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Teachers' Participation in Professional Development

A Systematic Review

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Contents

Chapter 1
Relevance and Scope of the Literature Review

Abstract There only seem to be a limited amount of studies regarding teachers' participation in professional development (PD). However, there is a rather wide range of studies dedicated to this research area. This research is characterized by different methodology approaches, target groups, and a focus of certain PD programs and therefore quantitative synthesizing approaches (e.g., meta-analysis) are not applicable. Nevertheless, this body of research provides relevant results for this area of research. Against this background, the first chapter introduces the relevance of conducting a systematic literature review on teachers' participation in PD and potential aspects that may influence their attendance. To do so, the chapter presents why (formal) PD is important and emphasizes the relevance of the first step in the PD process: The choice of participating in a (certain) PD workshop. The chapter also outlines the inconsistent and hard to compare state of research. Furthermore, it presents the three main research questions that motivated the literature review and describes the conditions for teacher PD within the three focused countries. Finally, a short preview of the book structure is outlined.

Keywords Teacher professional development · Training motivation · In-service teacher education · Teacher learning · Lifelong learning · Context conditions · Germany · Austria · Switzerland

1.1 Motivation for the Literature Review

Teachers' competence has a crucial effect on their teaching as well as their students' success (e.g., Baumert et al., 2010; Hattie, 2009). The foundation for that competence is established during the initial teacher training and continues throughout their entire teaching career. The constantly varying context conditions in schools and classrooms, as well as the changing requirements for students and for teachers themselves, require teachers to continue learning throughout their careers in order to maintain and develop their professionalism (e.g., Lipowsky & Rzejak, 2015; OECD, 2009). Furthermore, subject contents may change and be updated, regulations and standards with regard to processes in the school routine may be adapted, and new teaching methods might be developed and implemented. Professional development

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(PD) provides an opportunity for teachers to learn about such changes to improve their professional behavior. Furthermore, PD workshops may help teachers learn strategies for handling challenging situations (for different possible scopes of teacher in-service PD courses, see Richter, Kunter, Klusmann, Lüdtke, & Baumert, 2011).

Different meta-analyses have demonstrated that PD can have a positive effect on teachers' learning and behavior as well as on students' performance (e.g., Hattie, 2009; Timperley, Wilson, Barrar, & Fung, 2007; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). Based on these results, the studies identify characteristics of learning opportunities that are able to influence teaching in a positive manner. The analyzed studies often focused on "formal PD", i.e. the participation of learning opportunities provided by education and training institutions (e.g., PD workshops; Commission of the European Communities, 2000; Richter, 2013). In the context of continuous teacher education, formal PD activities do not necessarily lead to recognized qualifications (see the distinction with "further qualifying training" in Eurydice (2003, p. 103) but are officially recognized as further development. Both formal and non-formal learning activities (e.g., learning communities, cooperation with organizations, or individual information search) are characterized by the intention to learn something whereas informal learning may happen unintentionally and in the course of doing something different (Commission of the European Communities, 2000; see also Richter, 2011 for teachers). Yet the various learning activities should not compete with each other, but rather complement each other (e.g., Commission of the European Communities, 2000).

The current literature review focuses on formal teacher PD—that is, learning activities such as courses or workshops that are organized and offered by educational institutions. These learning opportunities are pre-structured by teacher educators and therefore have the potential to impart knowledge to teachers efficiently (Richter, 2016). Furthermore, in several countries, participation in formal PD is mandatory (for an overview of European countries, see European Commission/EACEA/Eurydice, 2013) and can therefore be seen as a "minimum requirement" for teachers' PD. Different international studies have shown that formal PD is highly relevant and used by many teachers (e.g., Boyle, Lamprianou, & Boyle, 2005; OECD, 2009). The current review focuses on such PD activities that aim to maintain and update existing a teacher's competences (called *Fortbildung* in German) but not provide further qualifying training, which enables teachers to assume an office or teach other subjects (*Weiterbildung* in German; e.g., Daschner, 2009; Richter, 2016).

Although a large body of research on crucial elements of successful PD courses exists (e.g., Lipowsky, 2011; Timperley et al., 2007; Yoon et al., 2007) and several models have been developed to investigate and explain the efficacy of PD workshops (e.g., Desimone, 2009; Lipowsky, 2010; Lipowsky & Rzejak, 2015; Van Veen, Zwart, & Meirink, 2012), there is no systematization of studies with regard to teachers' participation in PD as well as aspects that may influence their attendance or be associated

with it.[1] With regard to the quantity of PD workshops attended, existing studies focus on either a certain region within a country or teachers from a specific school type or few certain school subjects (Richter, 2016). In addition, studies concerned with the reasons for teachers to attend or not attend formal PD are rather scarce according to Richter (2016). Furthermore, the existing studies are not based on a coherent model of PD attendance, or teachers' decision-making process for or against certain PD workshops or programs (for the initial overviews of possible influencing variables, see Diehl, Krüger, Richter, & Vigerske, 2010; Kwakman, 2003).

However, it is important to understand the underlying processes and correlations as successful PD programs can only take an effect when teachers participate in them. Therefore, the process of effective teacher PD starts even before attending and utilizing the workshop—namely, when deciding on a PD activity and a specific learning opportunity (see Beier & Kanfer, 2010, for a stage model for training motivation in a general context). Accordingly, Rzejak et al. (2014) suggested not only considering "training motivation" but also further differentiating it into "training choice motivation" (the choice of a certain PD program before participating), "training utilization motivation" (how teachers use the program and actively engage in it), and "training transfer motivation" (motivation to apply new knowledge and skills in classroom). The differentiation into the three phases and qualitatively different motivation stages allows for investigating the whole training process more precisely and considering constructs that may be more influential in one of the phases but not throughout the whole process (Beier & Kanfer, 2010).

The current review focuses on the first phase: the training choice. For countries in which teachers' participation in PD is not mandatory (for an overview see e.g., European Commission/EACEA/Eurydice, 2013), it is important to know what motivates teachers to attend PD, what hinders them, and what other aspects may influence that choice. Furthermore, knowing what is crucial for teachers' PD participation can provide a valuable insight for designing attractive and effective PD programs and workshops.

1.2 Research Questions for the Literature Review

Against this background, the present literature review aims to summarize and systemize existing research results with regard to teachers' training choice or what influences teachers' PD behavior. To provide broad insights into this topic, the review not only focuses on motivational constructs (cf. Rzejak et al., 2014), but also covers teachers' self-reported reasons for and barriers to attending PD, as well as individual and context characteristics that have been examined with regard to their associations with teachers' PD attendance. The current literature review focuses on results from

[1] See Richter (2016) for a first approach to summarizing studies from Germany with regard to teachers' participation as well as reasons for and against attending PD. However, the results are based only on eight publications.

Germany, Austria, and Switzerland which are often (but not always) published in German and therefore may not be accessible to international researchers. Through this review, comparisons between studies from different countries and teacher education systems may be possible.

In a first step, the applied methods of the systematic literature review are presented and the included studies are summarized. Afterwards, the results are presented focusing on three research questions:

(1) What are teachers' self-reported reasons for choosing and participating in a (certain) PD program?
(2) What barriers do teachers report with regard to their participation in PD programs?
(3) What variables are associated with teachers' PD behavior?

The aim of the paper is to provide a broad overview of the existing research from Germany, Austria, and Switzerland on these questions. Applying a narrative approach serves to reveal what was examined in the context of teachers' PD behavior thus far rather than calculating effects of certain characteristics or variables. Nevertheless, this review may be used as a basis for further analyses, such as meta-analyses on more specific research questions. At the end, the results are summarized and incorporated into a comprehensive model of teachers' choice of PD programs.

1.3 Theoretical Approaches to Teachers' Participation in Professional Development

In order to systemize the results of the literature review, several attempts to systemize aspects that may affect teachers' PD participation exist. For example, Kwakman (2003) proposed a theoretical model with three different kinds of factors: personal factors (characteristics of the teacher), task factors (context conditions within the school), and work environment factors (different forms of support within the school). However, the hypothesized model is concerned with any professional learning activities at the workplace, particularly informal learning activities. In contrast, Diehl et al. (2010) outlined different summaries of affecting aspects and proposed a model that also included three factors: individual, internal contextual and external contextual factors. Individual factors are concerned with teachers' characteristics, such as their motivation, willingness to invest effort into PD, private conditions, and prior experiences. In contrast, the internal contextual factors represent factors concerned with characteristics of the school to which the teachers belong and their work environment. Examples of this kind of factors are regulations of class cancellations, colleagues' attitudes regarding PD, and available budget for PD attendance. Finally, external contextual factors comprise characteristics of the PD program that may influence teachers' decisions regarding potential participation, such as available information on the course, distance to the location, and organizational aspects such as the registration deadline (Diehl et al., 2010). When comparing the two described models,

it becomes apparent that both models distinguish individual characteristics of the teacher from those of the context. However, Kwakman (2003) differentiated characteristics of the school into two groups (task factors and work environment factors) but does not consider any characteristics of the targeted learning activity, as Diehl et al. (2010) did. This makes sense as she considered different learning activities in her study that vary widely. Against the background that the current literature review is concerned with participation in formal PD, it seems plausible to consider the courses' characteristics. Diehl et al.'s (2010) model is suitable for systemizing the results from a small qualitative pilot study. However, the results of the main study and therefore a proof of the model's usefulness have not yet been published. Nevertheless, a similar categorization of factors can be found in Lipowsky and Rzejak's (2015) model, which is concerned with the effectiveness of PD courses and what influences their success. Therefore, it can be assumed that this classification may be helpful to systemize characteristics and circumstances that are crucial for teachers' PD participation.

Against this background, it was aimed to summarize and systemize the results of the literature review in three steps: First, the results of all included studies were recorded regardless of the described categories. Next, in accordance with qualitative content analysis (Mayring, 2014), the outcomes were reviewed to determine if they would fit into the model suggested by Diehl et al. (2010) in the sense of a deductive analyses. In order to facilitate readability, the more obvious terms "characteristics of the teacher", "characteristics of the PD program", and "context conditions" were used. Finally, it was examined whether further categories should be considered in the context of teachers' PD participation or if the existing categories could be further subdivided in order to provide a suitable model for future research (inductive analyses).

1.4 Teacher Professional Development in Germany, Austria, and Switzerland

Overall, continuous PD is part of teachers' duty in Germany, Austria, and Switzerland (e.g., European Commission/EACEA/Eurydice, 2013). However, there are hardly any specifications on topics that teachers should consider or to what extent they should participate in formal PD. Therefore, there are no possibilities to monitor teachers' PD activities or sanction measures for not attending any formal PD courses. As a result, PD participation depends primarily on the teachers themselves and their characteristics, such as personal interest, perceived needs, and motivation (e.g., Kotthof & Terhart, 2013; Richter, 2013) as well as on the perceived trade-off between costs and benefits associated with PD participation (Rice, 2009). Furthermore, incentives that are typically considered to have a motivating effect in other professions (e.g., pay increase, further career steps or promotion, change of workplace; see, e.g., Tharenou, 2001) do not apply for teachers in these three countries. Instead, it is stated that PD

activities are an essential part of the teaching profession and therefore self-evident for every teacher (e.g., Balmer, 2017). There are a few exceptions within Germany, Austria, and Switzerland with regard to prescriptions on how much time teachers have to spend for PD. However, these obligations are not equal for all teachers and instead depend on where they teach or in what type of school they teach (e.g., Balmer, 2017; Daschner & Hanisch, 2019; Feller & Stürgkh, 2017). In addition, although in organizational contexts PD attendance counts as working hours, teachers are encouraged to participate in PD activities outside their class time to avoid class cancellation (e.g., Bundesgesetzblatt §40a, Section 12) and have to align their PD participation with class preparations, grading, or additional responsibilities within their school. Therefore, PD attendance is often associated with additional workloads for teachers. Finally, teachers have the main responsibility for choosing PD courses without being supported by a systematic assessment of needs or development plans.

Against this background, it is of particular interest to analyze teachers' PD behavior in order to understand why they participate in (certain) PD courses or what prevents them from doing so (Gorozidis & Papaioannou, 2014; Hildebrandt & Eom, 2011). Considering these findings, implications can be derived for the design of PD courses as well as context conditions in order to support teachers in their PD (Gorozidis & Papaioannou, 2014).

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Chapter 2
Methods of the Systematic Literature Review

Abstract The chapter describes the methodological approach realized for identifying relevant literature to the research questions raised in Chap. 1. (What are teachers' self-reported reasons for choosing and participating in a (certain) PD program? What barriers do teachers report with regard to their participation in PD programs? What variables are associated with teachers' PD behavior?). As important previously known studies were not contained in the search results of relevant databases (e.g., PSYNDEX, ERIC), Google Scholar was used for the initial search. This also enabled a search for different kinds of publications and a broad basis of studies. The results were first examined based on the titles and abstracts (if applicable). The remaining studies were screened in more detail based on the full text. In addition, snowballing as well as analyses of content tables were conducted. By applying these steps, a final set of 81 studies was identified as relevant for the literature review. The included studies are described in this chapter with regard to different characteristics, such as publication form, teacher samples, and kind of conducted analyses.

Keywords Teacher professional development · Training motivation · In-service teacher education · Systematic literature search · Research review

2.1 Search Procedure

First, a search in scientific databases relevant to the research domains related to teacher education and PD (e.g., pedagogical psychology, pedagogy, vocational education) was conducted (ERIC, PsyARTICLES, PsycINFO, PSYNDEX, Web of Science). A brief initial search using "professional development" and "teacher" as keywords returned only a few studies, and important previously known studies were not contained in these results. Therefore, Google Scholar was used because it has a broader access to (more or less) scientific publications and also includes search results from peDOCS, a document server for freely accessible publications. In addition, the results of the previously mentioned databases were included as a subset of the Google Scholar search results. Another advantage of this approach is that more types of publications (e.g., research reports, monographs, edited volumes, dissertations, conference presentations) can be included because Google Scholar is not limited to journal papers, as other databases are (e.g., PsycARTICLES).

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The initial search was done on 26 July 2017. As the focus was on studies from Germany, Austria, and Switzerland, the following German keywords were used: "Fortbildungsverhalten[1]" (PD behavior), "Fortbildungserwartungen" (PD expectations), "Fortbildungswünsche" (PD wishes), "Fortbildungsinteresse" (PD interests), and "Fortbildungsmotive" (PD motives). Each keyword was combined first with "Lehrkraft" and then with "Lehrer" (teacher[2]). If necessary, the actual publications or titles were searched as some results from Google Scholar were ambiguous. This approach identified 463 distinguishable hits.

As stated in Chap. 1, the focus was on training choice, meaning the phase before a PD workshop or program started was relevant (see first phase in Beier & Kanfer, 2010 or Richter, Kunter, Klusmann, Lüdtke, & Baumert 2014). The goal was to include all empirical studies focused on school teachers from Germany, Austria, or Switzerland that either examined teachers' self-reported reasons or barriers for participating or reported the relationship between individual or context characteristics with (the amount of) teachers' actual participation in formal PD in the past (but no results on efficacy of training programs or evaluations). Both quantitative and qualitative studies were considered. In addition, only studies with data collection after 1990 (i.e., after the German reunification) were included. Figure 2.1 summarizes the

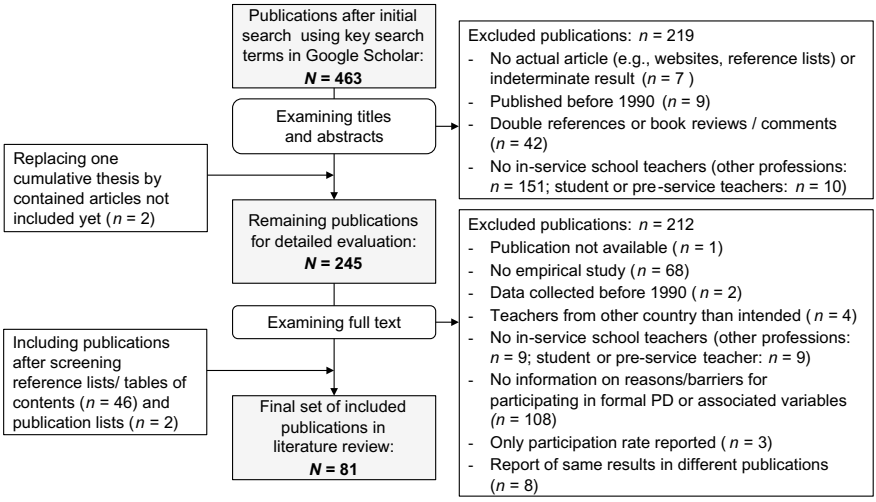

Fig. 2.1 Flow diagram for procedure of systematic literature search

[1] As stated in Sect. 1.1 the review does not include research on further qualifying training. Therefore, the search term "Weitebildung" was not used. However, a screening of the search results when including this term did not reveal any important studies that could contribute to the research aim of the current literature.

[2] "Lehrkraft" and "Lehrer" are both translations of "teacher". The former is a gender-neutral term whereas the latter refers to male teachers, although it was sometimes used as job title in earlier studies.

search procedure as a PRISMA flow diagram (Moher, Liberati, Tetzlaff, & Altman, 2009) and provides an overview of the process.

All titles and abstracts of the search results were screened and compared against the previously discussed inclusion criteria to determine if they were suitable for the review. If it was not possible to infer the relevance from the title or abstract, the publication was included for further screening. During this process, 219 publications were excluded (e.g., because the studies were published before 1990, studies occurred more than once, or the examined sample was not schoolteachers; see Fig. 2.1). One publication was a cumulative doctoral thesis (Nitsche, 2013) that included three articles; thus, it was replaced by the contained articles. Therefore, 245 publications remained for the second step: the screening of the full texts. If two publications reported the same results from the same study, only one of them was considered.[3] After collating the remaining texts with the inclusion criteria, 212 additional publications were excluded (e.g., because there was no data collection or it occurred before 1990, there was no information on teachers' reasons/barriers for their PD participation or on related variables; see Fig. 2.1). To broaden the publication basis of the literature review, reference lists and tables of content were reviewed for publications that might fit the inclusion criteria, which resulted in 48 additional publications being included. Ultimately, a final set of 81 publications was used as the basis of the current literature review.

2.2 Description of Included Studies

The 81 remaining publications contained 19 journal articles (16 from peer-reviewed journals), 17 chapters from edited volumes, 17 monographs, 13 research reports, 10 dissertations (4 published as monographs), 2 theses (Diploma), 2 conference presentations, and 1 article in a special issue that was used as a research report. Core characteristics of the study sample are summarized in Table 2.1 (see Table A.1 for an overview of all included studies).

In 67 studies (80%), data were collected using questionnaires that predominantly contained closed-ended questions; this is also true for 4 studies (5%) reporting results from standardized interviews. The questions in both kind of studies were typically concerned with PD workshops the teachers visited in the past (amount and/or topics), what reasons they have to attend formal PD, and what were or may have been reasons not to participate. Most studies asked teachers to rate predefined aspects with regard to their relevance for attending or not attending PD workshops. Only 13 studies (15%) used open-ended questions: 3 (4%) conducted group discussions, 8 (10%) worked with (semi-structured) interviews, and 2 (2%) used mixed methods. Overall, in 37 studies (44%) the analyses were realized through descriptive statistics. Finally, 46 publications (55%) reported results from statistical analyses, from which 32 studies (38%) realized group comparisons.

[3]The following studies were not considered for the analysis: Bachmaier (2011), Beck and Ullrich (1996), Daus et al. (2004), Jetzschke and Henn (2016), Neu and Melle (1998), Richter (2013), Richter and Klein (2013), Richter, Kunter, Klusmann, Lüdtke, and Baumert (2014).

Table 2.1 Characteristics of included studies

Characteristic	Number of studies
Region	Germany: $n = 70/86\%$ (one federal state or specific region: $n = 34/42\%$; several federal states: $n = 8/10\%$; whole country: $n = 28/35\%$); Austria: $n = 9/11\%$ (specific region: $n = 4/5\%$; whole country: $n = 5/6\%$); Switzerland: $n = 2/2\%$ (one canton: $n = 1/1\%$; several cantons: $n = 1/1\%$)
Time of data collection	Overall between 1992 and 2017; missing data ($n = 14/17\%$) Considering periods of 5 years: most data collection were realized between 2007 and 2011 ($n = 20/30\%$)[a]
Sample size[b]	Ranging from 6 to 4265 teachers (<100 persons: $n = 13/15\%$; <1000 persons: $n = 35/42\%$; >1000 persons: $n = 30/36\%$); missing data ($n = 6/7\%$)
Age	Report of means ($n = 20/49\%$): ranging from 37 to 50 years; report of mode ($n = 28/68\%$): greater than 40 years ($n = 11$), greater than 50 years ($n = 16$); missing data ($n = 40/49\%$); 8 studies reported mean and mode; 1 study reported range
Gender (proportion of women)	Less than 50% female ($n = 15/28\%$; smallest amount: 19% female, physics teacher at academic-track school); greater than 50% female ($n = 38/72\%$; proportions above 80%: $n = 11/21\%$, especially teachers from primary schools); missing data ($n = 28/35\%$)
School type[c]	Primary schools ($n = 13/16\%$); academic-track schools ("Gymnasium"/"Allgemeinbildende höhere Schule", $n = 4/5\%$); intermediate-track schools ("Regelschulen", $n = 1/1\%$); vocational schools (here "Berufskolleg", $n = 1/1\%$); several school types ($n = 60/75\%$); missing data ($n = 1/1\%$) General education ($n = 57/72\%$); (considering) vocational schools ($n = 20/25\%$)
School subject	Several subjects ($n = 39/51\%$); religion ($n = 5/7\%$); mathematics ($n = 5/7\%$); chemistry ($n = 4/5\%$); geography, German, physics, sciences in lower classes ("Sachunterricht") ($n = 2/3\%$ each), science ($n = 1/1\%$), mathematics and science ($n = 8/11\%$); other specific combinations of subjects ($n = 5/7\%$); missing data ($n = 5/6\%$)
Focus of PD	General/no specification ($n = 39/48\%$) Certain contents: ICT ($n = 12/15\%$); chemistry ($n = 4/5\%$); mathematics ($n = 4/5\%$); religion ($n = 3/4\%$), physics ($n = 2/2\%$); other contents ($n = 11/14\%$); Certain provider ($n = 5/6\%$);

Notes Relative frequencies are based on valid information

[a]Databases (e.g., from COACTIV, TIMSS, TALIS) used in several publications are only considered once

[b]$n = 84$ studies were considered because three publications reported two different studies each with different samples

[c]For a brief explanation of different school types, see for example Richter (2013)

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Chapter 3
Reasons for Participation in Professional Development

Abstract The chapter is dedicated to the first research question of the systematic literature review: What are teachers' self-reported reasons for choosing and participating in a (certain) PD program? Based on the quantitative data in the included studies, teachers' reasons to participate in PD workshops are systemized and their relevance evaluated by summarizing the reported means and (relative) frequencies. The overview is supplemented with results from qualitative studies. The reasons teachers rate as most relevant for their PD attendance are: receiving easy implementable materials and teaching strategies, inspirations for teaching, refreshing or extending (pedagogical) content knowledge and knowledge about new standards or changes, exchanging and networking with colleagues, and reflection of one's own teaching. The results also reflect the importance of organizational characteristics of PD workshops, such as time and location, as well as opportunities for active learning during the course. The results are systemized along the categories characteristics of PD program and characteristics of teacher. There were no studies identifying reasons for teachers' PD participation that can be categorized as context conditions.

Keywords Teacher professional development · Training motivation · Training participation · Reasons · In-service teacher education

To systemize teachers' reasons for participating in PD, all corresponding aspects from the included studies were analyzed and categorized. Reasons for PD attendance that are relevant for a significant number of teachers were especially considered. Therefore, the following results contain aspects that were rated as (if applicable: very or rather) relevant by more than 25% of the surveyed teachers in at least one study. If statistical means were reported, they were re-scaled to allow comparisons of different studies with different rating scale ranges. The re-scaled values ranged between 0 and 1, with 1 corresponding to the highest agreement. In the following discussion, reasons for participation were considered if the mean was equal to or greater than 0.25.[1] In addition, study results regarding motives for and expectations toward PD

[1] As teachers' responses were not equally distributed among the answer options, it cannot be assumed that the re-scaled mean of 0.25 is equivalent to the agreement of 25% teachers. However, results from studies reporting both measures (Prenzel, 1995; Richter & Schellenbach-Zell, 2016) revealed that the two criteria are comparable for including results in the report.

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attendance were considered, as both aspects often overlap with participation reasons. Afterwards, it was examined if results from studies with open-ended questions raised new aspects that had not yet been considered.

Table 3.1 summarizes the reasons for participating in formal PD that were rated or mentioned as relevant according to the previously described criteria. The different reasons are not sorted by the relevance ratings as there is no clear ranking order due to the (sometimes high) ranges between different studies. Furthermore, when the results referred to certain types of knowledge that teachers wanted to acquire, Richter, Kunter, Klusmann, Lüdtke, and Baumert (2011) categorization scheme was used. The suggested categorization is based on a model of teachers' professional competence (Baumert & Kunter, 2013). The model proposes that professional competence encompasses different aspects, such as beliefs and values, motivational orientations, self-regulatory abilities, as well as professional knowledge. Furthermore, based on expertise research, different types of knowledge are differentiated (content knowledge, pedagogical content knowledge, pedagogical knowledge, organizational knowledge, and counselling knowledge) that are assumed to be important for successful teachers (Baumert & Kunter, 2013). Richter et al. (2011) used the different domains of knowledge to categorize different PD contents and inductively added categories that had not yet been considered. The final categorization scheme comprised nine categories that were suitable to subsume teachers' attended PD programs. Therefore, this categorization scheme was used in the current literature review to simplify and summarize the various wordings within the included studies.

The results of the different studies can be summarized into two of the deductively derived categories (see Sect. 1.3) "characteristics of PD program", and "characteristics of teacher". However, no studies identify relevant reasons for teachers' PD participation that can be categorized as "context conditions".

With regard to the *characteristics of PD programs*, there are several reasons encompassing the intention of using PD workshops as tools to accomplish certain goals. Teachers seem to see PD courses as an instrument to acquire information on or knowledge of specific contents or to achieve support for their daily work. Therefore, the following aspects may be categorized as teachers' assessment of the "instrumentality of PD programs": suggestions and inspiration for teaching, refreshing or extending knowledge of subject content, subject-specific pedagogy, as well as knowledge of pedagogy and psychology, and counselling. Furthermore, teachers seem to see formal PD as a chance to get to know something about new requirements they need to implement and how to handle different (challenging) situations in the profession. However, support for teaching outside one's own subject area was barely rated as relevant. A possible explanation for this may be that only a few teachers need to teach subjects they did not study before whereas most teachers stay within their subject area and, therefore, do not need any help with this issue.

Teachers attend formal PD not only to refresh or acquire certain knowledge, but also because they perceive PD courses as an opportunity for other aspects. For example, they participate to receive ready-to-use materials and concepts for their classes, network with colleagues, build their careers, reflect on their own teaching and professional behavior, and to stay motivated for the job. While networking and exchanging

Table 3.1 Summary of teachers' reasons for participating in PD

Reason for participation	M (Min–Max): % of agreement & rescaled mean	References[a] (results smaller than 25% agreement or re-scaled mean of 0.25)
New suggestions and inspiration for teaching	76% (–) 0.88 (0.85–0.90)	*Aschenbrenner* (2010), *Diehl, Krüger, Richter, and Vigerske* (2010), *Greve and Höhne* (2009), Gröber and Wilhelm (2006), Jäger and Bodensohn (2007), Richter and Schellenbach-Zell (2016), *Schmidt and Neu* (2004), *Schwetlik* (1998)
Refreshing or extending knowledge of…		
… subject content	78% (67–86%) 0.80 (0.67–0.93)	Beck, Ullrich, and Schanz (1995), *Diehl et al.* (2010), Feige and Tzscheetzsch (2005), Gröber and Wilhelm (2006), Jacobi, Verweyen, and Wedding (1996), Kanwischer, Köhler, Oertel, Rhode-Jüchtern, and Uhlemann (2004), Landert (1999), *Niederhaus and Schmidt* (2016), Pennig (2006), Pietzner, Scheuer, and Daus (2004), Prenzel (1995), *Schmidt and Neu* (2004), Wolf, Göbel-Lehnert, and Chroust (1997)
…(subject-specific) pedagogy,	76% (58–90%) 0.78 (0.70–0.95)	*Aldorf* (2016), Beck et al. (1995), *Diehl et al.* (2010), Feige and Tzscheetzsch (2005), Gröber and Wilhelm (2006). *Häuptle, Florian, and Reinmann* (2008), Jacobi et al. (1996), Jäger and Bodensohn (2007), Kanwischer et al. (2004), Landert (1999), *Niederhaus and Schmidt* (2016), Pennig (2006), Pietzner et al. (2004), Prenzel (1995), Rzejak et al. (2014), *Schmidt and Neu* (2004), *Schwetlik* (1998), Wolf et al. (1997)
…pedagogy and psychology, and	70% (–) 0.71 (0.56–0.84)	*Aldorf* (2016), Beck et al. (1995), Jacobi et al. (1996), Jäger and Bodensohn (2007), Wolf et al. (1997)
…consulting	50% (–) 0.78 (–)	Kanwischer et al. (2004), Wolf et al. (1997)

(continued)

Table 3.1 (continued)

Reason for participation	M (Min–Max): % of agreement & rescaled mean	References[a] (results smaller than 25% agreement or re-scaled mean of 0.25)
Support for implementing (new) directives, standards of education, and curricula	65% (–) 0.61 (0.57–0.70)	*Aschenbrenner* (2010), *Häuptle et al.* (2008), Jacobi et al. (1996), Jäger and Bodensohn (2007), Kanwischer et al. (2004), *Schwetlik* (1998), Wolf et al. (1997)
Getting to know solutions for…		
…challenging situations or current problems,	63% (58–69%) 0.66 (0.58–0.74)	*Greve and Höhne* (2009), Jacobi et al. (1996), Prenzel (1995), Richter and Schellenbach-Zell (2016), Wolf et al. (1997)
…changing demands/requirements, or	40% (31–48%) 0.25 (–)	Landert (1999), *Niederhaus and Schmidt* (2016)
…communication or cooperation problems within staff	50% (29–71%) 0.46 (0.44–0.48)	Kanwischer et al. (2004), Prenzel (1995)
Support for teaching outside one's subject area	16% (–) 0.28 (–)	*Greve and Höhne* (2009), Jacobi et al. (1996), *Schwetlik* (1998) (Kanwischer et al., 2004)
Ready-to-use materials and preparation of PD content for immediate implementation in classroom	68% (25–96%) 0.80 (0.78–0.81)	*Aldorf* (2016), Beck et al. (1995), Faßmann (1994, 1995), *Greve and Höhne* (2009), *Herrmann and Hertramph* (2002), *Höhnle, Fögele, Mehren, and Schubert* (2016), Jäger and Bodensohn (2007), Kanwischer et al. (2004); Keppelmüller, Sigl, Lauber, and Feichtner (2004), *Niederhaus and Schmidt* (2016), Pennig (2006); Pietzner et al. (2004), *Schmidt and Neu* (2004), *Schwetlik* (1998)
Networking and sharing experiences with colleagues	70% (54–95%) 0.68 (0.54–0.83)	*Aldorf* (2016), *Aschenbrenner* (2010), Beck et al. (1995), *Diehl et al.* (2010), Faßmann (1994), Feige and Tzscheetzsch (2005), *Greve and Höhne* (2009), Jacobi et al. (1996), Jäger and Bodensohn (2007), Kanwischer et al. (2004), Keppelmüller et al. (2004), Landert (1999), Pietzner et al. (2004), Prenzel (1995), Richter and Schellenbach-Zell (2016), Rzejak et al. (2014), *Schmidt and Neu* (2004), *Schwetlik* (1998), Wolf et al. (1997)

(continued)

Table 3.1 (continued)

Reason for participation	M (Min–Max): % of agreement & rescaled mean	References[a] (results smaller than 25% agreement or re-scaled mean of 0.25)
Instrumentality for career, e.g., for taking on further responsibilities within school or…	18% (13–30%) 0.33 (–)	Jacobi et al. (1996), Kanwischer et al. (2004), *Niederhaus and Schmidt* (2016) (Faßmann, 1994, 1995; Landert, 1999; Richter and Schellenbach-Zell, 2016)
…continuing such responsibilities	34% (–) (–)	Landert (1999)
Reflection of one's own teaching and professional behavior	30% (29–31%) 0.72 (0.68–0.78)	Beck et al. (1995), *Diehl et al.* (2010), Jacobi et al. (1996), Jäger and Bodensohn (2007), Landert (1999), *Schwetlik* (1998), Wolf et al. (1997)
Distance and diversion from daily routine and…	20% (14–30%) 0.29 (–)	*Aschenbrenner* (2010), *Diehl et al.* (2010), Feige and Tzscheetzsch (2005), Landert (1999) (Faßmann, 1994, 1995)
…inspiration for changing habits and staying motivated for teaching	62% (–) 0.80 (–)	*Aldorf* (2016), Faßmann (1994), Kanwischer et al. (2004), Wolf et al. (1997)
Relatedness to subject contents taught or…	92% (88–96%) 0.64 (–)	Gysbers (2008), Keppelmüller et al. (2004), Pietzner et al. (2004), *Schmidt and Neu* (2004), *Schwetlik* (1998)
…school type	69% (–) 0.58 (–)	Pietzner et al. (2004), *Schmidt and Neu* (2004)
Active learning activities	69% (–) 0.67 (0.66–0.67)	*Greve and Höhne* (2009), *Höhnle et al.* (2016), Jäger and Bodensohn (2007), Pietzner et al. (2004), Prenzel (1995), *Schmidt and Neu* (2004), *Schwetlik* (1998)
Appropriate and convenient circumstances of PD program (e.g., date, duration, location, application procedure)	47% (32–70%) 0.62 (–)	Faßmann (1994, 1995), Gysbers (2008), Keppelmüller et al. (2004), Pietzner et al. (2004), *Schmidt and Neu* (2004)

(continued)

Table 3.1 (continued)

Reason for participation	M (Min–Max): % of agreement & rescaled mean	References[a] (results smaller than 25% agreement or re-scaled mean of 0.25)
Positive experiences with PD provider or	47% (35–63%) (–)	Faßmann (1994, 1995), *Häuptle et al.* (2008), Keppelmüller et al. (2004)
…instructor	26% (–) (–)	Keppelmüller et al. (2004)
Having a voice in designing the PD program	10% (8–12%) 0.42 (–)	*Greve and Höhne* (2009), Pietzner et al. (2004) (Faßmann, 1994, 1995)
Personal interest in PD content	85% (75–98%) 0.90 (–)	*Aldorf* (2016), *Aschenbrenner* (2010), Faßmann (1994, 1995), *Greve and Höhne* (2009), *Häuptle et al.* (2008), Hessisches Kultusministerium (2008), Kanwischer et al. (2004), Keppelmüller et al. (2004), *Nittel, Schütz, Fuchs, and Tippelt* (2011), Richter and Schellenbach-Zell (2016), *Schwetlik* (1998), Wolf et al. (1997)
General willingness/motivation for PD or…	79% (–) (–)	Faßmann (1994, 1995)
…enjoying PD participation	84% (–) (–)	*Greve and Höhne* (2009), Keppelmüller et al. (2004)
Personal development	43% (32–54%) (–)	*Aschenbrenner* (2010), Beck et al. (1995), Faßmann (1994), Landert (1999)
PD as a duty within teacher vocation	63% (–) (–)	Kanwischer et al. (2004)

Notes [a]Italics indicate results from qualitative analyses

experiences with other teachers is always ranked highly among all studies, there are mixed results with regard to the teaching materials. In Faßmann's (1994, 1995) studies, receiving materials ranked in the middle as a reason for participating in PD (thereby lowering the overall mean reported in Table 3.1) while in other studies the aspect of immediately implementable materials, solutions, and strategies was most important. A possible explanation for this discrepancy may be the kind of questions used: Faßmann asked if the distribution of teaching materials was expected, whereas other studies used phrases such as "for the concrete lesson" (e.g., Kanwischer et al., 2004) or "ready-to-use" (e.g., Keppelmüller et al., 2004). Therefore, it can be assumed that it is not essential for teachers to just receive materials; they wish for information and materials they can easily implement in the classroom (see also Pennig, 2006). The practical relevance and the importance of usability as an incentive is also well represented in the results of the studies with open-ended questions as almost all of them report that teachers wish for them (Aldorf, 2016; Greve & Höhne, 2009; Herrmann & Hertramph, 2002; Höhnle et al., 2016; Schmidt & Neu, 2004).

In contrast, the ratings of PD's instrumentality for career as a reason for participating are rather low among different studies. Again, it can be assumed that this motive and, consequently, the corresponding PD programs are only interesting for a small portion of teachers because not every teacher wants to take on further responsibilities. A similar pattern can be found for diversion from daily routines. Although some studies show that this is a relevant reason for teachers to participate in PD programs, other studies could only find a small relevance (e.g., Aschenbrenner, 2010, reported that only one teacher mentioned this aspect). Overall, this reason seems to be vital to only a few teachers. Changing routines and getting new motivation for teaching appear to be stronger motives for participating in PD.

A second group of reasons for participating in PD courses seems to be the formal characteristics of the PD program, such as content, learning activities, and timing. According to the previously mentioned results on easily implementable solutions and materials, teachers perceive a high relevance of PD workshops being related to their subject area and taught contents. It can be assumed that it is easier for teachers to implement newly learned knowledge into their classrooms if it is already tailored to their subject. However, it is less important to them that the PD program be only for teachers from the same school type. It is also quite important to teachers to have the opportunity for active learning and to apply different teaching or learning strategies as well as conduct experiments in the context of science PD workshops (Pietzner et al., 2004; Schmidt & Neu, 2004). This may also correspond with teachers' mentioned need for easily implementable teaching strategies: Applying and practicing strategies by themselves help easily incorporate them into one's own classroom and, therefore, accomplishes the teachers' wish for high practical relevance. Another important reason to participate in PD, as found in several studies, is the fit between the course set-up with work-related and private requirements (e.g., short distance to PD location to save time). Only one study asked teachers for the relevance of an attractive PD location and found that this is a motivation for only a few teachers (Keppelmüller

et al., 2004). Therefore, pragmatic considerations seem to be more important than those related to personal convenience. Some teachers seem to prefer participating in PD workshops about which they already know something positive (e.g., about the provider or colleagues' positive experiences). In addition, some teachers like to have a voice in what and how contents are taught during the workshops. However, only a few teachers perceive this as a relevant aspect for participating in formal PD.

Finally, there are several reasons for participating in PD that can be summarized as *teacher characteristics*. A very important reason for teachers to attend PD courses is their personal interest in the PD topic (see also Sect. 5.1). In addition, a few studies considered a general will or motivation for PD as well as an interest in PD as an activity, which were rated as relevant in those studies. Therefore, it can be assumed that enjoying dealing with certain topics and developing their own knowledge are important intrinsic reasons for teachers' PD attendance. Furthermore, in Kanwischer et al.'s (2004) sample, a considerable number of teachers considered PD to be a crucial part of the teaching profession and perceived this as a motive to attend PD courses.

Only about 20% of teachers agreed with the statement that the expected outcome of a PD program needs to be relatively high compared to the effort that is related to the workshop (Faßmann, 1994, 1995). Nevertheless, attempts to create extrinsic incentives seem to reinforce this "calculation". Indeed, 79% of surveyed teachers in Hesse mentioned that more attention is paid to the ratio of received credits and spent time due to the credit system introduced in 2005 (Hessisches Kultusministerium, 2008). Therefore, one could conclude that the aforementioned outcomes, such as knowledge refreshment or gain, or other aspects, such as receiving materials or networking, are more crucial than incentive systems provided by federal institutions. However, systematic studies examining the effect of (different) incentive systems or obligations are lacking so far.

Another extrinsic aspect, that could be categorized as a *context condition*—the principal's request for a teacher to participate in PD—was considered in several studies but turned out to be relevant for only a few teachers (6–7%/0.08; Faßmann, 1994, 1995; Jacobi et al., 1996; Kanwischer et al., 2004; Keppelmüller et al., 2004). The same is true for the support by colleagues (8–15%/0.12; Faßmann, 1994, 1995; Richter & Schellenbach-Zell, 2016; Rzejak et al., 2014). However, in studies with open-ended questions, this aspect was mentioned by some teachers (Aldorf, 2016; Aschenbrenner, 2010; Höhnle et al., 2016). These studies also show that it may be fruitful to distinguish between requirements and recommendations by the school management. There can be discussions between teachers and principals with regard to reasonable PD topics, for example within the context of personal development. However, even recommendations may be perceived as a request. These differences cannot yet be clarified with the available data.

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Chapter 4
Barriers to Participation in Professional Development

Abstract In the light of the high relevance of PD, it is of particular interest to examine why teachers do not attend PD workshops. Therefore, the second research question of the systematic literature review is focused in this chapter: What barriers do teachers report with regard to their participation in PD programs? In accordance with the procedure in Chap. 3, barriers for PD attendance rated as relevant by the teachers are summarized based on the quantitative results of the reviewed studies and supplemented with qualitative insights. The most important obstacles according to the studies are: High workload of teachers, concerns about cancelled classes, problems with the timing of PD workshops, (especially for women) family commitments, difficulties to organize substitute classes, as well as issues with the existing PD program (inappropriate content, poor quality, overbooked courses, high costs, faraway locations). Again, the results are summarized and systemized along the categories characteristics of PD program, characteristics of teacher, and context conditions. The barriers are discussed and reflected considering the reasons for PD participation.

Keywords Teacher professional development · Training motivation · Training participation · Barriers · In-service teacher education

In light of the high relevance of PD (Chap. 1), it is of particular interest to examine why teachers choose *not* to attend PD workshops. Therefore, the included studies were also analyzed with regard to reasons that are seen as relevant for avoiding formal PD. The analysis of these obstacles are realized in accordance with the procedure outlined in Chap. 3 for identifying reasons for PD participation. Thus, barriers for PD attendance are considered if they were rated as (very or rather) relevant by more than 25% of the teachers or have an empirical mean equal to or greater than 0.25 in at least one study.

Studies focusing on this part of training motivation mostly apply one of the following two approaches: ask the whole sample what it is that hinders them or makes it at least difficult to participate in PD or focus on those teachers who did not attend any PD workshops during a certain period of time (e.g., the last two years) and compare the results to teachers who did participate in PD. Those studies that applied the latter approach revealed that the responses between participating and non-participating teachers hardly differ (Pietzner, Scheuer, & Daus, 2004; Richter & Klein, 2013;

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Schmidt & Neu, 2004). Therefore, there was no differentiation between studies following the different approaches, and they were analyzed together herein. The results are summarized in Table 4.1.

After comparing different studies, it is apparent that teachers' agreement with the relevance of several barriers differs among these studies (see range of results in Table 4.1). For example, there was a wide range with regard to the agreement to concerns about cancelled classes (16–54%) or fully booked workshops (0–61%). Possible explanations for these differences are considered in the following discussion. Furthermore, by comparing the results presented in Chaps. 3 and 4, it becomes apparent that the relevance of the given barriers (overall mean approximately: 27%/0.30) is rated lower in general than the reasons for attending PD (overall mean approximately: 52%/0.58).

After analyzing the included studies, the results with regard to relevant barriers for attending formal PD could be categorized into the deductively derived categories (see Sect. 1.3): "context conditions", characteristics of PD program", and "characteristics of teacher".

With regard to barriers that can be summarized as *context conditions*, several results seem to be linked to characteristics of the profession as a schoolteacher, but less with characteristics of the work environment associated with single schools. For example, teachers seem to perceive the high workload as especially relevant for their PD behavior. However, from the few studies differentiating between burdens due to teaching and due to other school-related tasks, it can be assumed that the workload because of tasks beyond in-class responsibilities prevents teachers from attending workshops (see Beck et al., 1995; Diehl et al., 2010; similar relevance in Richter et al., 2012) more than in-class teaching (Faßmann, 1994, 1995). Nevertheless, concerns about class cancellation are also relevant to the decision to participate in a workshop or not as teachers already have too little time for teaching the provided contents within a school year (Diehl et al., 2010; Kanwischer et al., 2004). This issue may be aggravated due to more rigorous requirements for teachers to prevent class cancellation (Breiter et al., 2010). Due to the high workload of all teachers, it is not only seem to be challenging to find a colleague with "spare time" to substitute for the class, but teachers also feel bad about encumbering their colleagues with additional work. Against this background, it seems reasonable that some teachers complain about not getting any teaching reduction (or other incentives) to compensate for the extra effort. As such, incentives that have been shown to be useful for predicting PD behavior and success within industrial and organizational contexts (e.g., reach certain career goals, pay increases, job security, change of workplace, or promotion; e.g., Colquitt, LePine, & Noe, 2000) cannot be applied to the teaching profession and it seems that teachers' PD attendance depends on intrinsic reasons in particular.

The described barriers interact with additional barriers due to *characteristics of the PD program*. Given the perceived high workload, teachers have problems reconciling PD courses with their school hours. Maybe the results regarding the aspect of an

Table 4.1 Summary of teachers' barriers to participating in PD

Barriers to participation	M (Min–Max): % of agreement & rescaled mean	References (results smaller than 25% agreement or rescaled mean of 0.25)
High workload in school or…	44% (31–61%) 0.54 (0.40–0.68)	Beck, Ullrich, and Schanz (1995), *Breiter, Welling, and Stolpmann* (2010), Forsa (2017), Gagarina and Saldern (2010), *Greve and Höhne* (2009), Heitmann (2013), Jacobi, Verweyen, and Wedding (1996), Kanwischer, Köhler, Oertel, Rhode-Jüchtern, and Uhlemann (2004), Landert (1999), Nittel, Schütz, Fuchs, and Tippelt (2011), Richter and Schellenbach-Zell (2016), Richter, Kuhl, Reimers, and Pant (2012), Wolf, Göbel-Lehnert, and Chroust (1997)
…no time in general	30% (26–34%) (–)	BITKOM (2015), Büsching and Breiter (2011)
Concerns about cancelled classes	31% (16–54%) (–)	*Aschenbrenner* (2010), Beck et al. (1995), *Breiter et al.* (2010), *Diehl et al.* (2010), Forsa (2017), Gagarina and Saldern (2010), Jacobi et al. (1996), *Kanwischer et al.* (2004), Keppelmüller, Sigl, Lauber, and Feichtner (2004), Richter and Schellenbach-Zell (2016) (Bachmaier, 2008; Faßmann, 1994, 1995; Wolf et al., 1997)
Difficulties in organizing substitute classes and/or…	34% (11–53%) 0.23 (–)	*Breiter et al.* (2010), *Diehl et al.* (2010), Faßmann (1995), Kanwischer et al. (2004), Keppelmüller et al. (2004), Richter, Kuhl, Haag, and Pant (2013), Schwetlik (1998) (Faßmann, 1994; Landert, 1999)
…feeling guilty about additional load for colleagues due to substitution	30% (24–37%) 0.38 (–)	*Aschenbrenner* (2010), Beck et al. (1995), Wolf et al. (1997) (Bachmaier, 2008)
No (or insufficient) class reduction to compensate for PD participation or…	20% (12–27%) (–)	*Heitmann* (2013), Jacobi et al. (1996), *Schwetlik* (1998) (Landert, 1999)
…other incentives	*(open ended)*	*Heitmann* (2013)

(continued)

Table 4.1 (continued)

Barriers to participation	M (Min–Max): % of agreement & rescaled mean	References (results smaller than 25% agreement or rescaled mean of 0.25)
Time of workshops is incompatible with school hours	46% (28–66%) (–)	Gagarina and Saldern (2010), Grafendorfer, Neureiter, and Längauer-Hohengaßner (2009), Jacobi et al. (1996), Richter et al. (2013)
Workshop is scheduled for inconvenient time or…	49% (32–72%) 0.45 (–)	*Greve and Höhne* (2009), Kanwischer et al. (2004), Landert (1999), Richter et al. (2012, 2013), *Schmidt and Neu* (2004), Wolf et al. (1997)
…planning of appointment in advance is necessary	37% (–) 0.18 (–)	Beck et al. (1995), *Diehl et al.* (2010) (Wolf et al., 1997)
Workshops during holidays	30% (28–33%) (–)	Beck et al. (1995), Kanwischer et al. (2004)
Long distance to PD location	35% (8–57%) 0.52 (–)	*Aschenbrenner* (2010), Beck et al. (1995), *Diehl et al.* (2010), *Gallasch and Sprenger* (2000), *Greve and Höhne* (2009), Jacobi et al. (1996), Kanwischer et al. (2004), Keppelmüller et al. (2004), Pietzner et al. (2004), Richter and Schellenbach-Zell (2016), Richter et al. (2012), *Schmidt and Neu* (2004), *Schwetlik* (1998) (Faßmann, 1994, 1995; Landert, 1999; Prenzel, 1995)
High monetary costs	22% (0–42%) (–)	*Aschenbrenner* (2010), Gagarina and Saldern (2010), *Greve and Höhne* (2009), Kanwischer et al. (2004), Keppelmüller et al. (2004), Richter and Schellenbach-Zell (2016), Richter et al. (2013), *Schmidt and Neu* (1998, 2004) (BITKOM, 2015; Forsa, 2017; Grafendorfer et al., 2009; Landert, 1999; Richter et al., 2012)
Workshop has too little practical relevance or…	16% (10–37%) 0.62 (–)	*Breiter et al.* (2010), *Greve and Höhne* (2009), Kanwischer et al. (2004), Pietzner et al. (2004), Schwetlik (1998) (Beck et al., 1995; Faßmann, 1994, 1995; Neu, 1999; Prenzel, 1995)

(continued)

Table 4.1 (continued)

Barriers to participation	M (Min–Max): % of agreement & rescaled mean	References (results smaller than 25% agreement or rescaled mean of 0.25)
…poor quality and teachers have bad experiences	18% (1–39%) 0.33 (0.30–0.37)	*Aschenbrenner* (2010), *Diehl et al.* (2010), Gagarina and Saldern (2010), *Greve and Höhne* (2009), Nittel et al. (2011), Pietzner et al. (2004), Richter et al. (2012, 2013) (Beck et al., 1995; Büsching and Breiter, 2011; Faßmann, 1994, 1995; Kanwischer et al., 2004; Richter and Schellenbach-Zell, 2016)
Requested workshops are overcrowded and fully booked	22% (0–61%) (–)	Bachmaier (2008), Beck et al. (1995), *Breiter et al.* (2010), *Diehl et al.* (2010), Gagarina and Saldern (2010), *Schwetlik* (1998) (Büsching and Breiter, 2011; Faßmann, 1994, 1995; Kanwischer et al., 2004; Landert, 1999; Prenzel, 1995)
Too few workshops or appropriate workshops for teachers' needs	38% (14–84%) 0.60 (–)	*Aschenbrenner* (2010), Beck et al. (1995), BITKOM (2015), Faßmann (1994), Forsa (2017), Gagarina and Saldern (2010), *Gallasch and Sprenger* (2000), Grafendorfer et al. (2009), *Häuptle, Florian, and Reinmann* (2008), Kanwischer et al. (2004), Keppelmüller et al. (2004), Neu (1999), Pietzner et al. (2004), Richter et al. (2012, 2013), *Schmidt and Neu* (2004), *Schwetlik* (1998) (Büsching and Breiter, 2011; Faßmann, 1995; Keppelmüller et al., 2004; Landert, 1999)

(continued)

Table 4.1 (continued)

Barriers to participation	M (Min–Max): % of agreement & rescaled mean	References (results smaller than 25% agreement or rescaled mean of 0.25)
Mismatch between pre-knowledge and aspiration level of workshops	13% (3–25%) (–)	*Gallasch and Sprenger* (2000), *Häuptle et al.* (2008), Richter et al. (2013) (Grafendorfer et al., 2009; Richter and Schellenbach-Zell, 2016)
With regard to PD in the context of ICT: other PD contents are more important	47% (35–59%) (–)	BITKOM (2015), Büsching and Breiter (2011), *Gallasch and Sprenger* (2000)
No need of PD (e.g., due to sufficient knowledge and/or lack of relevance to teaching)	28% (10–46%) 0.20 (–)	Büsching and Breiter (2011), Forsa (2017), *Häuptle et al.* (2008), *Kanwischer et al.* (2004), *Schwetlik* (1998) (Neu, 1999; Pietzner et al., 2004)
Family commitments	28% (17–41%) 0.24 (0.18–0.30)	*Aschenbrenner* (2010), Bachmaier (2008), Beck et al. (1995), Gagarina and Saldern (2010), Grafendorfer et al. (2009), Keppelmüller et al. (2004), Landert (1999), Neu (1999), Nittel et al. (2011), Pietzner et al. (2004), Richter et al. (2012), *Schwetlik* (1998) (Faßmann, 1994, 1995; Kanwischer et al., 2004; Richter et al., 2013; Wolf et al., 1997)
Personal reasons, such as…		
… already spending enough resources on the profession or…	41% (35–46%) (–)	*Greve and Höhne* (2009), Landert (1999)
…lack of energy	25% (9–42%) 0.15 (–)	*Aschenbrenner* (2010), Richter et al. (2013) (Kanwischer et al., 2004; Wolf et al., 1997)
Preferring other learning activities than formal PD	52% (27–79%) (–)	Faßmann (1994), Landert (1999), Prenzel (1995), Richter and Schellenbach-Zell (2016), Richter et al. (2013), *Schwetlik* (1998)

Notes [a]Italics indicate results from qualitative analyses. Results from Richter, Richter, and Marx (2018) were not considered as they overlap with the results presented in Richter et al. (2013) (Richter et al., 2013 reported results on an item level while Richter et al., 2018 used the same data to calculate and report scale values).

inconvenient time of PD can be interpreted in a similar way.[1] For example, Greve and Höhne (2009) reported that teachers mentioned during their interviews that even PD workshops in the afternoon increase time pressure as they have to leave school immediately after classes to make it to the workshop on time. It is also conceivable that PD programs take place during times in which teachers have a high workload outside their classrooms, such as when grading final examinations, participating in teacher conferences, or writing school certificates. Evidence suggests that teachers prefer PD programs during the school year but not at its beginning or end (e.g., Keppelmüller et al., 2004; Wolf et al., 1997). Accordingly, when PD is scheduled it is important with regard to not only the time of day, but also the time within the school year. Rather controversial are the results concerning PD courses during vacation. For some teachers it seems to be a reason not to attend PD, but this is not true for all teachers. Studies that asked for the preferred time for workshops usually found (but not always: e.g., Pietzner et al., 2004) that teachers prefer sessions outside vacation time (e.g., Beck et al., 1995; Faßmann, 1994; Jacobi et al., 1996; Keppelmüller et al., 2004; Wolf et al., 1997).

In addition, many studies addressed the location where workshops take place. When a long drive is necessary, teachers stated that they are less willing to take that workshop. This barrier has a medium relevance according to different studies, suggesting that this aspect may be more important for some teachers. For example, all teachers who mentioned this reason in Aschenbrenner's (2010) study were female (see also the following discussion and Sect. 5.1 for a more detailed discussion of the association between gender and PD attendance). The results of this exemplary study indicate that there may be interactions between the characteristics of the teacher and the PD course. Therefore, more detailed analyses or re-analyses of existing datasets considering different groups of teachers should be conducted in future studies.

Although, teachers perceive costs associated with PD as an obstacle, it does not seem to be a decisive factor. In some studies, high costs are not even relevant after applying the previously described criterion (BITKOM, 2015; Landert, 1999). This is not surprising given that a lot of PD workshops are free for teachers, and schools have a budget for teachers' development (see, e.g., Hessisches Kultusministerium, 2008). However, Richter et al. (2013) differentiated the aspect of costs and asked for a separate assessment of the relevance of indirect costs (e.g., journey, board and lodging) and attendance fee. The results indicated that teachers rated the indirect costs as more relevant than the direct costs for not participating in PD. In contrast, the BITKOM (2015) study only asked if the PD workshop itself was too expensive, which was not crucial for teachers. Overall, the influence and relevance of costs probably depend on how often teachers attend PD in general and what obligations exist in the different federal states (e.g., Richter et al., 2012) or countries. This may lead to varying ratings, and therefore to an overall smaller relevance.

[1] None of the studies considering this phrase specifies in what way the PD time may be "inconvenient". Therefore, it cannot be differentiated if teachers refer to overlaps with other responsibilities within the school or their family or other aspects.

As discussed in Chap. 3, teachers wish for highly practical relevance and easily implementable strategies first and foremost. Accordingly, teachers perceive a lack of these characteristics as a possible obstacle to their PD attendance. However, the relevance is not as high as one might expect from the previously discussed results and is a rather low ranked barrier. Interestingly, the relevance ratings regarding poor quality and bad experiences with PD workshops load on the same factor as those of the lacking practical relevance in the study of Richter et al. (2018). One explanation may be that the ease of implementing the PD contents is an essential characteristic for the teachers' quality assessment (see also the similar ratings of both in Beck et al., 1995). However, further studies are needed to identify aspects that dominantly influence teachers' perceptions of PD courses.

Furthermore, some teachers complained that interesting workshops are already overcrowded or fully booked. In two studies, this reason was even the most important obstacle (Bachmaier, 2008; Beck et al., 1995), whereas in other studies it appeared to be not as crucial. Yet teachers not only complain about too few courses but also that they are unavailable—both in general and with regard to their PD needs. In some studies, this was teachers' most important reason for not attending PD (Faßmann, 1994; Gagarina & Saldern, 2010; Grafendorfer et al., 2009; Neu, 1999). In addition to the mismatch of the contents with their needs, teachers sometimes perceive the required knowledge level as being inappropriate and, therefore, do not attend the workshops. This is especially true for PD programs with regard to information and computer technology (ICT). There seem to be very heterogeneous levels of knowledge in this context, which may influence PD participation. However, it is not possible to draw any conclusions without knowing the available PD programs at this time.

With regard to barriers due to *teacher characteristics*, teachers reported no need for PD, either because they already had a high level of knowledge or did not see the PD program as having any relevance to their own teaching. The relevance of this barrier, however, differs highly between teachers and studies (see Table 4.1). A wide range in the results exists with regard to the self-assessment of one's own knowledge. In addition, there may be other relevant beliefs. For example, Häuptle et al. (2008) found that teachers who perceived no added value in integrating multimedia into classes also had no intentions of attending PD workshops with such a scope. These teachers perceived participating in ICT workshops and implementing multimedia as only an additional qualification, which does not seem to be attractive for a lot of teachers. Furthermore, in the context of ICT, several teachers perceived other topics as more crucial in the near future and, therefore, preferred workshops concerned with those other topics. But even if a teacher is interested in a certain course, other barriers may be relevant. For example, studies revealed that many teachers assess family commitments as relevant for their PD participation. However, the relevance of this barrier is rated quite differently over the different analyzed studies and sometimes appears rather low (see Table 4.1). One possible explanation may be that they are a barrier for female teachers in particular. For example, Aschenbrenner (2010) reported that five of the six teachers mentioning family-related issues as being important to their PD decisions were female. Furthermore, most studies with a high rate of female participants (more than 50%) reported higher ratings with regard to being hindered

by family commitments (exceptions: Kanwischer et al., 2004; Richter et al., 2013; see also Sect. 5.1 for a more detailed discussion of the association between gender and PD attendance). However, Nittel et al. (2011) also found a low relevance of family commitments, although the surveyed sample consisted of primary school teachers, who are typically female. This contradicts the aforementioned argument. Due to the missing information about the sample in the latter study, further conclusions cannot be drawn.

Various personal reasons for not participating in PD were mentioned. When the high workload is a major obstacle, it is not surprising that some teachers lack energy to engage in further activity outside the school or do not want to spend personal time attending PD. In addition, studies with open-ended questions pointed out that health-related issues may be a reason for not participating in PD. Finally, a high proportion of teachers indicated a preference for other learning activities than formal PD and the belief that they can be up-to-date without PD workshops. Almost half of the surveyed teachers agreed with this aspect (Landert, 1999; Richter et al., 2013). Considering the high relevance, it is surprising that only a few studies considered this aspect in their surveys.

Some potential barriers considered in several studies did not reach the cut-off value of 25% or 0.25, such as:

- complaints from parents because of cancelled classes (20%/0.10; Beck et al., 1995; Wolf et al., 1997),
- difficulties with exemption by the principal or school management (8–19%/0.05–0.20; Diehl et al., 2010; Faßmann, 1994, 1995; Gagarina & Saldern, 2010; Gallasch & Sprenger, 2000; Kanwischer et al., 2004; Neu, 1999; Richter & Schellenbach-Zell, 2016; Richter et al., 2012),
- insufficient information about workshops (2–22%; Aschenbrenner, 2010; Bachmaier, 2008; Diehl et al., 2010; Greve & Höhne, 2009; Kanwischer et al., 2004; Schmidt & Neu, 2004) or a lack of familiarity with the PD program (6–17%; Büsching & Breiter, 2011; Richter & Schellenbach-Zell, 2016),
- no need for PD due to the lack of opportunities to apply the contents (especially in the context of ICT workshops: lack of equipment in school: Büsching & Breiter, 2011; Gallasch & Sprenger, 2000; Gerick, Schaumburg, Kahnert, & Eickelmann, 2014; currently no teaching in the subject: Aschenbrenner, 2010),
- a fear of additional work before and after a workshop (2–23%; Beck et al., 1995; Faßmann, 1994, 1995; Landert, 1999) or getting more responsibilities respectively (1–6%, Kanwischer et al., 2004; Wolf et al., 1997), and
- the need for time to oneself or hobbies (3–13%/0.05; Faßmann, 1994, 1995; Kanwischer et al., 2004; Landert, 1999; Wolf et al., 1997).

Most of these barriers are rated as rather irrelevant or were relevant to only a small number of teachers. However, being hindered by insufficient information about PD courses was named in several qualitative studies (Aschenbrenner, 2010; Bachmaier, 2008; Greve & Höhne, 2009; Kanwischer et al., 2004; Schmidt & Neu, 2004), although the quantitative results revealed a rather low relevance of this aspect. Further studies are needed to determine the information on PD courses and programs

teachers actually receive, how they process the provided information, and what information they need or want to receive. This is especially interesting as communication methods and channels have probably changed over the last couple of years due to the increased use of emails and newsletters as well as web portals.

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Chapter 5
Individual and Context Characteristics Related to Teachers' Professional Development Behavior

Abstract To not only rely on the self-reported reasons for and barriers to teachers' PD participation, the systematic literature review was also concerned with other variables that were examined within the included studies. The results are differentiated into the three categories: Characteristics of teacher (e.g., age, teaching experience, gender, school type, subject, private circumstances, attitudes, beliefs etc.), the PD program (e.g., content, timing and duration, provider, location), and context conditions (e.g., school characteristics). For each category, the investigated variables are presented along with their associations to PD related variables, such as quantitative measures of teachers' PD participation, reasons and barriers for PD attendance, or characteristics of the attended PD workshops. Each category is discussed in more detail and against the background of the previously presented results.

Keywords Teacher professional development · Training participation · Teacher characteristics · School characteristics · Professional development programs · In-service teacher education

Among the reasons that teachers mention or perceive for increasing or decreasing their PD participation, other individual and context characteristics and their associations with teachers' PD behavior are examined within the included studies. This chapter summarizes and discusses these aspects and their associations with teachers' actual PD participation. As in Chaps. 3 and 4, the deductively derived categories "characteristics of teacher", "characteristics of PD program", and "context conditions" (see Sect. 1.3) are used to structure the results. They are presented and discussed in the following sections.

5.1 Characteristics of Teacher

Many of the reviewed studies were concerned with the question of which characteristics of teachers are associated with their PD behavior. The results of the analyzed studies are summarized in Table 5.1. It must be noted that the results are quite contradictory (see, e.g., results regarding teachers' age) or based on only a few studies that do not allow further conclusions on the relevance of teachers' characteristics to their PD behavior.

C. Krille, *Teachers' Participation in Professional Development*,
SpringerBriefs in Education, https://doi.org/10.1007/978-3-030-38844-7_5

Table 5.1 Overview of teachers' characteristics examined in the context of teachers' PD behavior

Variable	Association to PD-related variables[a]	References[b]
Age	*Participation in PD*	
	– Inverse U-shaped association: Younger and older teachers participate less in PD than teachers in the age groups in between	Doedens (2008), Forsa (2017), Kanwischer, Köhler, Oertel, Rhode-Jüchtern, and Uhlemann (2004), MPFS (2003), Wolf, Göbel-Lehnert, and Chroust (1997)
	– Negative association: Younger teachers participate in PD more than older teachers	BITKOM (2011)
	– Positive association: Older teachers participate in PD more than younger teachers	Florian (2008)
	– No association	Gröber and Wilhelm (2006), Schmidt and Neu (2004), Sieve (2015)
	Frequency of PD	
	– Inverse U-shaped association: Younger and older teachers participate less frequently in PD than teachers in the age groups in between (especially with regard to workshops concerning subject content, subject-specific pedagogy, pedagogy and psychology, and general skills)	Richter et al. (2011)
	– Positive association: Older teachers participate in PD more frequently than younger teachers	MPFS (2003)
	– No association	Pietzner, Scheuer, and Daus (2004); regarding school organization, school system, counselling: Richter et al. (2011)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Amount of PD	
	– Inverse U-shaped association: Younger and older teachers spend less time on PD than teachers in the age groups in between	Grafendorfer, Neureiter, and Längauer-Hohengaßner (2009), Wolf et al. (1997)
	Need for PD	
	– Negative association: Younger teachers report a higher need for PD than older teachers	Jäger and Bodensohn (2007)
	Reasons for attending PD	
	– Younger teachers: Instrumentality for career, diversion from daily routine, sent by principal	Faßmann (1994)
	– Older teachers: Convenient PD location	Faßmann (1994)
	– Potential incentives for younger teachers: instrumentality for career	Florian (2008), Keppelmüller et al. (2004)
	monetary incentives, and child care	Florian (2008)
	Barriers to attending PD	
	– Younger teachers: Family commitments, …	Kanwischer et al. (2004), Pietzner et al. (2004), specially between 30 and 45 years old: Keppelmüller et al. (2004)
	always the same speakers, bad reputation of provider, lack of interesting workshops	Faßmann (1994)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	– Older teachers: poor experiences with PD	Pietzner et al. (2004)
	follow-up obligations, poor school climate	Faßmann (1994)
	long distance to PD location	Pennig (2006)
	Willingness to attend PD during vacation	
	– Positive association: Younger teachers are more willing to participate in PD during vacations	Pietzner et al. (2004)
	Characteristics of attended PD workshops	
	– Content: Teachers in different age groups participate in workshops focusing on different topics (e.g., younger teachers: [subject-specific] pedagogy; older teachers: inclusion, performance assessment; both: teaching with multimedia; others in between: communication training)	Forsa (2017)
	Other associations	
	– No association with usage of information channels	Kanwischer et al. (2004)
	– No association with attitude toward PD	Richter and Schellenbach-Zell (2016)
Teaching experience	*Participation in PD*	
	– Inverse U-shaped association: Teachers with little or high experience participate in PD less than medium experienced teachers	Wolf et al. (1997)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	– Positive association: Experienced teachers participate in PD more than teachers with little experience	Gysbers (2008), MPFS (2003)
	– Negative association: Teachers with little experience participate in PD more than more experienced teachers	Faßmann (1995), Richter, Richter, and Marx (2018)
	Frequency of PD	
	– Positive association: Experienced teachers participate in PD more frequently than teachers with little experience	Gysbers (2008)
	– No association	Goldgruber (2012), Wolf et al. (1997)
	Amount of PD	
	– Inverse U-shaped association: Teachers with little or high experience spend more time on PD than medium experienced teachers	Wolf et al. (1997)
	Need for PD	
	– Negative association: Teachers with little experience report a higher need for PD than experienced teachers	Schwetlik (1998)
	Reasons for attending PD	
	– Inexperienced teachers: Qualification within pedagogical psychology and with regard to didactics	Wolf et al. (1997)
	– Medium experienced teachers: Change of professional routine (least important for other experience groups)	Wolf et al. (1997)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	– Highly experienced teachers: Refreshing or extending competence	*Diehl, Krüger, Richter, and Vigerske* (2010)
	Barriers to attending PD	
	– Teachers with little or high experience (inverse U-shaped): family commitments	Wolf et al. (1997)
	– Medium experienced teachers: investment of personal time	Richter and Schellenbach-Zell (2016)
	– Experienced teachers: Problems with substitute classes	Wolf et al. (1997), contradictory: Richter and Schellenbach-Zell (2016)
	workload	Wolf et al. (1997)
	high costs	Richter and Schellenbach-Zell (2016)
Gender	*Participation in PD*	
	– Male teachers participate in PD more than female teachers	BITKOM (2011), Faßmann (1995), Gerick and Eickelmann (2015)
	– Female teachers participate in PD more than male teachers	Grillitsch (2010), Richter et al. (2018), Rüegg (1997)
	– No association	Faßmann (1994), Sieve (2015), Wolf et al. (1997)
	– Inverse U-shaped association between age and PD participation, especially true for female teachers	Wolf et al. (1997)
	Frequency of PD	
	– Female teachers participate in PD more frequently than male teachers	Richter et al. (2011)
	– No association	Wolf et al. (1997)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Amount of PD	
	– Male teachers spend more time on PD than female teachers	Wolf et al. (1997)
	– No association	Grafendorfer et al. (2009)
	– Interaction with children at home: With two or more children, male teachers spend more time on PD than female teachers	Wolf et al. (1997)
	Reasons for attending PD	
	– Female teachers: relief from family commitments, high practical relevance, instrumentality for career	Faßmann (1994)
	…personal interest and enjoyment	Keppelmüller et al. (2004), Wolf et al. (1997)
	…change of professional routine, qualification within pedagogical psychology and didactics	Wolf et al. (1997)
	– Potential incentives for female teachers: Child care, monetary incentives, certificate of attendance	Florian (2008)
	Close PD location	Pietzner et al. (2004)
	Barriers to attending PD	
	– Female teachers: family commitments	Bachmaier (2008), Diehl et al. (2010), Pietzner et al. (2004), Wolf et al. (1997)
	– Male teachers: difficulties finding free time for PD (e.g., due to volunteer work or school-related workload)	Wolf et al. (1997)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	no exemption, organization of substitute classes, high organizational effort within school, overcrowded workshops, comfort	Bachmaier (2008)
	no need for PD	Pietzner et al. (2004)
	Willingness for PD during vacation	
	– Female teachers are more willing to participate in PD during vacation	Keppelmüller et al. (2004), Pietzner et al. (2004)
	Willingness to bear PD costs	
	– Female teachers are more willing to bear PD-related costs	Landert (1999)
	Characteristics of attended PD workshops	
	– Content: Female teachers especially participate in workshops concerning social and educational topics, counselling	Hildebrandt (2008), Rüegg (1997)
	…and didactics	Rüegg (1997)
	There are contradictory results with regard to subject-specific workshops	More women: Hildebrandt (2008), More men: Rüegg (1997)
	– Provider: Female teachers participate in workshops offered by teacher training institutes more than male teachers	Faßmann (1994), Florian (2008)
	Male teachers prefer attending workshops by: Companies	Faßmann (1994)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Universities	Florian (2008)
	– Duration and timing: Female teachers prefer to participate in PD outside school hours and one-time workshops	Rüegg (1997)
	Male teachers prefer periodic workshops or blocked courses	Rüegg (1997)
Personal circumstances	*Participation in PD*	
	– Teachers with partners participate in PD more than single teachers	Faßmann (1995)
	– Teachers with children participate in PD more than childless teachers	Faßmann (1995)
	– No association with partners, children or relatives in household	Faßmann (1994), Prenzel (1995), Wolf et al. (1997)
	Frequency of PD	
	– Teachers with partners participate in PD more frequently than single teachers	Richter et al. (2010, 2011)
Origin	*Participation in PD*	
	– Teachers from Eastern Germany participate in PD more than teachers from Western Germany	Hildebrandt (2008), Hoffmann and Richter (2016), Richter et al. (2018)
	– Differences between regions/federal states	Germany: Hoffmann and Richter (2016), Kammerl, Lorenz, and Endberg (2016), Richter et al. 2013b; Austria: Faßmann (1995); Grillitsch (2010), Switzerland: Landert (1999)
	– No association	Faßmann (1994)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Frequency of PD	
	– Teachers from Eastern Germany participate more frequently in PD than teachers from Western Germany	Richter et al. (2010)
	– Differences between federal states	Hoffmann and Richter (2016), Richter, Kuhl, Reimers, and Pant (2012, 2013b)
	Amount of PD	
	– Differences between federal states	Richter et al. (2012)
	– No differences between Eastern and Western Germany	Brunner et al. (2006)
	Barriers to attending PD	
	– Distance to PD location most relevant in Saxony; no differences for other examined barriers	Pietzner et al. (2004)
	Willingness for PD during vacation	
	– Differences between federal states (especially high willingness in Saxony)	Germany: Pietzner et al. (2004); Switzerland: Landert (1999)
	Willingness to bear PD costs	
	– Differences between cantons	Landert (1999)
	Characteristics of attended PD workshops	
	– Content: Differences between federal states in: most chosen PD contents	Kammerl et al. (2016)
	variety of topics	Richter et al. (2018)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
School type	*Participation in PD*	
	– Teachers for academic-track schools participate in PD less than teachers from other school types	Gerick and Eickelmann (2017), Jäger and Bodensohn (2007), Wolf et al. (1997), exception: Doedens (2008)
	– Teachers from vocational schools participate in PD more often than teachers from other school types	Doedens (2008), Wolf et al. (1997)
	– Teachers from special schools participate in PD more often than teachers from other school types	Richter and Schellenbach-Zell (2016)
	– No association	Germany: Büsching and Breiter (2011), Doedens (2005), Hoffmann and Richter (2016), Richter et al. (2018); Austria: Grillitsch (2010)
	Frequency of PD	
	– No association	Richter (2011), Richter et al. (2010),
	Amount of PD	
	– Teachers from academic-track schools spend more time on PD than teachers from other school types	Germany: Bachmaier, (2008), Wolf et al. (1997); Austria: Grafendorfer et al. (2009), Mayr and Müller (2010)
	– Teachers from vocational schools spend more time on PD than teachers from other school types	Wolf et al. (1997)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	– No association	Richter and Schellenbach-Zell (2016)
	Reasons for attending PD	
	– Teachers from academic-track schools assess the relevance of several reasons for PD attendance lower; teachers from primary schools and vocational school assess them higher than teachers from other school types	Beck, Ullrich, and Schanz (1995), Landert (1999), Wolf et al. (1997)
	– No differences with regard to the relevance of: networking with colleagues and innovations in subjects	Beck et al. (1995), Landert (1999)
	receiving materials for class	Beck et al. (1995)
	– No association	Pietzner et al. (2004)
	– Potential incentives: Child care most important for teachers from primary schools	Florian (2008), Prenzel (1995)
	Barriers to attending PD	
	– No systematic association with school type among all studies, although differences were found, for example:	
	– Important barriers for teachers from special schools: canceling classes and organizing substitute classes	Kanwischer et al. (2004)
	– For teachers from primary schools: PD location	Kanwischer et al. (2004), Landert (1999)
	– For teachers from academic-track schools: workload	Kanwischer et al. (2004), Landert (1999); opposite results: Wolf et al. (1997)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Willingness for PD during vacation	
	– Teachers from primary schools are more willing to participate in PD during vacations than teachers from other school types, especially from lower secondary schools ("Hauptschule")	Keppelmüller et al. (2004), Pietzner et al. (2004)
	Willingness to bear PD costs	
	– Teachers from vocational schools are the least willing to bear PD-related costs	Landert (1999)
	Characteristics of attended PD workshops	
	– Content: Teachers from academic-track schools would rather participate in workshops concerning subject-content and subject-specific pedagogy	Forsa (2017), Gerick and Eickelmann (2017), Hoffmann and Richter (2016), Jäger and Bodensohn, (2007), Richter (2011),Richter et al. (2010), Richter et al. 2013b), Schmidt and Neu (2004)
	performance assessment and differentiation	Richter et al. (2013b), Riedel, Griwatz, Leutert, and Westphal (1994); exception: Forsa (2017)
	– Teachers from other school types (especially from lower secondary schools) would rather participate in workshops concerning didactics as well as pedagogy and psychology	Forsa (2017), Hoffmann and Richter (2016), Jäger and Bodensohn (2007), Richter (2011), Richter, Engelbert, Weirich, and Pant (2013a, b), Riedel et al. (1994), Schmidt and Neu (2004); pattern also true for PD needs: Kast (2010)
	– There are no differences for general workshops such as those concerning school system, teacher licensing, or teacher training	Richter (2011)
	– Provider: Teachers from academic-track schools would rather participate in workshops offered by universities	Florian (2008)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Other associations	
	– The effect of school affiliation length on PD frequency is weaker for teachers from academic-track schools than for teachers from other school types	Richter (2011)
	– Predictors for PD participation differ for teachers from lower secondary schools (especially school-related aspects such as lack of support by principal or colleagues) and academic-track schools (gender, external feedback)	Mayr and Müller (2010)
Subject	*Participation in PD*	
	– Teachers teaching science-related subjects participate in more PD than teachers teaching other subjects (e.g., languages)	BITKOM (2011)
	– No association…	Grillitsch (2010), Sieve (2015)
	… or systematic association recognizable, respectively	Faßmann (1994, 1995)
	Characteristics of attended PD workshops	
	– Provider: Teachers teaching constructional engineering or electrical engineering would rather participate in PD provided by companies than other teachers	Faßmann (1994)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
Teaching load	*Participation in PD*	
	– Inverse U-shaped association: Teachers with a small or high teaching load participate in PD less than teachers with a medium teaching load	Faßmann (1994, 1995)
	– No association	Richter et al. (2018), Wolf et al. (1997)
	– Positive association: Teachers with a higher teaching load for a subject participate in PD more than teachers with a smaller teaching load	Doedens (2005, 2008), Kanwischer et al. (2004)
	Frequency in PD	
	– Positive associations: Teachers with higher teaching load for a subject participate in PD more frequently than teachers with a lower teaching load	Pietzner et al. (2004)
	Amount of PD	
	– Positive association: Teachers with a higher teaching load for a subject spend more time on PD than teachers with a lower teaching load (especially in schools at the higher secondary level)	Schmidt and Neu (2004)
	Other associations	
	– No association with attitude toward PD	Richter and Schellenbach-Zell (2016)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
Additional professional responsibilities	*Participation in PD*	
	– Positive association: Teachers with additional professional responsibilities participate in PD more than other teachers	Büsching and Breiter (2011), Wolf et al. (1997)
	Frequency in PD	
	– Positive association: Teachers with additional professional responsibilities participate in PD more frequently than other teachers	Richter et al. (2011)
	Amount of PD	
	– Inverse U-shaped association: Teachers with two additional professional responsibilities spend more time on PD than teachers with fewer or more professional responsibilities	Wolf et al. (1997)
	Reasons for attending PD	
	– Teachers with additional professional responsibilities participate in PD to learn more about organizational aspects in particular, other teachers focus on methods and didactics	Wolf et al. (1997)
	Barriers to attending PD	
	– Teachers with additional professional responsibilities rate problems with finding spare time for PD, organizing substitute classes, and a high workload as more important than other teachers	Wolf et al. (1997)
	Characteristics of attended PD workshops	
	– Content: Teachers with additional responsibilities in counselling would rather participate in workshops concerning social topics	Kast (2010)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
Study and qualification	*Participation in PD*	
	– Teachers teaching the subject they studied participate in PD more than teachers teaching outside their subject area	Doedens (2005, 2008)
	– No association with major of study…	Porsch and Wendt (2015)
	… or teacher training	Richter et al. (2018); see also Hoffmann and Richter (2016)
	Frequency of PD	
	– Positive association with number of classes taught within the subject teachers have studied	Keppelmüller et al. (2004)
	Amount of PD	
	– Negative association with number of studied subjects	Schmidt and Neu (2004)
	Barriers to attending PD	
	– Teachers with teacher training consider spending personal time for PD more relevant than lateral entrants	Richter and Schellenbach-Zell (2016)
	Characteristics of attended PD workshops	
	– Content: Teachers with teacher training in their taught subject participate in PD concerning: subject contents more often than teachers teaching outside their subject area	Geest-Rack (2013), Hoffmann and Richter (2016); especially true for inexperienced teachers: Porsch and Wendt (2015); partially opposite results: Porsch (2015), Porsch and Wendt (2016)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	subject-specific aspects (subject-specific pedagogy, educational standards, curricula), and individual assessment/promotion more often than teachers teaching outside their subject area	Porsch (2015), Porsch and Wendt (2016), Richter et al. (2013b)
	– Teachers teaching outside their subject area would rather attend workshops concerning: Superordinate topics within the subject	Geest-Rack (2013)
	inclusion	Hoffmann and Richter (2016); for mathematics teachers also Richter et al. (2013b)
	– Lateral entrants participate in PD regarding class design more than teachers with teacher training in their subject	Hoffmann and Richter (2016)
	Other associations	
	– No association with attitude toward PD	Richter and Schellenbach-Zell (2016)
Secondary employment	*Participation in PD*	
	– Teachers with secondary employment participate in PD more than other teachers	Faßmann (1995)
	– Teachers with secondary employment participate as frequently as other teachers	Faßmann (1994)
	Characteristics of attended PD workshops	
	– Provider: Teachers with secondary employment participate in PD provided by companies and universities more than in those offered by teacher training institutes	Faßmann (1994)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
Burnout	*Participation in PD*	
	– No association with burnout and/or "inner resignation"	Lauck (2003)
	Amount of PD	
	– No association with burnout and/or "inner resignation"	Lauck (2003)
	Barriers to attending PD	
	– Teachers suffering from burnout (without "inner resignation") rate workload and organizational issues as more relevant than teachers without burnout and/or "inner resignation"; teachers with burnout and "inner resignation" assess the lack of adequate workshops as crucial	Lauck (2003)
Achievement goals	*Frequency of PD*	
	– Positive association with learning goals	Nitsche, Dickhäuser, Dresel, and Fasching (2013a, b)
	– Contradictory results with regard to performance goals: positive association with approach goals and negative association with avoidance goals	Nitsche et al. (2013a)
	no association	Nitsche et al. (2013b)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	– Contradictory results with regard to work avoidance goals: negative association	Nitsche et al. (2013b)
	no association	Nitsche et al. (2013a)
	Characteristics of attended PD workshops	
	– Content: Teachers would rather participate in workshops that match their learning goal facets	Nitsche et al. (2013a)
Subject-specific interest	*Frequency of PD*	
	– Positive association with teachers' personal interest in their subject	Peschel and Koch (2014)
	– No association with pursuing a subject-related hobby	Peschel and Koch (2014)
Self-efficacy	*Participation in PD*	
	– Positive association	Mammes (2008), Richter et al. (2013a), Sieve (2015); also true for sustainable PD: Mayr and Müller (2010)
	Characteristics of attended PD workshops	
	– Content: Teachers with high self-efficacy participate in different workshops with diverse topics	Richter et al. (2013a)
Beliefs about teaching	*Participation in PD*	
	– Teachers who prefer constructive teaching methods would rather participate in "sustainable" PD	Mayr and Müller (2010)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Frequency of PD	
	– Positive association with constructive orientations	Richter et al. (2010)
	– No association with constructive or traditional orientations	Mammes (2008)
	Amount of PD	
	– Negative association with traditional orientations	Mayr and Müller (2010)
	Characteristics of attended PD workshops	
	– Content: Teachers with constructive orientations would rather participate in PD concerning teaching strategies (no association for subject content)	Mammes (2008)
Work engagement	*Frequency of PD*	
	– Positive association	Richter et al. (2010, 2011)
Attitude toward PD	*Participation in PD*	
	– No association	Schmidt and Neu (2004), Wolf et al. (1997)
	Frequency of PD	
	– No association	Nitsche et al. (2013b)
	Amount of PD	
	– No association with attitude regarding necessity of PD	Schmidt and Neu (2004)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
Relevance of reasons for PD	*Participation in PD*	
	– Positive association	Wolf et al. (1997)
Relevance of barriers to PD	*Participation in PD*	
	– Negative association with: disengagement and perceived lack of PD quality	Richter et al. (2018)
	worries regarding PD and avoidance of additional effort	Wolf et al. (1997)
	– No association	Richter et al. (2018), Schmidt and Neu (2004), Wolf et al. (1997)
	Frequency of PD	
	– No association	Landert (1999)
Willingness to bear PD costs	*Participation in PD*	
	– No association	Gagarina and Saldern, (2010); also true for sustainable PD: Mayr and Müller (2010)
	Frequency of PD	
	– No association	Landert (1999)
	Amount of PD	
	– Positive association	Mayr and Müller (2010)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	Other associations	
	– Positive association between having paid attendance fee for the last workshop and the motivation to attend that course	Landert (1999)
Other variables	*Participation in PD*	
	– No association with status as civil servant	Faßmann (1994, 1995)
	– No association with number of taught subjects	Schmidt and Neu (2004)
	– No association with mentioned PD need (teachers attend only some of the workshops they wished for before)	Huppert and Abs (2008)
	– Positive association with previous PD experiences: teachers with positive experiences participate in PD more than teachers with negative experiences	Schmidt and Neu (2004)
	– Negative association with professional experiences before teaching: Teachers with more experience before teaching participate in PD less than teachers without such experiences	Faßmann (1995)
	– Participation with colleagues: Teachers participate by themselves more often than with colleagues	Goldgruber (2012)
	Teachers participate as much with and without colleagues	Jäger and Bodensohn (2007)
	Frequency in PD	
	– Teachers with status as civil servant participate in PD more than other teachers	Faßmann (1995)

(continued)

Table 5.1 (continued)

Variable	Association to PD-related variables[a]	References[b]
	– No association with individual professional result	Mammes (2008)
	– No association with job satisfaction or if teachers would re-choose the profession	Wolf et al. (1997)
	Amount of PD	
	– Teachers with "role model" profile (adaptive prerequisites regarding knowledge, constructive beliefs, teaching enthusiasm, but low in self-regulation) spend more time on PD than teachers with other, partly maladaptive profiles	Kunter and Klusmann (2010)
	Characteristics of attended PD workshops	
	– Content: No association with denomination of religion teachers	Feige and Tzscheetzsch (2005)
	No association with personal professional result	Mammes (2008)

Notes [a]Participation in PD = participation in PD in general (yes/no; also "participation rate"); Frequency of PD = number of attended PD workshops; Amount of PD = number of hours or days spent on PD
[b]Italics indicate results from qualitative analyses

Age and Teaching Experience

One of the often-examined attributes is teachers' age and teaching experience. Considering the high correlation between both variables (e.g., $r = 0.90$ in Richter et al., 2011), the results for both variables are quite similar, as expected. With regard to the participation rate, frequency, and amount of PD, an inverse U-shaped association was repeatedly found. In other words, young and inexperienced teachers as well as older and very experienced teachers participate in PD the least, while teachers between these groups attend PD the most. Results from some qualitative studies suggest that there are different rationales for the low participation of the "fringe groups". Young teachers reported that they had just entered the teaching profession and still had high knowledge from their pre-service teacher training; therefore, they had no PD needs. Alternatively they might be overwhelmed by the job (e.g., summary of first and second phase of teaching profession in Richter et al., 2011) and need time to adjust to it (Faßmann, 1994; Kanwischer et al., 2004). Older teachers, however, mentioned that they were not considered for PD workshops because of their age or because they wanted to yield to younger teachers (Bachmaier, 2008; Faßmann, 1994).

Considering obstacles to PD participation, only a few single studies focused on different aspects, which does not allow for well-founded conclusions. However, the results from these different studies (see Table 5.1) are summarized as follows: Young teachers in particular cannot attend PD courses due to family commitments—a burden that becomes relevant again for some older teachers (roughly inverse U-shaped in Wolf et al., 1997; high dispersion for older teachers, Kanwischer et al., 2004). Younger teachers are probably more concerned with caring for their children, while some older teachers may need to take care of other relatives. Furthermore, for older teachers the high workload is an important obstacle for PD participation. This is not only true for the already existing workload, but also includes the concern of getting more responsibilities as a consequence of PD workshops. Accordingly, they are less willing to participate in PD during vacations than their younger colleagues. Maybe they need this time to either "recover" or to handle loose ends. Furthermore, both young and older teachers criticized existing PD programs. Although criticism from older (and therefore mostly more experienced) teachers is probably based on their former experiences with PD, it is not clear how younger teachers developed their opinions, as they could not yet have gathered that many insights into different workshops (Faßmann, 1994). Overall, it becomes obvious that it is not enough to consider only teachers' age or experience; one must take a deeper look into the different reasons for (not) participating in PD when examining teachers' PD behavior.

Accordingly, Richter et al. (2011) proposed interpreting such results in light of career stage models. However, in their study, the authors only compared the participation rate with the model and did not examine the rationale behind their hypotheses. Nevertheless, they used a statistical approach that allowed them to examine nonlinear relationships that other studies did not take into account. In contrast, most studies have used linear analyses (e.g., Goldgruber, 2012; Pietzner et al., 2004) or compared young and older teachers (e.g., Sieve, 2015), which may be a reason why these studies did not find any or only small associations with age or teaching experiences.

Also, when comparing teachers with a low and high amount of PD participation (e.g., Gröber & Wilhelm, 2006; Schmidt & Neu, 2004), such associations cannot be identified. Although middle-aged teachers in particular should be included in the "active" group, the group of less active teachers should contain younger and older persons. When comparing the means, there should be no differences, and only the dispersions within both groups could give some further hints. However, the standard deviations are often not reported in the included studies and cannot be used for further analyses. There may also be content-related reasons for the missing associations. Richter et al. (2011) showed that the curvilinear relationship existed only for certain PD topics (subject content, subject-specific pedagogy, pedagogy and psychology, and general skills). For other contents (school organization and system as well as counselling), they found no relationship as only a few teachers, irrespective of their age, attend these courses.

Other studies have found a negative association with age or teaching experiences. However, the effects reported by Faßmann (1995) and Richter et al. (2018) are, although statistically significant, rather small and therefore barely meaningful. The other study with a negative association (BITKOM, 2011) is concerned with PD workshops on multimedia. In this context, younger teachers seem to be more willing to attend PD than their older colleagues. Two studies that reported a positive association between age/teaching experience and the number of attended workshops were set in the same context, but were concerned with PD courses that focused on basics in dealing with computers (Gysbers, 2008; MPFS, 2003). It can be assumed that younger teachers grew up with computers and are more familiar with them whereas older teachers have a higher need for PD in this area (MPFS, 2003). Nevertheless, the results reveal that, overall, there is—at least for the most popular PD topics—an inverse U-shaped association between age and teaching experiences, respectively, and PD attendance.

As with the already-mentioned barriers, there are differences with regard to the reasons for attending PD between the different age groups. Older teachers tend to emphasize the relevance of the PD location. Maybe they consider it a chance to escape their school in which they already spend a lot of time. In contrast, younger/less experienced teachers see instrumentality to their career as an incentive for attending PD. In addition, they tend to emphasize the need to build up teaching-related knowledge that is hardly elaborated yet and perhaps get helpful input on that. Once teachers have some experience and are more versed in teaching, they seem to perceive PD as a measure to get inspiration to change their teaching routines.

Gender

With regard to teachers' gender, there are contradictory results. Some studies revealed that men participate more in PD while other studies reported the opposite. Interestingly, two of the studies that reported higher PD activity among men were in the context of multimedia usage (BITKOM, 2011; Gerick & Eickelmann, 2015). A third study only examined teachers from vocational schools (Faßmann, 1995), but the reported effect was rather small. In accordance with this result, a previous study by

the author (Faßmann, 1994) did not find any association with gender. When surveying teachers from different schools and without narrowing the PD topics (Richter et al., 2018; Rüegg, 1997), the results indicate that women participate in PD more than men, although the reported effect from Richter (2011) was also rather small. In contrast, Wolf et al. (1997) reported that the inverse U-shaped association between age and PD participation can be found especially for female teachers and that the effect of gender on PD attendance varies depending on the number of children in the household. This finding fits very well the results from various studies that family commitments are particularly relevant for women as a barrier for PD participation and that being relieved from these commitments is a reason for them to participate in PD. In addition, the preference for nearby PD locations as well as one-time workshops (that do not require a long-term commitment) could be associated with women's high family responsibilities. Results from the qualitative study by Diehl et al. (2010) also point in this direction. In contrast, men tend to participate in periodic workshops, which may explain why Wolf et al. (1997) found that male teachers spend more time on PD, although there was no difference between women and men with regard to the number of attended PD courses. However, considering that family commitments seem to have such an influence on female teachers' PD behavior, it is surprising that they tend to participate in workshops more in the afternoon and are more willing to participate during vacation time than their male colleagues. One could conclude that PD is more attractive to women. This may be also recognizable in the fact that women usually rate pre-defined reasons for PD attendance as being more relevant than men do, while men perceive most barriers as being more relevant than women do. Furthermore, women are more willing to invest time beyond school hours and to bear the PD costs.

Another difference with regard to gender refers to the choice of PD topics examined in a few studies: Women prefer courses on pedagogy and psychology and perceive an enhancement in these knowledge areas as a reason to participate in PD more than men. Similarly, women more often choose workshops provided by teacher training institutes (while men prefer courses by companies and universities) that may be more suited to pedagogy and teaching. However, there are rather contradictory results for PD courses on subject content. Faßmann (1994) concludes that the effect of gender is rather an effect of the school subject as male teachers often teach technical topics that may be more focused on in workshops offered by companies.

Personal Circumstances

With regard to personal circumstances, most studies show that teachers with partners are more active in PD than those without partners. Wolf et al. (1997) examined whether married teachers attend more PD workshops, but could not find any differences. Considering the high relevance of family commitments, it is surprising that only a few studies have investigated if and to what extent children in the household have an influence on teachers' PD behavior. Against the background of the abovementioned results, one would expect that teachers with children participate less in PD. However, usually no effect or the opposite effect has been found.

Origin

When examining German teachers' origin and its relevance to their PD activity, studies repeatedly reported that teachers from Eastern Germany participate in PD more than teachers from Western Germany (e.g., Richter, 2016, for such a conclusion). Comparisons of teachers' participation in the different federal states, however, suggest that this is probably too rough a differentiation (see also Table A.2 in the Appendix). They reveal that teachers from Thuringia and Brandenburg are especially more active in PD, while the results for teachers from Saxony-Anhalt and Mecklenburg-West Pomerania vary, and teachers from Saxony usually range in the middle compared to all other federal states (Hoffmann & Richter, 2016; Kammerl et al., 2016; Richter et al., 2012, 2013b). With regard to Western Germany, the studies also showed that teachers from Hamburg often participate in PD while those from Baden-Wuerttemberg and Rhineland-Palatinate are less active in PD. One possible explanation for these differences may be that regulations regarding PD obligations differ between the German states (see Sect. 1.4 and Table A.2). However, these regulations apparently have not had the expected effect (Hoffmann & Richter, 2016; Mayr & Müller, 2010; Richter, 2016; Richter et al., 2012; see also italic printed federal states in Table A.2). Although Bavarian teachers are supposed to participate in PD rather frequently, they rank in the middle compared to the other states with regard to their PD participation. In contrast, there are no obligations for teachers in Thuringia, but the teachers attend PD rather often. However, the studies' results reveal that it is more crucial which dependent variable is chosen (participation rate, frequency, or amount of PD) as even within the same study, the ranking order of the states differs depending on the focused outcome variable (e.g., Bavaria: first place for participation in PD versus seventh place for amount of PD in Richter et al., 2012; see Table A.2). The different focuses of the examined PD topics may also influence the results (e.g., multimedia in Kammerl et al., 2016 versus no certain focus in other studies). Overall, there are differences between the different German federal states with regard to their teachers' PD behavior and associated variables but more studies on the actual reasons are needed in future. The included studies from Austria and Switzerland also found differences between teachers from different regions. However, the small number of existing studies does not allow any comprehensive conclusions yet (see also Richter, 2016).

School Type

Another often-examined characteristic in the context of teachers' PD behavior is the school type,[1] but no consistent results were found for this aspect. A large number of studies found no differences between teachers in different school tracks. The only result reported among the different studies is that teachers from vocational schools participate relatively often in PD compared to other teachers. Also, it does not seem

[1] School type is considered as a characteristic of the teacher (instead of the school context) as the teachers choose which kind of school to teach in and follow different initial teacher training. Presumably, individual variables and processes influence this decision.

that teachers from academic-track schools attend PD the least. However, when analyzing the studies that compare academic-track school teachers with other teachers, the differences do not become significant (Hoffmann & Richter, 2016; Richter et al., 2010, 2011, 2018). Therefore, it seems insufficient to focus only on quantitative measures when examining the differences between teachers from different school types. For example, the taught subject (chemistry teachers from academic- and intermediate-track schools participated more often than other teachers in Pietzner et al., 2004) and its importance within each school type (e.g., in terms of how often it is offered) may be a conceivable variable that moderates possible associations. However, other variables, such as gender (see, e.g., high proportion of female teachers in primary schools) should also be kept in mind and controlled for. Furthermore, the analysis of rank orders is questionable as comparable participation rates may lead to different ranks in different studies (e.g., for primary school: 83% corresponds with the third place in Jäger and Bodensohn, 2007, versus 88% corresponding with first place in Keppelmüller et al., 2004). In addition, it is important to consider the available PD programs for teachers in different school types. For example, Keppelmüller et al. (2004) stated that there are barely any workshops for teachers from special schools or vocational schools and that they have fewer possibilities to attend (school-specific) PD.

There do not seem to be any systematic differences between teachers from different school types with regard to the reasons for and barriers to their PD attendance, and it is easier to find similarities than differences between them. Results, such as that child care could enhance PD participation for primary school teachers or that they are more willing to attend PD during vacation, seem to confirm the problem of confounded results due to the high proportion of female teachers (see previous discussion on gender). The most consistent results can be found with regard to the contents of the attended PD workshops: Teachers from academic-track schools tend to participate in workshops on subject content or subject-specific pedagogy as well as performance assessment and differentiation (which is probably also subject specific—at least to some extent). Assuming that universities provide primarily subject-related courses, it is not surprising that teachers from academic-track schools prefer this kind of workshops in particular. Other teachers, most notably those from lower secondary schools, are more interested in pedagogy and psychology. Again, for topics concerning school in general or teacher licensing/training there is a rather low participation rate regardless of the school types in which teachers teach. Finally, there is evidence that there are differences with regard to predictors for PD behavior of teachers from different school tracks. The results suggest that school characteristics are less predictive for teachers from academic-track schools than for those from other school types. Why these differences exist cannot yet be clarified, and more research is needed to understand the underlying processes and reasons for the few differences that can be found between teachers from different school types.

Subject

When comparing teachers teaching different subjects, there are hardly any (systematic) results with regard to PD behavior. The BITKOM study (2011) is an exception;

it revealed that mathematics and science teachers in particular attend PD workshops on multimedia usage. A possible explanation may be that these teachers already have a higher interest in technology and multimedia and, therefore, attend courses in this context more often. However, this assumption cannot be proved with the results of the analyzed studies and needs further research. Another finding is that teachers of technical subjects would rather participate in PD courses provided by companies than other teachers. Again, this might be a consequence of a PD program lacking in this subject area when considering other providers. Overall, most studies have reported a participation rate of about 70% or 80%, regardless of the subject area (see also Richter, 2016). Only for religion teachers does the attendance rate seem to be smaller (about 50%; Doedens, 2005, 2008). Nevertheless, the studies are hard to compare due to, for example, the different time periods to which they refer (e.g., last school year versus last five years).

Teaching Load

At first glance, one might expect that teachers with a high teaching load participate less in PD because of their higher workload. However, most studies have reported a positive association between the number of classes a teacher has to teach and their PD activity. It can be assumed that the increased teaching load leads to a greater PD need as well as to more possibilities for applying new learned strategies, which increases the cost-benefit ratio. When considering the overall teaching load per week, the relationship with teachers' PD participation is more inverse U-shaped than linear. It can be assumed that the high workload becomes more salient with a very high teaching load as a barrier to PD attendance as those teachers have limited time for participating in PD courses. In contrast, teachers with lighter teaching loads may not perceive any need for PD. Maybe other aspects—such that cause the teacher to teach only a small number of classes in the first place—are relevant. This would also match results from Faßmann (1994), revealing that the teaching load is related to the teachers' current contract as well as their age/teaching experience.

Additional Professional Responsibilities

In addition to the teaching, some teachers take on additional professional responsibilities in their schools. The results of the reviewed studies revealed a positive association between such responsibilities and PD activity. In other words, the more tasks teachers take on, the more involved in PD they are. Again, it can be assumed that there are increased PD needs due to the different kinds of responsibilities. This is also in accordance with the higher relevance of learning something about organizational aspects as a reason for PD, and that counselling teachers in particular attend PD courses on social topics. However, Richter et al. (2011) pointed out that their positive correlation is rather small. One possible reason for this could be that the time spent on PD decreases when a teacher has more than two additional professional responsibilities (Wolf et al., 1997). Here, the workload is probably too high to have enough time to attend PD courses as well.

Study and Qualification

With regard to the initial studies and qualification, it does not seem to be relevant for PD behavior if a teacher completed an initial teacher training or works as a lateral entrant. At least for primary school teachers, it is also irrelevant if the major was in the taught subject or in a similar subject. Only for religion teachers does studying a specific subject (i.e., religion) seem to matter (Doedens, 2005, 2008): Teachers who teach religion without having studied it before attend less PD than those who studied religion.

With regard to PD contents, teachers with subject-specific initial training prefer workshops on subject contents relevant for their classes and subject-specific pedagogy rather than teachers who teach outside their subject area. The latter ones would rather attend courses concerned with more general subject contents or on pedagogy and psychology (e.g., inclusion). These results are counterintuitive insofar as one would assume that teachers who did not study a subject have an interest in enhancing their knowledge in the subject they have to teach. The fact that teachers primarily attend PD workshops in the field they studied before and they are interested in is discussed as "inclination hypothesis" (Richter, 2013). Intuitively, the results showing that teachers without an initial teacher training participate in PD workshops on teaching strategies make more sense as their education probably focused on the subject content but not on how to teach it to others (subject-specific pedagogy). To explain the negative association between the number of studied subjects and the amount of PD, more research is necessary; it cannot be clarified on the basis of the currently available data. However, Schmidt and Neu (2004) stated that the detected correlation is rather small.

Secondary Employment

The effect that secondary employment has on teachers' PD behavior was only examined in Faßmann's (1994, 1995) studies, which focused on vocational school teachers. The results of both studies are contradictory, but there seems to be no negative effect of secondary employment regarding PD activity. The preference of teachers with secondary employment for workshops provided by companies and universities may be explained as follows: They focus on PD with regard to not only their teaching profession, but also their second occupation. However, the number of teachers with secondary employment is probably rather small (about a third of the examined vocational school teachers in Faßmann, 1994, 1995), meaning possible effects apply for only a few teachers. Further research is needed to investigate how many teachers actually hold down secondary employment and the influences it has on their professional behavior.

Burnout

With teachers' declaration of their high workload as one of the main reasons for not participating in PD, it is interesting to examine if exhaustion or disorders such as burnout are associated with PD activity (for the relevance of burnout within the teaching profession see, e.g., Klusmann, Kunter, Trautwein, Lüdtke, & Baumert, 2008). However, only one study examined this relation and only a total of 36 teachers were affected. It seems reasonable that teachers with burnout symptoms perceive

their daily workload as an important obstacle for PD attendance. However, it does not influence the PD activity of teachers with burnout syndrome.

Achievement Goals

Several studies examined the associations between PD behavior and different motivation-related variables. Unfortunately, they were mainly single studies that involved a particular construct. With regard to achievement goals, the existing studies indicated that learning goals are positively associated with the number of attended PD workshops—that is, the more teachers are motivated by their desire to improve their teaching skills, the more they participate in PD. In addition, they tend to participate in workshops with topics that fit the highly self-rated facets of learning goals (e.g., higher proportion of pedagogical topics when highly motivated to increase pedagogical[-content] knowledge). However, there are no consistent results on the other types of achievement goals, which indicates the need for further research to learn more about the relevance of achievement goals within the PD process.

Subject-specific Interest

Against the background that personal interest in the PD topic is an important reason to attend PD (Chap. 3), one may expect that interest in the subject is positively related to PD activity. Accordingly, this positive relationship is reported by the existing study. However, a physics-related hobby is not a suitable predictor for the number of physics-related PD workshops attended, although this seems to be a reasonable indicator for someone's personal interest. Overall, only one study (Peschel & Koch, 2014) investigated the role of personal interest in the taught subject and PD activity. It focuses on teachers of only one subject (physics). Therefore, more research is needed to understand the role of (subject-specific) interest within the PD process.

Self-efficacy

Self-efficacy, another motivational construct, is also positively associated with teachers' PD activity. Teachers with high self-reported self-efficacy or self-rating of their own knowledge about teaching strategies not only participate more in PD, but also choose more "sustainable" PD programs (e.g., comprehensive qualification programs, network meetings, individual research; Mayr & Müller, 2010). Furthermore, teachers with high self-efficacy have a broader scope with regard to the PD contents they choose than teachers with lower self-efficacy. This again reflects the previously mentioned inclination hypothesis, as teachers seem to attend courses in content areas they think they are good at. Against this background, it would be interesting how teachers can be motivated to also participate in PD workshops concerning new developments in the context of teaching or topics in which the teachers have low self-efficacy or only limited knowledge.

Beliefs About Teaching

With regard to teachers' beliefs about teaching, studies have revealed that constructive orientations and the use of respective methods are positively associated with PD participation, whereas traditional orientations are negatively related. This seems to

be especially true for sustainable PD programs and probably for PD workshops on (subject-specific) pedagogy as well. In other words, if teachers do not focus exclusively on passing on knowledge to their students, they are more likely to attend PD workshops on teaching. However, it is not clear if teachers apply their beliefs about teaching to their own learning (and want to construct sustainable knowledge instead of "receiving" knowledge) or if they perceive PD workshops as a tool to design constructive classes better. In accordance with the latter explanation, Häuptle, Florian, and Reinmann (2008) reported that teachers who believe that using multimedia in their classes does not add any value or improves their teaching or students' learning are not interested in PD workshops on multimedia.

Work Engagement

The results also suggest that high work engagement is positively associated with the number of attended PD workshops. In other words, teachers who consider the teaching profession as important to themselves, want to proceed in their career, and are willing to put effort into it also participate in PD courses more. This makes sense as formal PD can be seen as a tool to perform well on the job. However, according to Richter et al. (2011) the detected association is rather small.

Attitude Toward PD

When comparing the included studies with regard to teachers' attitudes toward PD, several operationalizations were used and showed different associations with teachers' PD activity. For example, Nitsche et al. (2013b) used a rather broad definition that includes the perceived utility of PD as well as the willingness to attend PD during vacation. They do not find any association with the frequency of PD participation. The same applies for other studies using assessments of the necessity or utility of PD. In contrast, Wolf et al. (1997) reported significant differences between teachers who attended or did not attend any PD courses within the last two years with regard to two attitude scales. However, the difference between means seems so small that it is questionable if there is any meaningful effect (see p. 131; effect sizes are not reported). Overall, operationalizing "attitude" rather broadly and with regard to teacher PD in general does not seem to be suitable for predicting their PD behavior. However, Hofmann's (2015) results indicated that measures adapted to certain PD workshops can reveal the impact of attitudes on teachers' PD activity. Specifically, teachers who were convinced that working with video tapes during the workshop would be useful for them participated in the examined PD program more regularly. Interestingly, there was no effect when teachers assessed the utility of the workshop format for their students.

Relevance of Reasons for and Barriers to PD

Surprisingly, only a few studies examined if the relevance of different reasons and barriers is actually associated with teachers' attendance in PD. They revealed that teachers who participate in PD more noted several reasons for PD being more relevant than their less active colleagues. However, the differences are rather small. With regard to the barriers to PD participation, some studies found no association. Only

general disengagement in formal PD, bad experiences with workshops, avoidance of additional effort, and worries regarding a PD workshop were negatively related with teachers' PD participation. Unfortunately, these results are only based on studies with predefined reasons for (not) attending PD. Therefore, it cannot be clarified if there are other reasons that actually influence teachers' participation behavior.

Willingness to Bear PD Costs

When analyzing the results with regard to teachers' willingness to bear PD costs, there are mostly no associations with their PD behavior. There is only a positive relation with the amount of PD namely, the more teachers are willing to pay for PD workshops, the more time they spend on PD in a certain period of time. This finding seems plausible as it can be assumed that longer workshops are more expensive and, if a teacher wants to attend it, there may be the need to personally bear the costs—especially in the light of schools' limited budgets. Although there is probably no direct relationship between the willingness to pay for PD and spending more time on it, both variables may be indicators for another variable, such as teachers' training motivation. Indeed, Landert (1999) reported a positive correlation between paying the attendance fee of the last workshop and the motivation to participate in that particular course.

Other Variables

Several additional variables were considered in the analyzed studies, such as status as a civil servant, number of taught subjects, religion teachers' denomination, and (variables associated with) teachers' job satisfaction. However, the named variables were not found to be associated with teachers' PD behavior. Surprisingly, this is also true for reported PD needs: Teachers only partly attend the workshops they wished for before. Significant results exist for at least some variables. For example, previous experiences with PD are related with actual participation in PD; teachers with negative experiences tend to attend fewer courses than teachers with positive experiences. In addition, professional experience before teaching is negatively associated with PD attendance, meaning the more teachers worked in a different profession before becoming a teacher the less they participate in formal PD. However, this correlation is probably only relevant for a particular sample of teachers as the results derive from a study examining vocational school teachers in Austria (Faßmann, 1995). The author reported that teachers have to have work experience before they can teach in vocational schools. Therefore, it would be interesting to see if the associations are also true for teachers in other countries (and for currently active teachers as that study was conducted in the 1990s). Considering that in Germany vocational school teachers also often complete other professional qualifications (for apprenticeship before study see, e.g., Fritsch et al., 2015), it would be interesting to take a closer look at the relevance of previous work experiences and qualifications.

Finally, there are inconsistent results in terms of whether teachers participate in PD workshops by themselves or together with colleagues. Aldorf's (2016) results suggest that participating with colleagues makes PD more attractive, but it is probably

difficult to realize considering the problems of cancelling classes and organizing substitute classes.

Overall, most studies only surveyed one or two particular teacher characteristics and analyzed their individual associations with PD activity, but not the interaction of these constructs (Kunter & Klusmann, 2010). In contrast, Kunter and Klusmann (2010) used latent profile analyses to examine if different individual profiles of several constructs are able to predict teachers' PD activity. They identified profiles positively associated with the number of attended PD workshops. Therefore, more studies using a range of theoretically well-chosen variables are needed in the future to get deeper insights into the effect and interactions of different teacher characteristics on their PD behavior.

5.2 Characteristics of Professional Development Program

The characteristics of PD workshops are an obvious and regularly examined aspect in the research on PD behavior. Within the reviewed studies, data concerning different characteristics of PD programs were collected, including content, learning activities, provider, duration and timing, as well as (distance to) location. The results are summarized in Table 5.2.

PD Content

With regard to the PD content, teachers often choose workshops focusing on subject content and (subject-specific) pedagogy whereas other topics, such as teaching with multimedia (exception: Kanwischer et al., 2004[2]) and school organization or development, play a subordinate role. In the context of multimedia usage in classrooms, teachers attend primarily subject-specific courses, which is consistent with the previously discussed results. It can be assumed that these kinds of workshops were included in the category "subject-specific pedagogy" in studies that did not consider workshops on teaching with multimedia explicitly, as the courses cover possible strategies to teach subject contents. However, the way that reported PD contents were differentiated and the "resolution" of these classifications are quite different among studies (e.g., very detailed in Richter et al., 2012, 2013b, versus rather roughly in Richter et al., 2010), making it difficult to summarize the studies and draw conclusions among them. Furthermore, rather broad categories may be problematic if they are presented to teachers in a questionnaire as closed-ended questions (e.g., Hildebrandt, 2008; Kirchner, 2016; Mammes, 2008) as teachers may have trouble allocating their attended workshops to these categories. Interestingly, teachers' preferences differ among studies depending on the question format. When teachers were asked to list their last attended PD workshops, which were subsequently categorized by the authors (e.g., Richter et al., 2010, 2011, 2012, 2013b), workshops on

[2] In addition, Porsch and Wendt (2015) report a high attendance rate of 70% in workshops concerning multimedia. However, analyzing the more detailed results, this must be a typographical error and is supposedly a rate of about 7%.

Table 5.2 Overview of characteristics of PD programs examined in the context of teachers' PD behavior

Variable	Association to PD related variables[a]	References
Content	*Participation in PD*	
	– Teachers participate in workshops focusing especially on subject content[b] and (subject-specific) pedagogy	Drossel, Wendt, Schmitz, and Eickelmann (2012), Forsa (2017), Hildebrandt (2008), Hoffmann and Richter (2016), Kanwischer et al. (2004), Kirschner (2013). Mammes (2008), Porsch and Wendt (2015, 2016), Prenzel (1995), Richter and Schellenbach-Zell (2016), Richter et al. (2012, 2013a, b)
	Less favored workshops focus on: using multimedia in classes	Drossel et al. (2012), Hoffmann and Richter (2016), Porsch and Wendt (2015, 2016), Richter et al. (2012); Richter and Schellenbach-Zell (2016), Richter et al. (2013b); *exception:* Kanwischer et al. (2004)
	school organization/development	Hildebrandt (2008), Mammes (2008), Richter et al. (2012, 2013b)
	– In the context of PD regarding multimedia, subject-related workshops are especially chosen	Gerick and Eickelmann (2015, 2017)
	Amount of PD	
	– Teachers spend the most time on workshops focusing on subject content and (subject-specific) pedagogy	Richter et al. (2010, 2011); *exception:* Richter and Schellenbach-Zell (2016)

(continued)

Table 5.2 (continued)

Variable	Association to PD related variables[a]	References
	– They spend the least time on PD concerning school organization	Richter et al. (2011)
Activities during PD	*Participation in PD*	
	– Teachers participate more in workshops with presentations or study groups, but less in field trips; individual consulting or supervision, and blended learning are rarely used	Florian (2008)
	– Pre-structured PD workshops are attended more frequently than fully open, shapeable forms	Neu (1999)
Provider	*Participation in PD*	
	– Teachers participate in particular in workshops provided by teacher training institutes	Faßmann (1994, 1995), Kanwischer et al. (2004), Richter and Schellenbach-Zell (2016)
	Teachers also tend to attend workshops by other providers, …	Richter and Schellenbach-Zell (2016)
	…such as private suppliers/companies, universities, unions, and church-based institutions	Faßmann (1995), Florian (2008)
	Frequency of PD	
	– Teachers participate most frequently in workshops provided by teacher training institutes or in study groups	Marose (2016)

(continued)

Table 5.2 (continued)

Variable	Association to PD related variables[a]	References
	Amount of PD	
	– Teachers spend the most time in workshops offered by local providers or teacher training institutes	Bachmaier (2008), teacher training institute: Richter and Schellenbach-Zell (2016)
Duration and timing	*Participation in PD*	
	– Teachers participate in short workshops (half-day or one to two days) more often than in longer ones (several days)	Abs, Roczen, and Klieme (2007), Faßmann (1994, 1995), Forsa (2017), Grillitsch (2010), Hessisches Kultusministerium (2008), Jäger and Bodensohn (2007), Kanwischer et al. (2004)
	– Teachers participate in workshops during school hours more often than outside class time	Rüegg (1997)
	Teachers rarely participate in workshops held on weekends …	Jäger and Bodensohn (2007)
	…or vacation	Rüegg (1997)
	Frequency of PD	
	– Teachers participate more frequently in recurring and short workshops than in one-time and/or long workshops	Kanwischer et al. (2004)
Distance to PD location	*Participation in PD*	
	– Teachers would rather participate in workshops provided nearby than in ones that are further away (more than 50 km/about 30 miles)	Neu (1999), Prenzel (1995)

Notes [a]Participation in PD = participation in PD in general (yes/no; also "participation rate"); Frequency of PD = number of attended PD workshops; Amount of PD = number of hours or days spent on PD
[b]As stated in Chap. 3, the differentiation of PD program contents by Richter et al. (2011) is used

subject-specific pedagogy were more often chosen than those on subject contents. In studies with closed-ended questions asking teachers to tick off categories to which their attended courses belong (e.g., Drossel et al., 2012; Hoffmann & Richter, 2016; Porsch & Wendt, 2015, 2016), the order was reversed (exception: Kanwischer et al., 2004). Overall, the differences are rather small and become more salient when analyzing ranking order instead of total frequencies, but future studies should examine whether the different results are a methodological artifact. Nevertheless, the preference for subject-related topics and pedagogy matches the desire to get something out of the courses that is easy to implement in the classroom, which was one of the most important reasons for participating in PD (see Chap. 3).

Activities During PD

Only two studies examined if certain activities during PD courses are related to teachers' PD participation. The results with regard to activities in frequently attended PD workshops somewhat contradict previously reported results. Although teachers reported that they want to be active and apply teaching and learning strategies themselves (see Chap. 3), they mainly participated in courses with presentations. However, it cannot be clarified if teachers attended such courses because they preferred listening to a pre-structured input, because presentations are shorter than more elaborated courses, or if the most available courses are designed this way. In contrast, their frequent participation in study groups fits well with the desire to exchange experiences with colleagues as this format should provide teachers with room to discuss different topics instead of getting input from a facilitator. In accordance with the low relevance of teachers having a voice in designing a workshop (Chap. 3), Neu (1999) reported that more teachers participated in a pre-structured workshop than in one that could be structured by the participants themselves. These results suggest that teachers seem to be willing to engage in some learning tasks actively but prefer to be provided with pre-structured information and a given course structure. However, more research is needed.

PD Provider

Teachers most often attend workshops offered by teacher training institutes. It can be assumed that these courses are tailored to teachers' needs and the requirements of their profession as the only target group is teachers. This may reflect the importance of easily transferring the PD contents into the classroom, and teachers probably expect the facilitator to create a link between the workshop and classrooms or school. However, it is also possible that teacher training institutes offer the most courses for teachers and, therefore, it would be more likely to participate in such workshop.

Duration and Timing of PD Workshops

The typical choices for teachers with regard to the duration and timing of the PD courses are in accordance with the high relevance of teachers' workload for not attending PD, namely they participate primarily in short workshops that only take up a little time. This may also be a way for teachers to avoid cancelling classes, which is also a relevant barrier to PD attendance (see Chap. 4). However, results Rüegg's

(1997) results revealed that teachers prefer courses during school hours, which seems to contradict this assumption. Therefore, future research should systematically investigate participation rates of courses with different durations and timings as well as how and why teachers consider these aspects in their decisions. Initial hints from studies examining teachers' reported preferences with regard to these characteristics do not seem to shed more light on this question as the results are inconsistent (e.g., wish for outside-class time, Aschenbrenner, 2010 versus during school hours, Beck et al., 1995). The appropriate duration and timing of a PD workshop probably depend on other aspects, such as the topic (e.g., Aschenbrenner, 2010; Gallasch, Moll, & Tulodziecki, 2000; Scheuer, 2002). Wolf et al. (1997) revealed that low-participating teachers in particular prefer courses that are held before noon whereas more often-participating teachers favor those that take place in the afternoon or last all day long. However, the root of these differences cannot be concluded from the reviewed studies.

Distance to PD Location

Finally, the question of a possible association between distance to the PD location and teachers' PD behavior was examined, albeit only in two studies. Supporting the finding that a long distance to the PD location is an obstacle to attending PD (Chap. 4), teachers more often participated in workshops that took place nearby. However, it can be assumed that the decision to make longer journeys to attend PD depends on other course characteristics. For example, in two studies with open-ended questions teachers stated that they would agree to greater distances to PD locations if the topic was interesting or if the courses took longer (Aschenbrenner, 2010; Scheuer, 2002).

As stated previously, any further conclusions need to be drawn carefully as none of the analyzed studies considered the available PD courses (Richter et al., 2013a). For example, teacher training institutes are expected to offer more PD workshops targeting teachers rather than other providers (e.g., Hessisches Kultusministerium, 2008) and most courses rely on presentations, which are considered a less time-consuming method and therefore suitable for short workshops. If provided more often, it is much more likely that teachers would choose such workshops. Therefore, when analyzing teachers' PD behavior and how it is connected to different workshop characteristics, the provided courses need to be kept in mind in future research.

5.3 Context Conditions

Context conditions include characteristics of the school in which the teachers work as well as the staff to which the teacher belongs. The results of the analyzed studies in the current literature review are summarized and categorized in Table 5.3. Overall, only a few studies considered context conditions as influencing factors for teachers' PD behavior. Most studies focused on variables more directly linked to teachers' PD attendance (see Sects. 5.1 and 5.2).

Table 5.3 Overview of context conditions examined in the context of teachers' PD behavior

Variable	Association to PD-related variables[a]	References
School management/principal	*Participation in PD*	
	– No association with school management's priority of certain PD contents	Gerick and Eickelmann (2015)
	Amount of PD	
	– No association with leadership behavior (self-reported or by teachers)	Mayr and Müller (2010)
	Need of PD	
	– No association with school management's attached importance of PD or its reconcilement with teaching goals	Kast (2010)
School size	*Participation in PD*	
	– Positive association: Teachers from bigger schools participate in PD more than teachers from smaller schools	Faßmann (1995)
	– Inverse U-shaped association: Teachers in small schools (up to 30 teachers) and bigger schools (more than 60 teachers) participate in PD more than teachers in medium-sized schools	Faßmann (1994)
	– No association	Wolf et al. (1997)
School location	*Amount of PD*	
	– No association	Mayr and Müller (2010)
	Barriers to attending PD	
	– Teachers working in bigger cities perceive costs for PD, a lack of adequate workshops, and unqualified speakers as higher barriers than teachers in smaller towns; teachers teaching in smaller towns perceive the distance to a PD location as more relevant	Kanwischer et al. (2004)

(continued)

Table 5.3 (continued)

Variable	Association to PD-related variables[a]	References
	– Teachers working in urban areas perceive their workload as more relevant than teachers from rural areas	Prenzel (1995)
	Characteristics of attended PD workshops	
	– Duration and timing: Teachers in bigger cities would rather participate in workshops in the afternoon than teachers in smaller towns	Kanwischer et al. (2004)
Other school characteristics	*Participation in PD*	
	– Positive association with perceived value of PD within staff	Richter et al. (2010)
	Amount of PD	
	– Positive association with collegial cooperation regarding PD	Mayr and Müller (2010)
	– No association with evaluation practices or student–teacher relationships in particular schools	Mayr and Müller (2010)
	Characteristics of attended PD workshops	
	– Content: Teachers perceiving a high level of cooperation with colleagues would rather participate in workshops with diverse topics; teachers perceiving a below average level of cooperation participate less in PD	Richter et al. (2013)
	Other associations	
	– Teachers from schools that are part of PD projects participate more in PD (even beyond program-specific topics), …	Dalehefte et al. (2014)
	…and report a higher willingness to travel for PD	Neu (1999)

Notes [a]Participation in PD = participation in PD in general (yes/no; also "participation rate"); Frequency of PD = number of attended PD workshops; Amount of PD = number of hours or days spent on PD

School Management/Principal

Among different studies, characteristics of the school principal/management showed no association with teachers' PD behavior. This is true for several variables, such as the school management's beliefs about PD or leadership behavior. A possible explanation may be that the responsibility for teachers' PD is mainly in their own hands. That would match previously reported results that most teachers did not have any problems with being exempted by the principal for a certain PD course (Chap. 4).

School Size

The size of the school (usually operationalized as the number of teachers in a school) generates different results. However, Faßmann (1995) already stated that the found effects are rather small and therefore match the results of Wolf et al. (1997) who found no relationships for PD activity. As the effects reported by Faßmann (1994) are also rather low, it can be assumed that no considerable associations exist between school size and teachers' PD behavior.

School Location

The size of the town in which the school is located is also not related to the time teachers spend on PD, although it seems to be associated to teachers' perceptions of barriers to attending PD workshops as teachers from smaller and bigger towns differ in the obstacles they perceive as relevant. However, studies have not examined why these differences exist. Kanwischer et al. (2004) assumed that teachers in bigger towns participate more often in non-formal PD activities (e.g., exhibitions and presentations), which influences the teachers' assessment of barriers. There are also differences in the duration of PD workshops that teachers attend. Given the influence that available PD programs may have, Kanwischer et al. (2004) argued that not as many short workshops are offered in rural areas as in urban areas. However, they did not analyze the programs offered at the time of their survey.

Other School Characteristics

When analyzing further characteristics of schools, it becomes apparent that mostly non-quantitative variables are related with teachers' PD behavior. For example, there is a positive association with the perceived value colleagues assign to formal PD. This can also be seen in the higher PD attendance of teachers who teach in schools that are part of a PD-related project. It can be assumed that being part of a project is associated with appreciation of PD (although it cannot be clarified how these aspects influence each other). Similarly, a perceived cooperation between colleagues is positively associated with teachers' PD activities.

However, other school-level characteristics, such as evaluation practices, are not related with teachers' PD behavior. Mayr and Müller (2010) stated that this pattern can also be found in many other countries. It is also in accordance with the result presented in Chap. 3 that only a few teachers feel motivated by requests/recommendations from school management or colleagues to participate in

PD. Nevertheless, results suggest that the school to which teachers belong is associated with the frequency of PD attendance (14% explained variance on school level in Richter et al., 2011). It can be assumed that it is the school climate between colleagues rather than quantitative variables or characteristics of the school management that may affect a teacher's PD behavior.

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Chapter 6
Conclusions from the Literature Review

Abstract This chapter summarizes the results from the systematic literature review. The insights from the chapters on reasons for and barriers to teachers' participation in PD are integrated to provide a comprehensive overview about the recent research in the context of teacher PD. The interplay of the so far separately discussed reasons for and barriers to teachers' PD participation is highlighted. Conclusions are discussed for the design and implementation of PD courses for teachers. In addition, conclusions are derived with regard to further research questions and future research. It is argued that expectancy-value theories should be applied for examining teachers' training motivation and illustrated how the current results fit into this approach. Limitations of the existing and included studies are discussed and methodological suggestions for future studies are derived. Finally, the limitations of the systematic literature review are discussed.

Keywords Teacher professional development · Training participation · Training motivation · Expectancy-value theory · Teacher characteristics · School characteristics · Professional development programs · In-service teacher education

6.1 Summary of Results and Discussion

This systematic literature review aimed to summarize and systemize the results of studies from Germany, Austria, and Switzerland since 1990 with regard to teachers' reasons for and barriers to attending formal PD as well as potential associations with teachers' choice for or against (certain) PD courses. Figure 6.1 summarizes the results with regard to relevant reasons for and barriers to teachers' PD participation as well as further characteristics and context conditions that were analyzed. In the following sections, the results will be briefly discussed.

Overall, the study results indicate that teachers align their PD activities with their perceived need for enhanced knowledge. They use PD workshops to refresh or extend knowledge on subject content or (subject-specific) pedagogy, especially when they currently give lessons within that subject and teach it a lot. PD courses are also attractive for learning something about new directives or curricula and how to apply them in school or classrooms. Teachers use PD to take on additional professional

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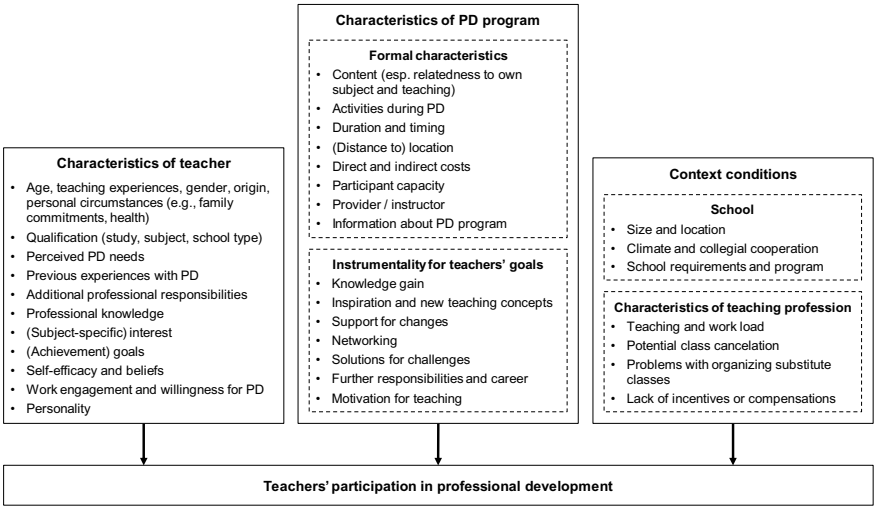

Fig. 6.1 Summary of relevant characteristics of teachers and PD programs, as well as context conditions for teachers' PD participation (based on Diehl, Krüger, Richter, and Vigerske 2010; see Sect. 1.3)

responsibilities (in terms of enhancing their career), or, if they already have such responsibilities, to meet the requirements. They also hope to learn about input and solutions for difficult situations in school or the classroom. Therefore, teachers seem to perceive PD as a tool to get solutions for their current needs. To this end, they hope to receive easily applicable materials and teaching strategies or methods, as well as "recipes" they can test during the workshops. Guskey (2010) already referred to this aspect by stating that teachers "tend to be quite pragmatic" (p. 382). In line with his statement, the analyzed studies revealed that teachers look for PD courses that are linked to their subjects (and sometimes even their school type). If workshops do not meet these requirements, teachers perceive them as unattractive (see also Guskey, 2010).

In addition to teachers' intention to achieve certain goals by attending PD courses (referred to as the "instrumentality of PD programs" in Fig. 6.1), whereas other motives include personal interest in the PD topic and improving oneself. Teachers aim to reflect their own teaching—be it in light of scientific results or by exchanging experiences with colleagues. They may also want to break out of their daily routine, see something new, put themselves into the role of learners, be inspired, and become motivated for their classes. Overall, most teachers report that they are willing to participate in PD and enjoy this learning activity.

The greatest burden for attending PD is the additional effort teachers have to invest. Teachers already perceive a high workload due to responsibilities within and outside the classroom. PD workshops outside of school hours restrict the time for grading or preparing classes; courses within school time require the organization and preparation of substitute classes (and colleagues with the time and willingness

to undertake the additional classes), as well as long journeys and high (indirect) monetary costs that increase the effort. In addition, family commitments are an issue, especially for female teachers.

Therefore, considering the trade-off between costs and benefits is crucial in the decision to attend (or not) a certain PD workshop. Important characteristics of the PD program in this calculation are the content, activities during the course, course provider or instructor, and consequential expected outcome (or its usefulness and ease of implementation into the classroom). The circumstances of a workshop (such as timing, duration, or location) help teachers estimate the effort they need to put into a course. However, teachers have reported that there are too few workshops that meet their wishes and needs.

When evaluating the trade-off of a PD workshop, teachers can only rely on the information they receive about the course (typically from a description of the single workshops, but sometimes from colleagues or the school principal as well). Therefore, a poor workshop description can negatively influence a teacher's PD participation. When evaluating the available information with regard to the utility of a certain workshop, previous experiences with PD may be helpful and influence current choices of PD courses. Yet individual (e.g., age, gender, taught subject, school type) and motivation-related (e.g., achievement goals, self-efficacy, ability beliefs, and beliefs about teaching) teacher characteristics also seem to influence how much teachers perceive the need for PD and if they decide on a certain PD topic and format. However, it can be assumed that no certain individual characteristics of teachers (e.g., gender, taught subject, and school type) are directly related with their PD activity. Instead, it is more likely that different requirements or needs arise due to these characteristics (e.g., caring for children, focus on subject-content or disciplinary questions), thereby affecting teachers' PD behavior. These individual characteristics may also interact with a teacher's other individual prerequisites, such as interest, goals, and beliefs. Still, the kinds of associations and processes that lie behind the choice of PD workshops cannot be untangled with the current research due to the many inconsistent results among the various studies. Furthermore, only a few studies considered interactions between different characteristics and conditions in the research on teachers' PD behavior. Moreover, some variables are only relevant for some teachers, seeming crucial for these teachers. Even if a teacher finds a PD course in which he or she is interested, it may be overcrowded and fully booked, the school management may disagree with the participation for some reason, or personal reasons (e.g., health issues) may prevent attendance. Constructs identified as relevant for the teaching profession, such as burnout and exhaustion, also need to be more integrated into the research on teachers' PD behavior as PD may help cope with such issues while also putting even more pressure on teachers. In the end, it is necessary to obtain not only teachers' needs and characteristics, but also their context conditions. Current studies on the latter aspects are rather scarce. For example, requirements of the teachers' schools as well as standards and guidelines from ministries or school authorities are not considered in studies or examined to determine how they may influence teachers' PD behavior (Richter, Engelbert, Weirich, & Pant 2013a; Timperley, 2008). It can be assumed that

such conditions can either lead to new PD needs (e.g., change of curriculum or educational standards) or influence the availability or accessibility of PD courses (e.g., due to changes in budgets, guidelines on important PD contents, or class cancellation).

None of the publications provided a model that considered how the examined variables influence teachers' PD participation and how teacher characteristics, characteristics of PD programs, and context conditions interact (see Fig. 6.1). Recently, Gorges (2016) suggested transferring expectancy-value theory (e.g., Eccles & Wigfield, 2002) into the context of adult education. She argued that PD participation can be seen as a form of task choice, and relevant motivational processes for such a choice should be transferable to the decision process of an adult learner contemplating whether to attend a PD course. Following this argumentation, decisions with regard to task choice—or, in the current case, to PD participation—depend on the (teachers') assessment of (a) one's expectancy of success and (b) the subjective task value (Eccles, 2007; Gorges, 2016). The task value in turn comprises four different kinds of values specifying if a task is joyful and interesting (intrinsic value), useful for reaching certain goals (utility value), or personally relevant (attainment value). In addition, the cost component refers to how much effort or other resources a person needs to invest in a task.

Considering the results of the literature review, highly relevant intrinsic reasons, such as interest in the PD topic or in participating in PD, can be allocated as an intrinsic value of PD participation whereas aspects referred to as "instrumentality of PD programs" can be categorized as utility values (see also Gorges, 2016). In addition, Gorges (2016) differentiated four types of costs: effort, time, money, and psychological strain. Again, the reported results of the current literature review fit with these costs as teachers often claimed to have no time for PD and to be already fully stretched with teaching and other responsibilities. However, monetary costs are only an issue for some PD courses as many programs are offered free for teachers (Chap. 4). It may also be interesting to further distinguish some of the categories; for example, there are different reasons why teachers reported having too little time for PD (e.g., work load versus family commitments), which may in turn influence how different groups of teachers systematically assess the value in different ways (e.g., women and men; see Chap. 4). However, the theory provides a suitable framework to systemize the different reasons for and barriers to PD participation. In addition, the approach suggests that values and costs are not independent factors. Instead, there is a trade-off between values and costs (Eccles, 2007). Only if the values outweigh the costs will teachers want to participate in a PD course. Future research should examine if this theoretical approach is suitable for predicting teachers' PD participation as the influence of the expectancy of success on the choice of a PD course has not been tested yet. The results with regard to the influence of self-efficacy on teachers' PD participation suggest that there is a positive relationship (Sect. 5.1) suggested by the theory (Eccles, 2007). However, it is not clear if and/or how teachers' success expectancy influences their assessment of the task values. Furthermore, the subjective task values probably depend highly on the targeted PD course as they vary widely in their formal characteristics, such as content, timing and duration, provider, and location (e.g., see the research design by Gorges, Neumann, Lütje-Klose, and Wild, 2017). In contrast,

previous research has mainly asked about teachers' participation in PD in general without differentiating between the kinds of PD programs. Against the background of the expectancy-value theory, it seems reasonable to focus more on teachers' reasons for and barriers to attending particular PD courses. Finally, further work is necessary to examine how individual characteristics (e.g., beliefs about teaching, interest in subject, previous experiences with PD) influence teachers' value assessment. Eccles (2007) already described how two important motivation theories, self-determination theory and achievement goals, can be integrated into the expectancy-value theory. Therefore, further research should investigate if the hypothesized relationship can be found for teachers' choice of PD courses. This is also true for the influence of context conditions. The suggested model already considers the impact of environmental conditions, but seems rather narrow. Thus, further research is needed to examine how context conditions within schools as well as due to state and/or country regulations affect teachers' subjective task values and, ultimately, their PD behavior.

Nevertheless, the existing results can be used to derive some suggestions for designing attractive PD courses for teachers. For example, teachers should be provided with detailed and transparent information on the PD courses to enable teachers to assess the related values and costs. Furthermore, there should be a clear connection to teachers' daily work within the classroom and in supporting them to transfer the knowledge into their classrooms. In addition, it would be appropriate to offer the same course at different times to enable different teacher groups to participate in the course. When designing PD courses, research results on characteristics of effective PD courses should be considered as well (e.g., Rzejak et al., 2014; Timperley, Wilson, Barrar, & Fung, 2007; Yoon, Duncan, Lee, Scarloss, Shapley, 2007). It would be interesting to investigate how teachers actually assess PD courses that meet these criteria as such courses are related with more effort and investment of time by the participants and, thus, with higher costs.

In addition to designing attractive PD courses, the results of the literature review suggest that teachers should be supported in identifying their PD needs. Thus, teachers' choice is highly dependent on individual characteristics, such as interest, but not necessarily knowledge gaps. In addition, although barriers (or costs) should be reduced (providing teachers with times in which they can attend PD courses without cancelling classes or supporting the organization of substitute classes), potential positive values should be facilitated. Here, a positive climate among school staff (see Sect. 5.3) or incentives may be a way to highlight the importance of PD courses (see Chap. 4).

6.2 Limitations of Included Studies and Conclusions for Further Research

While reviewing the included studies, several limitations became apparent. One of the most dominant issues is that none of the analyzed studies considered the available PD programs when examining teachers' PD behavior. As previously mentioned, due

to the lack of this information, it cannot be differentiated how much the obtained PD behavior is influenced by the available courses. Studies on teachers' wishes regarding the design of PD courses as well as analyses of the given PD program may help fill the gap. This also applies for the consideration of regulations regarding PD obligations in the different states and countries. The results from Chaps. 3, 4, and 5 suggest that these regulations do not seem to have a meaningful influence on teachers' PD participation (see also the results with regard to "origin" in Sect. 5.1). Only six studies examined teachers from states that have regulations about the amount of PD teachers have to attend (Bachmaier, 2008; Büsching and Breiter, 2011; Doedens, 2005; Hessisches Kultusministerium, 2008; Mammes, 2008; Schwetlik, 1998). The results of these studies correspond with those from other studies from different regions, which may be a first indication that obligations to attend PD are not that crucial for teachers' PD behavior. However, teachers reported that the implementation of a system with credit points changed their perception of the available PD program and how they chose PD courses (Hessisches Kultusministerium, 2008). Furthermore, an international comparison of different education systems revealed that successful countries require their teachers to engage in PD activities. Therefore, studies are needed that explicitly examine the influence of obligations and how they need to be designed to motivate teachers to participate in meaningful PD courses.

Furthermore, all studies focused on decision-making processes related to PD workshops in the past. Therefore, it cannot be clarified which aspects and characteristics of the teacher, the PD workshops, and the context are crucial for the choice of a certain course and which aspects actually hinder teachers. Teachers' answers may be biased when thinking about past decisions. In addition, most studies only focused on single variables instead of recognizing or examining how different context or individual characteristics interact in their influence on teachers' PD participation. For example, a correlation exists between gender and school type as well as taught subject, which were in turn examined as influencing aspects. More than one variable needs to be considered at the same time, along with more complex research models and more comprehensive data analyses. This is also true for examining teachers' reasons for and barriers to participating in PD courses. Thus, most studies have considered either reasons or barriers and reported lists of different aspects that teachers consider as relevant for their decision on PD participation (see also Gorges, 2016, for adult education). However, none of them included an interaction between the different elements and how the combination of different individual and context characteristics may influence a teacher's decision. Considering expectancy-value theories (e.g., Eccles, 2007; Gorges, 2016), this approach is too narrow as it is acknowledged that individual decisions are influenced by a trade-off between costs and benefits associated with that decision.

In addition, more studies focusing on the current and actual decisions or selection processes are needed. The analyzed studies were based on teachers' voluntary responses. Therefore, it can be assumed that teachers already more engaged in PD filled in the questionnaires rather than those less engaged. This may lead to a bias within the reported results (Rzejak et al., 2014). Studies focusing more on teachers who do not regularly attend PD are needed.

Due to the frequent use of closed-ended questions, most studies examined aspects pre-selected by the researchers and are quite different among the included studies (with regard to the content as well as amount). Qualitative studies are rather scarce and seem to coexist with the quantitative studies instead of serving as the basis for or extension of quantitative studies. However, during the systemization of the results for the current review, the qualitative studies helped interpret and understand the results of the quantitative studies. Therefore, more qualitative studies are needed, especially those that help explain existing results. It also remains unclear if the question format influenced the study outcomes (see the discussion regarding PD contents depending on open- and closed-ended question formats). Beyond this problem, summarizing the results was also difficult due to the different operationalizations used in the included studies (e.g., see discussion on attitude towards PD or referenced period for PD attendance) as well as due the fact that most studies focused on certain teachers (e.g., in terms of school type or subject; Richter, 2016). Therefore, further research is needed with representative teacher samples using comparable operationalizations of the investigated constructs. As several constructs and variables are investigated only within one or few studies, this approach would also help replicate the existing studies and clarify how stable the reported results are. Such studies shall take a deeper look into those school types (e.g., vocational schools) or subjects (e.g., languages, physical training, music) that have not yet examined.

Most studies did not report any effect sizes, and some did not even conduct statistical testing to prove their descriptive interpretations. In addition, post hoc calculations were often not possible as relevant information was missing (e.g., dispersion measures) or frequencies, means, and effects had to be read off graphics and diagrams (e.g., Landert, 1999; Wolf, Göbel-Lehnert, & Chroust, 1997). Other studies did not present all results, but only the "most important" reasons for and barriers to PD attendance (e.g., Gröber and Wilhelm, 2006; Jacobi, Verweyen, & Wedding, 1996; Jäger and Bodensohn, 2007), making the comparison of studies even harder (especially as it was not always transparent how the authors decided what is important and what is not). With regard to the publications using statistical analyses, group comparisons were realized most often. More complex analyses, such as multilevel analyses (cf. Richter, 2011), or polynomial regressions that do not presume linear relationships between variables (cf. Richter, Kunter, Klusmann, Lüdtke, & Baumert, 2011) can only be found in a few studies, although they seem to contribute to the insights into teachers' PD behavior. Finally, all studies were cross-sectional and cannot be used to investigate either progresses in or adaptations to policy changes or test predictions of subsequent PD activity (e.g., OECD, 2014). Cross-sectional data are not suitable for deriving causal relations or for determining what actually influences teachers' PD attendance. One exception is the study by Huppert and Abs (2008), who collected longitudinal data and compared current data on PD participation with previously collected data and to show that the teachers' reported PD needs did not completely correspond with their actual choices for PD workshops and attendance.

Taking these limitations together, several suggestions can be offered for future studies in the field of teacher PD:

- Consider available PD programs, characteristics of existing PD courses and context conditions (e.g., PD obligations, regional promotion of certain PD topics, revisions of curricula)
- Consider several relevant variables, especially their interactions when analyzing the influence on PD behavior
- Consider existing research and operationalizations of relevant variables as well as items to enable the comparability of study results
- Replicate existing studies with thus far little-considered variables in different samples
- Aim for representative teacher samples
- Use research designs that allow for causal conclusions
- Report statistical testing, relevant parameters, and effect sizes
- Focus on actual decision-making process (instead of asking about decisions in the past) by, for example, using learning journals or (quasi-)experimental designs with controlled conditions
- Conduct longitudinal studies considering teachers' intentions and actual behavior as well as the development of teachers' PD behavior throughout their careers.

6.3 Limitations of the Literature Review

Among the shortcomings of the included studies, some limitations of the current review also need to be considered. First, the review focuses only on teachers' participation in formal PD, which might be too narrow of a focus when thinking about teachers' professional learning. Several studies did not find any associations between teachers' participation in PD and their knowledge (Brunner et al., 2006) or student performance (for Germany, e.g., Hoffmann and Richter, 2016; Richter, Kuhl, Haag, & Pant, 2013b; Wendt et al., 2016; see also Lipowsky, 2011). However, Hattie (2009) showed in his meta-analysis that different kinds of PD programs can have different effects (see also OECD, 2009). Therefore, future studies should focus not only on teachers' motivation to participate in PD, but also on how to promote their participation in sustainable and effective PD. Thus far, teacher preferences for PD characteristics rarely match such PD formats (Lipowsky, 2011).

As stated herein, there are other ways for teachers to extend their knowledge and abilities, which were not taken into account for the review (see also Richter, 2016). The use of professional literature seems to be an especially important source for teachers (e.g., Breiter, Welling, & Stolpmann, 2010; Florian, 2008; Gysbers, 2008; OECD, 2009; Prenzel, 1995; Richter et al., 2013b). Some studies also discussed and examined the exchange of ideas and collaboration between colleagues as a form of teacher PD (e.g., OECD, 2009; Richter, 2011, 2013). Recently, new formats such as online training have been developed and discussed to overcome certain barriers

(e.g., long distance to PD locations, inconvenient dates) and fit with teachers' needs (e.g., Dede, Jass Ketelhut, Whitehouse, Breit, & McCloskey, 2009). However, when comparing the research on teachers' reasons for and barriers to engaging in more informal activities (e.g., Geijsel, Sleegers, Stoel, & Krüger, 2009; Kwakman, 2003; Lohman, 2000, 2003, 2006) or web-based PD or learning activities (e.g., Downer, Locasale-Crouch, Hamre, & Pianta, 2009; Duncan-Howell, 2010; Kao, Wu, & Tsai, 2011), quite similar results can be found, indicating that there might be motivational processes as well as certain context characteristics that are relevant for different kinds of learning activities. Therefore, systematic empirical studies and literature reviews on already existing research are needed to gain deeper insights into different kinds of learning activities as well as what influences teachers' engagement in them (see e.g., Nitsche, 2013). Simply participating in PD courses does not guarantee that teachers actually learn something or transfer their knowledge into the classroom. As stated in Sect. 1.1, the current literature review only focused on the choice to participate in PD (Beier & Kanfer, 2010; "training choice motivation", Rzejak et al., 2014); it was not concerned with the influence of this phase on processes during and after a PD program. Therefore, research is needed on how the different (motivational) stages interact and if the decision-making process before a PD course has any influence on how teachers use the learning activity and transfer the gained knowledge into their classrooms.

Finally, by the use of Google Scholar as a starting point for the systematic literature search was an effort to identify a broad basis of studies that might be relevant for the current literature review. However, it cannot be ruled out that certain publications were not identified. Especially for Austria and Switzerland, only a few studies were found. A systematic approach and snowballing were used in order to minimize the number of missed studies. Furthermore, it is not clear whether the publication bias (i.e., non-significant or null results are less likely published than significant and expected results) had an influence on the presented results. The current systematic literature review aimed to gain insights into the variety of existing studies with regard to teachers' PD participation in Germany, Austria, and Switzerland. The publications found seem to have contributed well to this question and are a good starting point for further research questions and studies.

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Appendix

See Tables A. 1 and A.2.

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Table A.1 Overview of studies included in systematic literature review

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Abs, Roczen, and Klieme (2007)	DE (except SL, BY, NI, NW)	2006	Various	Various (incl. vocational)	$N = 2039$	Questionnaire	Certain program
Aldorf (2016)	DE (BW)	2012	Various	Secondary schools	$N = 6$	Interview	None
Aschenbrenner (2010)	AT (LA)	2009	Languages, business education	Various (vocational)	$N = 24$	Interview	None
Bachmaier (2008)	DE (BY)	2008	Various	Various	$N = 628$	Questionnaire	None
Beck, Ullrich, and Schanz (1995)	DE (RP)	–	Various	Various	$N = 989$	Questionnaire	None
BITKOM (2011)	DE	2011	Various	Secondary schools	$N = 501$	Interview (standardized)	Digital media
BITKOM (2015)	DE	2013/14	Various	Secondary schools	$N = 502$*	Interview	Digital media
Breiter, Welling, and Stolpmann (2010)	DE (NW)	2009	Various	Secondary schools	$N = 46$	Interview, group discussion	Digital media
Brunner et al. (2006)	DE	2004	Mathematics	Secondary schools	$N = 195$	Questionnaire	–
Büsching and Breiter (2011)	DE (HB)	2010	–	Various (incl. vocational	$N = 833$	Questionnaire	Digital media
Dalehefte et al. (2014)	DE	2011	Mathematics	Elementary schools	$N = 274$	Questionnaire	Certain program

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Diehl, Krüger, Richter, and Vigerske (2010)	DE (BW)	2010	Various	Various (incl. vocational)	$N = 41$	Interview	None
Doedens (2005)	DE (HH)	2002/03	Religion	Secondary schools	$N = 431$*	Questionnaire	–
Doedens (2008)	DE (SH)	2007	Religion	Various (incl. vocational	$N = 1764$*	Questionnaire	–
Drossel, Wendt, Schmitz, and Eickelmann (2012)	International	2011	Mathematics, science	Elementary schools	–	Questionnaire	Mathematics
Faßmann (1994)	AT (BL, CA, UA, VI)	1993	Various	Various (vocational)	$N = 2800$	Questionnaire	Certain provider
Faßmann (1995)	AT	1994	Various	Various (vocational)	$N = 1892$	Questionnaire	Certain provider
Feige and Tzscheetzsch (2005)	DE (BW)	–	Religion	–	$N = 4196$*	Questionnaire	Religion
Florian (2008)	DE	2006/07	Various	Various (incl. vocational)	$N = 1613$	Questionnaire	None
Forsa (2017)	DE	2017	STEM	Various	$N = 500$*	Interview	None
Gagarina and Saldern (2010)	DE	2007/08	Various	Secondary schools	$N = 3734$*	Questionnaire	None
Gallasch and Sprenger (2000)	DE (NW)	1999	Various	Elementary schools	$N = 40$	Interview	Digital media
Geest-Rack (2013)	DE (BE)	2011	Various	Elementary schools	$N = 122$	Questionnaire	Nutrition

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Gerick and Eickelmann (2015)	International	2013	Various	Various	$N = 1386$	Questionnaire	Digital media
Gerick and Eickelmann (2017)	DE (SH)	2016	Various	Various	$N = 383$	Questionnaire	Digital media
Gerick, Schaumburg, Kahnert, and Eickelmann (2014)	International	2013	Various	Various	$N = 1386$	Questionnaire	Digital media
Goldgruber (2012)	AT (VI)	2012	Various	Elementary schools	$N = 221$	Questionnaire	None
Grafendorfer, Neureiter, and Längauer-Hohengaßner (2009)	AT	2008	Various	Secondary schools	$N = 4265$	Questionnaire	None
Greve and Höhne (2009)	DE (NW)	2000	–	Elementary schools	–	Group discussion	None
Grillitsch (2010)	AT	2009	German, English, mathematics	Secondary schools	$N = 1270$	Questionnaire	Educational standards
Gröber and Wilhelm (2006)	DE (RP)	2004	Physics	Academic-track schools	$N = 293$	Questionnaire	None, digital media in Physics
Gysbers (2008)	DE (NI)	2004/05	Various	Various	$N = 1013$	Questionnaire	Digital media
Häuptle, Florian, and Reinmann (2008)	DE (HH, BY, RP, TH)	2007	Various	Various (incl. vocational)	$N = 64$	Interview, group discussion	Digital media
Heitmann (2013)	DE (SH)	–	Various	Academic-track schools	$N = 13$	Interview	None

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Herrmann and Hertramph (2002)	DE (BW)	–	–	Various (incl. vocational)	$N = 64$	Interview	None
Hessisches Kultusministerium (2008)	DE (HE)	2007/08	German	Secondary schools	$N = 685$	Questionnaire	Reading promotion
Hildebrandt (2008)	DE	2004/05	Various	Academic-track schools	$N = 368$	Questionnaire	None
Hoffmann and Richter (2016)	DE	2015	German, English	Secondary schools	$N = 2988$	Questionnaire	None
Höhnle, Fögele, Mehren, and Schubert (2016)	DE	–	Geography	Various	–	Group discussion	Geography
Huppert and Abs (2008)	DE	–	–	Various (incl. vocational)	–	Questionnaire	Certain program
Jacobi, Verweyen, and Wedding (1996)	DE (NW, NI)	1995	Religion	Various (incl. vocational)	$N = 685$	Questionnaire	Religion
Jäger and Bodensohn (2007)	DE	2006	Mathematics	Various	$N \approx 1715$	Questionnaire	Mathematics
Kammerl, Lorenz, and Endberg (2016)	DE	2016	Various	Secondary schools	$N = 1210$*	Questionnaire	Digital media
Kanwischer, Köhler, Oertel, Rhode-Jüchtern, and Uhlemann (2004)	DE (TH)	2003	Geography	Secondary schools	$N = 477$	Questionnaire	None
		2004	Geography	Secondary schools	$N = 6$	Interview	None
Kast (2010)	AT	2008	Various	Secondary schools	$N = 4134$	Questionnaire	None

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Keppelmüller, Sigl, Lauber, and Feichtner (2004)	AT (UA)	2000	Various	Various	$N = 1427$	Questionnaire	Certain provider
Kirschner (2013)	DE (NW, BY, HE, HB, TH, NI, BE)	–	Physics	Secondary schools	$N = 186$	Questionnaire	Physics
Kunter and Klusmann (2010)	DE	2004	Mathematics	Secondary schools	$N = 229$	Questionnaire	None
Landert (1999)	CH	1995	Various	Various (incl. vocational)	$N = 3789$	Questionnaire	None
Lauck (2003)	DE (BW)	2002	Various	Vocational schools	$N = 333$	Questionnaire	None
Mammes (2008)	DE (BY)	–	Science	Academic-track schools	$N = 487$	Questionnaire	None
Marose (2016)	DE (NW)	–	Religion	Vocational schools	$N = 81$	Questionnaire	Religion
Mayr and Müller (2010)	AT	2008	Various	Secondary schools	3209	Questionnaire	None
MPFS (2003)	DE	2002/03	Various	Various	$N = 2002$	Interview	Computer
Neu (1999)	DE (HE)	1996	Chemistry	Secondary schools	$N = 173$	Questionnaire	Chemistry
		1996–98	Chemistry	Various (incl. vocational)	$N = 97$	Questionnaire	Chemistry
Niederhaus and Schmidt (2016)	DE (NW)	2015	German as 2nd language	–	$N = 15$	Questionnaire	Certain program
Nitsche, Dickhäuser, Dresel, and Fasching (2013a)	DE (BW, RP, NW)	–	Various	Various	$N = 667$	Questionnaire	None

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Nitsche, Dickhäuser, Fasching, and Dresel (2013b)	DE	–	Various	Various (incl. vocational)	$N = 224$	Questionnaire	None
Nittel, Schütz, Fuchs, and Tippelt (2011)	DE (BY, HE)	–	Various	Elementary schools	–	Questionnaire	None
		–	Various	Elementary schools	–	Group discussion	None
Pennig (2006)	DE (TH)	2003/04	Chemistry	Secondary schools	$N = 119$	Questionnaire	Chemistry
Peschel and Koch (2014)	DE (NW)	2006/07	Social studies and science	Elementary schools	$N = 1210$	Questionnaire	Physics
Pietzner, Scheuer, and Daus (2004)	DE (BY, HE, NI, NW, SN)	2002	Chemistry	Secondary schools	$N = 852$	Questionnaire	Chemistry
Porsch (2015)	DE	2007	Mathematics, social studies and science	Elementary schools	$N = 242$	Questionnaire	Mathematics
Porsch and Wendt (2015)	International	2011	Social studies and science	Elementary schools	$N = 146$	Questionnaire	Social studies and science
Porsch and Wendt (2016)	International	2015	Mathematics, social studies and science	Elementary schools	$N = 450$	Questionnaire	Mathematics
Prenzel (1995)	DE (BE, BB)	1990/91	Various	Elementary schools	$N = 136$	Questionnaire	None
Richter (2011)	DE	2003	Mathematics, science	Various	$N = 1939$	Questionnaire	None

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Richter, Engelbert, Weirich, and Pant (2013a)	DE	2009	German, English	Secondary schools	$N = 2076$	Questionnaire	None, languages
Richter, Kuhl, Haag, and Pant (2013b)	DE	2012	Mathematics, science	Various	$N = 4050$	Questionnaire	None
Richter, Kuhl, Reimers, and Pant (2012)	DE	2011	German, mathematics	Elementary schools	$N = 1816$	Questionnaire	None
Richter et al. (2010)	DE	2003	Mathematics	Secondary schools	$N = 330$	Questionnaire	None
Richter, Kunter, Klusmann, Lüdtke, and Baumert (2011)	DE	2003	Mathematics, science	Secondary schools	$N = 1939$	Questionnaire	None
Richter, Richter, and Marx (2018)	DE	2012	Mathematics, science	Secondary schools	$N = 2447$	Questionnaire	None
Richter and Schellenbach-Zell (2016)	DE (SH)	2016	Various	Various (incl. vocational)	$N = 523$	Questionnaire	None
Riedel, Griwatz, Leutert, and Westphal (1994)	DE (BE)	1992	Various	Secondary schools	$N = 175$	Questionnaire	None
Rüegg (1997)	CH (AG)	1994	Various	Various	$N = 1054$	Questionnaire	Certain provider
Rzejak et al. (2014)	DE (HE)	–	–	Secondary schools	$N = 102$	Questionnaire	None
Schmidt and Neu (2004)	DE (BY, HE, NI, NW, SN)	2002	Chemistry	Secondary schools	$N = 96$	Interview	Chemistry
Schwetlik (1998)	DE (BY)	1993/94	Social studies and science	Elementary schools	$N = 1364$	Questionnaire	None

(continued)

Table A.1 (continued)

Study	Country (region)	Data collection	Subject	School type	Sample	Method	Focus of PD program
Sieve (2015)	DE (NI)	2010/11	Various	Secondary schools	$N = 360$	Questionnaire	Interactive whiteboards
Wolf, Göbel-Lehnert, and Chroust (1997)	DE (HE)	1994	Various	Various (incl. vocational)	$N =$ 1718*	Questionnaire	None

Notes DE … Germany; BW … Baden-Wuerttemberg; BY … Bavaria; BE … Berlin; BB … Brandenburg; HB … Bremen; HH … Hamburg; HE … Hesse; MV … Mecklenburg-Western Pomerania; NI … Lower Saxony; NW … North Rhine-Westphalia; RP … Rhineland-Palatinate; SL … Saarland; SN … Saxony; ST … Saxony-Anhalt; SH … Schleswig-Holstein; TH … Thuringia; AT … Austria; BL … Burgenland; CA … Carinthia; LA … Lower Austria; UA … Upper Austria; VI … Vienna; CH … Switzerland; AG … Aargau. *… attempts to achieve representativity

Table A.2 Ranking order of German federal states with regard to teachers' PD attendance depending on dependent variable

Kammerl et al. (2016)	Richter et al. (2013b)		Richter et al. (2012)		Hoffmann and Richter (2016)	
PD on multimedia	PD in general		PD in general		PD in general	
Several subjects	Mathematics, Science		German, Mathematics		German, English	
Participation in PD	Participation in PD	Frequency of PD	Frequency of PD	Amount of PD	Participation in PD	Amount of PD
TH^{E}	ST^{E}	TH^{E}	BY^{W}	HB^{W}	MV^{E}	MV^{E}
$BE^{E/W}$	TH^{E}	ST^{E}	TH^{E}	*HH^{W}*	TH^{E}	TH^{E}
BB^{E}	MV^{E}	BB^{E}	HB^{W}	HE^{W}	BB^{E}	*HH^{W}*
HH^{W}	*HH^{W}*	*HH^{W}*	BB^{E}	BB^{E}	SN^{E}	BB^{E}
SH^{W}	SN^{E}	SN^{E}	ST^{E}	TH^{E}	ST^{E}	ST^{E}
SL^{W}	BB^{E}	MV^{E}	HE^{W}	NW^{W}	NI^{W}	SN^{E}
ST^{E}	HB^{W}	HB^{W}	SN^{E}	*BY^{W}*	*BY^{W}*	HB^{W}
HE^{W}	HE^{W}	SL^{W}	MV^{E}	SN^{E}	HB^{W}	*BY^{W}*
MV^{E}	$BE^{E/W}$	$BE^{E/W}$	$BE^{E/W}$	MV^{E}	*HH^{W}*	NI^{W}
RP^{W}	SL^{W}	NI^{W}	NW^{W}	BW^{W}	NW^{W}	$BE^{E/W}$
BY^{W}	*BY^{W}*	HE^{W}	*HH^{W}*	$BE^{E/W}$	$BE^{E/W}$	HE^{W}
HB^{W}	NI^{W}	BW^{W}	NI^{W}	NI^{W}	HE^{W}	SH^{W}
BW^{W}	BW^{W}	*BY^{W}*	SL^{W}	ST^{E}	SL^{W}	NW^{W}
NI^{W}	NW^{W}	NW^{W}	SH^{W}	SH^{W}	SH^{W}	BW^{W}
NW^{W}	SH^{W}	SH^{W}	BW^{W}	RP^{W}	BW^{W}	SL^{W}
SN^{E}	RP^{W}	RP^{W}	RP^{W}	SL^{W}	RP^{W}	RP^{W}

Notes Italic printed states have regulations regarding PD obligations. ^{E} … Federal state from Eastern Germany (former GDR); ^{W}… Federal state in Western Germany; BW … Baden-Wuerttemberg; BY … Bavaria; BE … Berlin; BB … Brandenburg; HB … Bremen; HH … Hamburg; HE … Hesse; MV … Mecklenburg-Western Pomerania; NI … Lower Saxony; NW … North Rhine-Westphalia; RP … Rhineland-Palatinate; SL … Saarland; SN … Saxony; ST … Saxony-Anhalt; SH … Schleswig-Holstein; TH … Thuringia

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