be able to put the educational innovation into their own teaching practice. The cases covered a variety of educational innovations: (a) comprehensive educational models, e.g., challenge-based learning (CBL), problem-based learning (PBL), and design-based education (DBE); (b) innovations that focused on technological aspects of the learning environment, e.g., blended learning, online education, digital peer feedback; and (c) innovations that focused on pedagogical aspects or teaching methods e.g., collaborative reading, open space, boundary crossing and learning communities. The rationale for the professional development was based on improving student learning, a specific model or pedagogy about student learning was used to achieve this, and the PDI was designed to help teachers bring it to practice:

The ambition of [university] is to help students become investigative, critical, and reflective professionals that can collaborate beyond their own discipline [...]. In order to achieve this ambition, the university has developed and implemented a new education concept: Design Based Education [...] DBE is an innovative, student-oriented education concept [...]. The support and development of teachers is used as a resource to facilitate and implement Design Based Education, and the focus is on what they contribute to the learning of students.

The required teacher expertise was often defined in terms of applying new teaching skills, and not in terms of acquiring work-related skills more generally (leadership, scholarship, collaboration, etc.). The required teacher expertise was about: being able to apply a pedagogy in teaching activities (seven times); being able to apply the educational concept in the educational design (six times); being able to apply the concept in student assessment (four times) and; being able to apply a new digital teaching tool. Cases also described the required teaching expertise in terms of adopting a new teaching role, such as: a coach for learning, i.e., supporting the learning process of individual students (seven times); project group facilitator, i.e., supporting interdisciplinary collaboration, multi-actor projects, and project-based working (five times); student group facilitator, i.e., supporting group processes and dynamics (two times); and, expert role, i.e., being a subject matter expert (SME) for students (two times).

To support teachers in the educational innovation, many cases (thirteen) initiated multiple PDIs targeted at different teacher groups. The PDIs included learning programs such as ‘courses’, ‘programs’, and ‘trainings’ (ten times), as well as learning communities such as ‘teacher teams’, ‘learning teams’, and ‘open spaces’ (seven times). Most cases involved educational support to support the application in education practice (ten times), and some form of personal coaching (eleven times). Participating teachers were often from a specific study program (seven times in this type, compared to eight in the total sample), which involved all sorts of teachers, including junior and medior professionals (teaching assistants, teachers, lecturers). Accordingly, the educational innovations were applied within one university (eight times), at the faculty level (one time); at the program level (one time), and at the course level (five times). Moreover, enrolment was often mandatory (five times in this type, compared to seven in the total sample),

especially for teachers of a specific study program. If the professional development was not mandatory, a specific group of teachers was targeted for participation in the professional development (six times), or teachers could simply register for participation. Lastly, the intensity of the PD (duration and workload) was relatively low (20–100 h in total, duration of less than 6 months) in comparison to the average of our sample.

Teacher learning was predominantly trainer-centred: in eleven cases the learning activities were predominantly organized by the trainers (instead of teachers themselves) or the feedback was predominantly given by trainers (instead of peers). Learning activities that were relatively often mentioned were: making assignments (eight); applying the innovation to the educational design, learning activities or assessment (thirteen), and; evaluating on one's own application (eleven). More generally, the learning process was characterized by application-oriented learning for the teaching practice (twelve times in this type, compared to thirteen in the total sample).

In comparison to the other types, outcome measures often included the impact on teaching practice (seven times) and students (eight times), and rarely included the impact on the organization (one time). Looking more closely at the outcome measures for the learning of teachers, we found that cases frequently measured 'skills in teaching practice' (ten times), and rarely measured teachers' higher levels of cognition, i.e., 'critical evaluation of the learning materials and creating a vision or theory' (two times).

#### **4.2 Supporting teachers' PLD**

In nine cases the focus was on teachers' professional development and the educational innovations were presented as spin-offs. In six of these cases the educational innovation was not predefined, because teachers were able to work on an educational innovation of their choice (in line with their personal interest and/or relevant for their own teaching practice). One of the cases explicated this as follows:

This teacher professional development initiative leaves the specific educational innovation open. Teachers conduct research on their own teaching practice that needs an educational innovation. This can be about community-engaged learning (CEL), the use of drama techniques to teach presentation skills, new teaching methods about ethical skills and knowledge, etc.

In these cases, teachers developed, practiced, and evaluated educational innovations themselves as part of the PDIs' learning activities. Hence, although the PDI was designed in such a way that it would eventually lead to educational innovations, the primary goal was defined in terms of supporting teachers in their professional development and the educational innovations were seen as spin-offs. In three cases the educational innovation was not completely open because the innovation topic was described. These innovations were not concerned with the application of a specific pedagogy to improve student learning, but with supporting teachers to learn about the topic and to help them develop in their profession both within and beyond the classroom, such as futures literacy and intercultural competencies.

The required teacher expertise was often defined in terms of developing work-related skills (e.g., leadership, scholarship, collaboration skills), rather than in terms of applying specific teaching skills. The required teacher expertise was about: being able to organize

educational innovations (three times); being able to systematically research education (three times); understanding the organizational context (two times), and collaborating and communicating with colleagues (two times). Two cases explicitly referred to the career framework for university teaching of Graham (Graham, 2018), placing the learning objectives in level 3 or 4 about educational leadership and scholarship.

PDI generally aimed to guide the learning trajectory of teachers in an open, process-oriented manner, with a singular PDI format, in the form of a program or learning community. The PDI involved a wide variety of (optional) learning activities, both individual and collective. The learning objectives and activities were generally not predefined. PD support services included various facilities and resources, such as the support of special interest groups with organizational matters, communication and finance. Six out of the nine cases involved personal coaching, while only two cases involved educational support for the application in education practice.

Participating teachers were from one or multiple institutions (seven and two cases respectively). Accordingly, the educational innovations that were developed as part of the PLD of teachers were not applied on the faculty level, program level or the course level (as in type 1), but institution-wide (eight times) or on multiple institutions (one time). Four cases targeted senior professionals (out of the five in our sample), such as a senior fellow program and programs about educational leadership and scholarship. In all cases participation was voluntary and in three cases candidates were selected from applications. Lastly, the intensity of the PD (duration and workload) was relatively high (>100 h in total, duration of more than a year) in comparison to the average of our sample.

Teacher learning was predominantly learner-centred: in seven cases the learning activities were organized by teachers (instead of the trainers), and in five cases the feedback was predominantly given by peers (instead of trainers). Learning activities that were mentioned relatively often were: research (four times), dissemination (five times), and cross-, or trans-curricular innovation (five times). More generally, the learning process was characterized by research-based learning (four times in this type, compared to seven in the total sample), and meaning-oriented learning (four times in this type, compared to eight in the total sample).

For the learning of teachers, cases frequently measured higher levels of cognition; *critical evaluation of the learning materials and creating a vision or theory* (six times). Moreover, in contrast to the other types, outcome measures more often involved general *skills for work* (four times) than *skills for teaching practice* (three times). The impact on teaching practice was rarely measured (two times). In none of the cases the impact on students was measured. However, some cases did report that teachers themselves conducted evaluative research on the impact of their practice on students. The impact on the organization was relatively often measured (four times).

### 4.3 Stimulating innovations

In nine cases the focus was on stimulating innovations and teacher learning was a side-effect. In six of these cases the educational innovation was not predefined, because teachers were able to work on an educational innovation that they defined themselves. Many cases involved innovation funds for teachers. These innovation funds come in

various forms, with more or less support for teacher PLD and with more or less conditions for the type of innovations that are funded. For example, one of the cases aimed to stimulate and support course innovations:

In 2015–2017, the university initiated a Course Innovation Fund. Teachers were able to apply for a grant to innovate their course. The proposed innovation had to align with one of the three pillars of the educational vision.

In another case, the innovation fund was only available for teachers of a Teacher Academy as part of a wider program to structurally advance education:

Members of the Teachers Academy are teachers who are forerunners in educational development and innovation [...] and can submit proposals for educational innovations. They have full autonomy and control over the innovation [...] They share their knowledge with teachers within and outside their education program.

And in yet another case, the innovation fund was part of a program to guide educational redesigns:

In order to guide structural innovations and support teachers in such processes, the university developed the Redesign Lab. The Redesign Lab facilitates a process that brings together teachers and other stakeholders to (re)design a program. The process focusses on innovations in educational designs but also contributes to the professional development of teachers [...] and has become part a funding scheme for innovations.

Two cases involved an innovation trajectory at a faculty. One case described an innovation trajectory to revitalize PBL, and another case described pilot projects for implementing learning communities. In both cases practice- and experience-based learning were used as a means to stimulate and advance the educational innovation, at the respective faculty but also at the university level. Lastly, two cases were concerned with stimulating and supporting innovations through the collaborative learning of teachers and professionals from multiple institutions.

The required teacher expertise was often not defined in terms of learning objectives, but more generally in terms of competencies that teachers need in order to succeed in the innovation (six times). These competencies involved work-related skills as well as teaching skills. In general, cases in which the educational innovation was not predefined described the required teacher expertise predominantly in terms of new work-related skills. Cases in which the educational innovation was bounded by conditions described the required teacher expertise predominantly in terms of teaching skills.

PDI were generally based on a single format to guide different innovation trajectories (including both individual and collective activities). These programs aimed to guide the innovation trajectory and support the learning of teachers in the process. For example, in the case about the revitalization of PBL, an innovation trajectory was set up (which involved goal setting, proposed changes, implementation, reflection and peer feedback) to guide the innovation phases based on work-based learning.

PD support services included various facilities and resources to stimulate and support innovations, such as funding, recognition (awards), and ICT support. In six cases educational support was organized as part of the PD to help bringing the educational innovation into practice, while only three cases involved personal coaching. Participants were teachers, and sometimes professionals (three times), from one or multiple institutions

(seven and two cases respectively). The educational innovations were applied at different levels; the course level (one times), the faculty level (two times), institution-wide (four times) or on multiple institutions (two times). In all cases participation was voluntary, although in two cases a specific group of teachers was approached to participate. Four cases involved some form of selection based on innovation proposals. Lastly, the intensity of the PD (duration and workload) was moderate (20–100 h, 6–12 months) in comparison to the average of our sample.

Teacher learning was predominantly learner-centred: in only three cases the learning activities were predominantly organized by trainers (instead of teachers), or feedback was predominantly given by trainers (instead of teachers). Learning activities that were often mentioned were: collaboration (six times), dissemination (five times), and cross-, or trans-curricular innovation (four times). More generally, the learning process was characterized by practice-based learning (four times in this type, compared to nine in the total sample) and implicit learning (four times in this type as well as in the total sample).

In relatively many cases teacher outcomes were not measured at all (six). Some cases reported that teachers themselves evaluated the impact of their innovation on students. Relatively many cases reported impact on the organization (five), such as increased cross-pollination between faculties, new working groups, and the development of a teaching tool repository.

## 5. Discussion

### 5.1. Interpretation of the typology

Literature reviews on teacher PLD in HE have pointed out that articles often lack key information to be able to systematically compare results (e.g., Ilie et al., 2020; Levinson-Rose & Menges, 1981; Steinert et al., 2006; Stes et al., 2010) and that qualitative research is needed for a more detailed understanding of practices (Amundsen & Wilson, 2012; Levinson-Rose & Menges, 1981; Steinert et al., 2006; Stes et al., 2010). Moreover, they all have stressed the need for a framework to be able to relate research findings. To address these shortcomings, this study collected and compared rich information about PLD and innovation practices from a wide variety of HE institutions to develop a typology of practices.

The typology shows that educational innovations and teacher PLD are typically configured in three ways, and that these types of configurations differ with regard to features of the educational innovation, required teacher expertise, the PDI, teacher learning and outcome measures. The types characterize those features that a group of cases have in common (i.e., highlights ingroup similarity and outgroup dissimilarity). Hence, the typology is not a taxonomy in which cases can be pigeonholed based on classification principles but a framework to meaningfully relate practices and case study research (Stevens et al., 2018). A type is defined by how the educational innovation and teacher learning are configured in terms of objective and instrument. In essence, each type of practice has a different focus, which is reflected by the primary objective, the intervention strategy (PD activities, incentives, support), and the outcome measures. In the first type of practice, the focus is on implementing a new form of education. The starting point is a

desired form of education (a predefined innovation). The PDI is designed to help teachers obtain the required teaching skills and apply the innovation to their own teaching practice (trainer-centred and application-oriented learning). Typically, PD trainers evaluate the impact on teachers’ practices. We consider this type of practice a form of evidence-based and exploitative innovation because existing knowledge is utilized for implementing an innovation in a new context (Gupta et al., 2006; Tassone et al., 2021).

In the second type of practice, the focus is on supporting teachers’ PLD. The starting point is the desire to support teachers in advancing their expertise as an educator, such as educational leadership or scholarship. The PDI is designed to support teachers in developing and evaluating a self-initiated innovation (learner-centred and research-based learning). Hence, teachers themselves study the effects of their innovation on students. We consider this practice as a form of research-based learning and explorative innovation because the innovation and knowledge are (co)developed through an inquiry process (Gupta et al., 2006).

In the third type of practice, the focus is on stimulating educational innovations. The starting point is a program that stimulates and supports teachers to innovate their own education. Based on the experiences of their own teaching practice teachers propose an educational innovation. The learning of teachers is not a goal but a side-effect. We consider this a form of practice-based innovation because it involves advancing existing education based on knowledge for, in and of practice (Bessant, 2013; Cai, 2017; Tassone et al., 2021).

Overall, the results suggest that each type of practice has its own rationale or intervention logic, which can be inferred by modelling the relations between components (Figure 1).

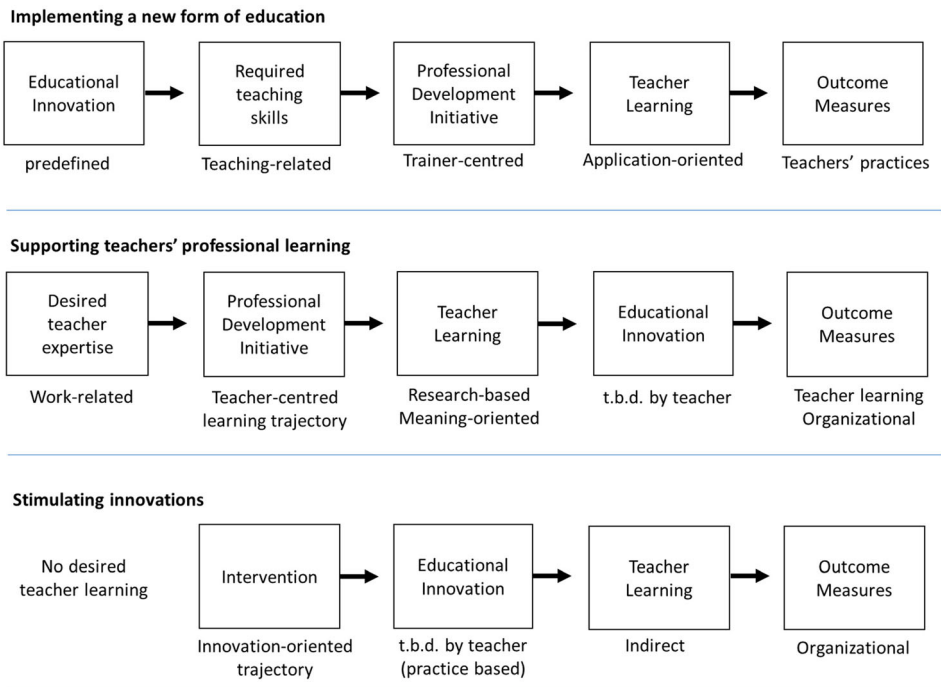


Figure 1. The relations between the five components in each type.

## 5.2. Contributions to literature

Previous review studies on teacher PLD in HE have aimed to understand the effectiveness of PDIs by studying the relations between specific PDI features and outcomes. However, Amundsen and Wilson (2012) argued that the quest to determine ‘what features of PDIs are effective’ (p. 91) is elusive because it tends to ‘compare apples and oranges’ (p. 112) (Amundsen & Wilson, 2012). The typology developed in this paper helps to group different types of practices and make more meaningful comparisons. More specifically, the results show that some programs that are studied as PDIs may not have teacher PLD as a primary focus, and that teacher PLD can be a means for educational innovation or a side-effect of educational innovation. This raises questions about the conceptualization of PDIs. Review studies concerned with PLD in HE have used generic categories of PDIs, such as workshops, seminars and programs, grants, consultation, resource materials, and colleagues helping colleagues. In this study we defined PDIs as activities explicitly designed for teacher PLD, and differentiated these activities from PD support services, facilities and resources, such as grants. This conceptual distinction allows for a more refined understanding of the arrangement of activities, services, facilities, and resources that are offered to teachers.

The three types correspond to the findings of a recent literature review about teacher PLD in the context of innovation in HE (Day et al., 2022). They identified studies concerned with a specific educational innovation (differentiating technological- and student-focused pedagogies), but also studies in which the innovation was not predetermined (Hirsto et al., 2013) or teachers could access funding for designing their own innovation (Adler et al., 2015). These practices with open innovations were rarely studied in the literature (six out of the 68 papers included in the literature review). A plausible explanation is that the research on teacher professional learning and on student learning are disconnected (Vermunt, 2013): studies either analyze the effect of professional development programs on teachers, or they analyze the effect of educational innovations on students’ learning without considering the role of teacher learning in the process. Moreover, studies may tend to study the effect of learning environments as interventions on learners (students or teachers) as target groups, without considering the learning processes, such as how learners co-create the environment in continuous interactions.

## 5.3. Limitations and suggestions for future research

The typology presented in this study is based on an iterative comparative analysis of 33 cases in the Netherlands. Although the goal of this study was not generalization to larger settings but analytic generalization through theoretically informed data collection and analysis (Yin, 2009), it is important to reflect on the transferability of this typology (Shenton, 2004). In this regard it is important to note that the typology is comprised of two components that need to be interpreted differently: the three configurations and the associated features. The types of configurations are conceptual abstractions that are mutually exclusive and collectively exhaustive (they do not overlap and together provide a complete picture) and can thus be transferred to other contexts. However, the associated features are based on co-occurrences in our data and rely on the representativeness of our sample. These should thus be



interpreted with much more caution. Future research is needed to investigate the prevalence of these types of configurations in different contexts (e.g., countries, institutions, faculties), and use larger samples and more detailed data to study how co-occurring features are causally related. In addition, qualitative case studies are needed to better understand how teachers learn in each type.

#### 5.4. Implications for practice

The typology can be used by practitioners to map what practices are taking place in their context (e.g., HE institution), to normatively reflect on these practices (e.g., what is missing?), and to (re)define objectives and design new interventions. In this regard, it should be noted that the three types of configurations reflect intervention rationales (complementary perspectives on educational change), and that the features represent co-occurrences in the investigated practices (they are not given, but changeable). The typology has the potential to show how practices are related and can inspire connecting them in new interventions. For example, teacher PLD and educational innovations can mutually reinforce each other if research-based learning and evidence-informed innovation are combined in a process-oriented approach. This can enhance the sense of ownership among teachers, utilize their practice-based knowledge and lead to appropriate educational innovations. Coordination and collective learning are needed to bring individual initiatives together and build a common knowledge base, which in turn is needed to implement innovations more widely.

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## References

- Adler, S. R., Chang, A., Loeser, H., Cooke, M., Wang, J., & Teherani, A. (2015). The Impact of Intramural Grants on Educators' Careers and on Medical Education Innovation. *Academic Medicine*, 90(6), 827–831. <http://doi.org/10.1097/ACM.0000000000000685>
- Amundsen, C., & Wilson, M. (2012). Are we asking the right questions? A Conceptual Review of the Educational Development Literature in Higher Education. *Review of Educational Research*, 82(1), 90–126. <https://doi.org/10.3102/0034654312438409>
- Bakkenes, I., Vermunt, J. D., & Wubbels, T. (2010). Teacher learning in the context of educational innovation: Learning activities and learning outcomes of experienced teachers. *Learning and Instruction*, 20(6), 533–548. <https://doi.org/10.1016/j.learninstruc.2009.09.001>
- Bessant, J. (2013). Innovation in the twenty first century. In R. Owen, J. Bessant, & M. Heintz (Eds.), *Responsible innovation: Managing the responsible emergence of science and innovation in society* (pp. 51–74). Wiley.
- Bowen, G. A. (2006). Grounded theory and sensitizing concepts. *International Journal of Qualitative Methods*, 5(3), 1–108. <https://doi.org/10.1177/160940690600500304>
- Cai, Y. (2017). From an analytical framework for understanding the innovation process in higher education to an emerging research field of innovations in higher education. *Review of Higher Education*, 40(4), 585–616. <https://doi.org/10.1353/rhe.2017.0023>
- Day, I. N. Z., Prins, F. J., Stevens, T. M., den Brok, P. J., & Vermunt, J. D. (2022, June 30). Teacher learning and professional development in innovative higher education: a literature review. *EARLI SIG1&4 Joint Conference*.
- de Rijdt, C., Stes, A., van der Vleuten, C., & Dochy, F. (2013). Influencing variables and moderators of transfer of learning to the workplace within the area of staff development in higher education: Research review. *Educational Research Review*, 8, 48–74. <https://doi.org/10.1016/j.edurev.2012.05.007>
- Elmore, R. F. (2000). Building a new structure for school leadership. *American Educator*, 23(4).
- Eraut, M. (2000). Non-formal learning and tacit knowledge in professional work. *British Journal of Educational Psychology*, 70(1), 113–136. <https://doi.org/10.1348/000709900158001>
- Graham, R. (2018). *The Career Framework for University Teaching*. [www.teachingframework.com](http://www.teachingframework.com).
- Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The interplay between exploration and exploitation. *Academy of Management Journal*, 49(4), 693–706. <https://doi.org/10.5465/AMJ.2006.22083026>
- Hirsto, L., Lampinen, M., & Syrjäkari, M. (2013). Learning outcomes of university lecturers from a process-oriented university pedagogical course. *Trames*, 17(4), 347–365. <http://dx.doi.org/10.3176/tr.2013.4.03>
- Ilie, M. D., Maricuțoiu, L. P., Iancu, D. E., Smarandache, I. G., Mladenovici, V., Stoia, D. C. M., & Toth, S. A. (2020). Reviewing the research on instructional development programs for academics. Trying to tell a different story: A meta-analysis. *Educational Research Review*, 30, 100331. <https://doi.org/10.1016/j.edurev.2020.100331>
- Kopcha, T. J., Rieber, L. P., & Walker, B. B. (2016). Understanding university faculty perceptions about innovation in teaching and technology. *British Journal of Educational Technology*, 47(5), 945–957. <https://doi.org/10.1111/bjet.12361>
- Latif, F. (2017). Telfest: An approach to encouraging the adoption of educational technologies. *Research in Learning Technology*, 25, <https://doi.org/10.25304/rlt.v25.1869>
- Levinson-Rose, J., & Menges, R. J. (1981). Improving college teaching: A. *Critical Review of Research. Review of Educational Research*, 51(3), 403–434. <https://doi.org/10.3102/00346543051003403>
- Littlejohn, A., Jaldemark, J., Vrieling-Teunter, E., & Nijland, F. (Eds.). (2019). *Networked professional learning. Research in networked learning*. Springer. [https://doi.org/10.1007/978-3-030-18030-0\\_1](https://doi.org/10.1007/978-3-030-18030-0_1)
- Merchie, E., Tuytens, M., Devos, G., & Vanderlinde, R. (2018). Evaluating teachers' professional development initiatives: towards an extended evaluative framework. *Research Papers in Education*, 33(2), 143–168. <https://doi.org/10.1080/02671522.2016.1271003>

- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63–75. <https://doi.org/10.3233/EFI-2004-22201>
- Steinert, Y., Mann, K., Anderson, B., Barnett, B. M., Centeno, A., Naismith, L., Prideaux, D., Spencer, J., Tullo, E., Viggiano, T., Ward, H., & Dolmans, D. (2016). A systematic review of faculty development initiatives designed to enhance teaching effectiveness: A 10-year update. *Medical Teacher*, 38(8), 769–786. <https://doi.org/10.1080/0142159X.2016.1181851>
- Steinert, Y., Mann, K., Centeno, A., Dolmans, D., Spencer, J., Gelula, M., & Prideaux, D. (2006). A systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education: BEME Guide No. 8. *Medical Teacher*, 8(6), 497–526. <https://doi.org/10.1080/01421590600902976>
- Stes, A., Min-Leliveld, M., Gijbels, D., & van Petegem, P. (2010). The impact of instructional development in higher education: The state-of-the-art of the research. *Educational Research Review*, 5(1), 25–49. <https://doi.org/10.1016/j.edurev.2009.07.001>
- Stevens, T. M., Aarts, N., Termeer, C. J. A. M., & Dewulf, A. (2018). Social media hypes about agro-food issues: Activism, scandals and conflicts. *Food Policy*, 79, 23–34. <https://doi.org/10.1016/j.foodpol.2018.04.009>
- Tassone, V. C., Biemans, H. J. A., den Brok, P., & Runhaar, P. (2021). Mapping course innovation in higher education: A multi-faceted analytical framework. *Higher Education Research & Development*, 41(7), 2458–2472. <https://doi.org/10.1080/07294360.2021.1985089>
- van Dijk, E. E., van Tartwijk, J., van der Schaaf, M. F., & Kluijtmans, M. (2020). What makes an expert university teacher? A systematic review and synthesis of frameworks for teacher expertise in higher education. *Educational Research Review*, 31, 100365. <https://doi.org/10.1016/j.edurev.2020.100365>
- Vanhanen, H., Pitkälä, K., Puolakkainen, P., Strandberg, T. E., & Lonka, K. (2001). The problem-based learning tutorial laboratory – A method for training medical teachers. *Medical Teacher*, 23(1), 99–101. <https://doi.org/10.1080/01421590125201>
- Vermunt, J. D. (2013, May 22). Teacher learning and student learning: are they related? In *Inaugural lecture given at the University of Cambridge*. Faculty of Education.
- Vermunt, J. D., & Endedijk, M. D. (2011). Patterns in teacher learning in different phases of the professional career. *Learning and Individual Differences*, 21(3), 294–302. <https://doi.org/10.1016/j.lindif.2010.11.019>
- Vermunt, J. D., & Verloop, N. (1999). Congruence and friction between learning and teaching. *Learning and Instruction*, 9(3), 257–280. [https://doi.org/10.1016/S0959-4752\(98\)00028-0](https://doi.org/10.1016/S0959-4752(98)00028-0)
- Vermunt, J. D., Vrieki, M., van Halem, N., Warwick, P., & Mercer, N. (2019). The impact of Lesson Study professional development on the quality of teacher learning. *Teaching and Teacher Education*, 81, 61–73. <https://doi.org/10.1016/j.tate.2019.02.009>
- Walder, A. M. (2014). The concept of pedagogical innovation in higher education. *Education Journal*, 3(3), 195–202. <https://doi.org/10.11648/j.edu.20140303.22>
- Weimer, M. (1991). Instructional interventions: a review of the literature on efforts to improve instruction. Higher education. *Handbook of theory and research*, 294–333.
- Yin, R. K. (2009). *Case study research : design and methods* (4th ed.). Sage Publications.

## Appendix: analytical framework

The analytical framework was operationalized in an Excel sheet with open and multiple-choice questions (with single and multiple answer options), for the analysis of each case.

Question/feature	Dimension	Response type	N answer options	Options
1 Focus of the case		single	3	Implementing a new form of education; Supporting teachers' PLD; Stimulating innovation
2 Educational innovation	Innovation	single	14	New pedagogy (Collaborative reading; Open space; Boundary crossing; Learning communities); New technology (ICT literacy; blended learning; online education; digital peer feedback); New content (Futures Literacy; Intercultural Competencies); New educational model (Design-Based Education; Challenge-based-education; problem-based education); Undefined
3 Scale of implementation	Innovation	single	6	course; program; faculty; institution; national; international
4 Main driver	Innovation	single	3	top-down, bottom-up, externally driven
5 Teacher expertise focusses on	Required expertise	single	2	Teaching skills; Work-related skills
6 Definition of learning objectives	Required expertise	single	3	Yes; descriptive; no
7 Personal learning objectives	Required expertise	single	2	Yes; No
8 Learning objectives	Required expertise	multiple	13	Teaching roles (coach for learning; project group facilitator; student group facilitator; expert role), Scope of application (application in design; teaching activity; assessment; teaching tool); General work-related tasks (collaborating; researching; understanding the organizational context; trans-curricular innovation)
9 Type of participants	PDI	single	7	Teachers of a course; Teachers of a program; Teachers of research; Teachers of a faculty; Teachers of an institution; Teachers of multiple institutions; N.A.
10 Number of participants	PDI	open	–	
11 Type of participation	PDI	single	2	Voluntary; Mandatory
12 Selection of participants	PDI	single	5	Open subscription; Selection based on application; Selective group of teachers is approached for participation; The PLD is initiated by teacher themselves; N.A.
13 Duration of the PDI	PDI	single	3	< 6 months; 6–12 months; > 1 year
14 Total time investment (hours)	PDI	open	–	
15 PDI program	PDI	single	2	Yes; No
16 Teacher coaching	PDI	single	2	Yes; No
17 Education support	PDI	single	2	Yes; No
18 PDI format	PDI	single	3	Learning Program; Learning Community; no formal PDI
19 Learning activities	Teacher learning	multiple	14	self-study; making assignments; participating in skills trainings; applying in practice; evaluating practice; in-depth processing; conducting research; peer feedback; collaborating; disseminating; cross-, or trans-curricular innovation; open or personalized learning activities

(Continued)

Continued.

Question/feature	Dimension	Response type	N answer options	Options
20 Learning processes	Teacher learning	multiple	5	research-based learning; practice-based learning; application-oriented learning; transformative or meaning-oriented learning; and/or implicit learning
21 Individual or collective learning activities	Teacher learning	single	3	Individual; Collective; 50/50
22 Learning activities organized by teacher or trainer	Teacher learning	single	3	Teacher; Trainer; 50/50
23 Feedback and reflection by teacher or trainer	Teacher learning	single	5	Teacher; Trainer; Self-reflection
24 Unit of analysis	Outcome measure	multiple	12	teacher satisfaction; teacher self-perceived learning; teacher learning results; application in education products; application in teaching behaviour; student satisfaction; student self-perceived learning; student behaviour; student learning results; student grades; impact on the organization; other
25 Learning domain teacher	Outcome measure	multiple	7	knowledge and understanding; application; evaluation and creation; attitude; affective; skills; identity;
26 Data course	Outcome measure	multiple	6	survey; interview; focus group; documents; behaviour; other
27 Type of Analysis	Outcome measure	single	3	quantitative, qualitative, mixed
28 Baseline measurement	Outcome measure	single	2	Yes; No
29 Control group	Outcome measure	single	2	Yes; No
30 Sources	Outcome measure	open	–	