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Subject Didactics and Educational Sciences: Relationships and Their Implications for Teacher Education from the Viewpoint of Educational Sciences

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Abstract

The quality of teacher education is closely linked to the relationship between its core elements — scientific disciplines, educational sciences, subject didactics and practical training. This article uses examples to describe the different relationships between subject didactics (elements of subject-matter teaching and learning) and educational sciences in Germany. Theories of professionalism in the teaching profession are proposed as a possible way to promote dialogue between the two elements while still taking their autonomy into account. The enhanced scientific dialogue between both elements could inspire teacher education that benefits from a stronger interrelation.

Keywords

subject didactics; educational sciences; teacher education; professionalization; meta-reflexivity

1 Introduction

In the German discourse on teacher education, the disconnectedness of its four constitutive elements — scientific disciplines (e.g., mathematics), educational sciences (e.g., educational psychology), subject didactics (e.g., subject-matter teaching and learning, such as mathematics education), and practical training (e.g., internships) — is prominent. The overall success of teacher education depends on the capacity for dialogue of the individual elements of teacher education. Intensified cooperation between all elements of teacher education is needed to understand what the respective elements are about: What content do they address? What epistemic background do they have? What is their scientific self-conception? As to the various types of (research in) subject didactics in the German discourse (e.g., Bayrhuber, 2012), there is no common understanding of their disciplinary status or epistemic core; the situation in educational sciences is similar (Terhart, 2012). This article argues that a better understanding of what subject didactics and educational sciences are about is critical for communication between these and other elements of teacher education. Possible relationships are illustrated and discussed. We argue that theories of professionalism in teaching can serve as one point of reference for a dialogue between subject didactics and educational sciences to optimize teacher education.

The theories of professionalism in the teaching profession originate in educational sciences. These theories and their related empirical approaches have been developed in the German context and have not yet been comprehensively introduced into the discourse on teacher education within the anglophone literature. The most common approaches are as follows: (1) The *competence-based approach* has been introduced most extensively to the anglophone discussion (Kunter et al., 2013). The basic idea is that the

professional competence of teachers is a result of their professional knowledge, motivation, beliefs, and self-regulation. Professionalism, then, is modelled by accumulated competence along these four dimensions. (2) The *structural theory approach* refers to the assumption that professional teaching is a kind of substitutive crisis management of students' problems (Helsper, 2016). Because teachers are caught in antinomic plot structures (e.g., between proximity and distance or autonomy and heteronomy) that are characteristic of classroom interaction, the ability to reflect is at the core of teachers' professionalism. (3) The *occupational–biographical approach* views professionalism from a lifelong learning perspective (Keller-Schneider, 2016). Professional teachers can identify necessary development perspectives to define corresponding tasks and solve them during their ongoing occupational biography. (4) Recent approaches can be read under the perspective of the *meta-reflexivity approach* (see 3.2), which defines professionalism as the ability to understand the epistemic background and relationship of theories, empirical approaches, and knowledge that (student) teachers are confronted with and identify their specific potentials and limitations in the interpretation of typical action situations in both classroom and school in the context of teacher education (Cramer et al., 2019). Here, the professional teacher is able to refer to such interpretations of typical action while coming to situation-specific interpretations in the field of action itself.

To address the question of what subject didactics and educational sciences are and what their relation is, this article discusses the scope of subject didactics and the possible relationships with educational sciences that can be found in the relevant literature. We then argue that referring to different theories of teachers' professionalism could be one way to inspire the communication process between subject didactics and educational sciences and promote both elements to come to scientific self-conceptions that enable an intensified dialogue that strengthens their role and position in the teacher education system.

2 Scope and Relationships

Discussing the question of how the discourse in educational sciences regarding approaches of *professionalism in the teaching profession* (“Ansätze der Professionalität”) can be productive for the various subject didactics (“Fachdidaktiken”) and educational sciences and their relationship requires an understanding of how the two scientific fields interact and of their respective scopes. This understanding can be sharpened with recourse to aspects of the sociology of science, with a focus on subject didactics as an example (see 2.1). These basic assumptions can be used to introduce and discuss several localizations of subject didactics and educational sciences in the field (see 2.2) and the relations between the two elements (see 2.3).

2.1 Scope of Subject Didactics and Educational Sciences

In this paper, *educational sciences* (“Bildungswissenschaften”) are understood as a collective term for those disciplines and subdisciplines that refer to the topics, institutions, processes, and results of education (“Bildung”) and training in any possible theoretical, or methodological way (Terhart, 2012, p. 28); examples include education science (“Erziehungswissenschaft”), educational psychology, sociology of education, economy of

education, and other (sub)disciplines. A scientific discipline is understood as an institutionalized result of demarcations that can be identified by several characteristics, such as the existence of a scientific community, a body of scientific knowledge, current scientific problems that are addressed, a set of joint methods and paradigmatic problem-solving strategies, and typical paths for academic careers (Stichweh, 1979, 83). Using such categories, the individual scientific fields under the category of educational sciences can be identified as disciplinary, but the category of “educational sciences” itself cannot.

Coming from this definition of what scientific disciplines are in general, one definition of subject didactics is the science of subject-specific learning. Today, “subject didactics” marks an independent and institutionalized field of research that is theoretically and methodologically related to the corresponding scientific disciplines (“Fachwissenschaften”) and to educational sciences (Bayrhuber, 2012, p. 230). Subject didactics is the sum of these various subject-related sciences. For Heitzmann and Pauli (2015), subject didactics represents school subjects and learning fields as well as their protagonists in education and vocational training, research, and professional practice (“Berufspraxis”), while the various subject-related subject didactics refer to elements of teacher education as functional subsystems with specific subject-related problems and solutions. The European tradition of subject didactics is distinct from “Curriculum Studies” (Taylor & Bovill, 2017, p. 115) which developed earlier in the anglophone context: While the teacher is more or less absent in curriculum studies, his or her role is very important in the tradition of didactics (Westbury, 1998).

First, subject didactics developed as scientific (sub-)disciplines. Their increasingly disciplinary characteristics (see 2.1) have been pointed out since the turn of the millennium (Bayrhuber et al., 2011; Tenorth, 2012; Schneuwly, 2013; Criblez & Manz, 2015; Heitzmann & Pauli, 2015; Leuders, 2015). At the same time, Mangold and Oelkers (2000, p. 4) point out that the unsettled relationship between the scientific disciplines and education science allows for a wide range of approaches and methods within the different subject didactics themselves. However, these approaches and methods do not postulate an inner-subject consensus about what should and should not count as scientific. The epistemological status of subject didactics ultimately remains unclear (Timmerhaus, 2001, p. 14), which is also true of educational sciences (see above). A further demarcation regarding proximity to the profession is found in the international discourse. For instance, Schneuwly (2011) diagnoses French mathematics education as showing a “descriptive and explicative” understanding of subject didactics, moving away from an “interventionist” understanding. Here, subject didactics is a “basis for the experimental study of conditions of teaching and learning” (Schneuwly, 2011, p. 283). The dynamic coupling of the scientific discipline and the profession requires constantly new referentialities between the two areas (Criblez, 2014), and the approaching interdisciplinarity of sciences in general (Stichweh, 2014) points toward a scientific system in which subject didactics in particular find fertile ground for their disciplinary development. At the same time, subject didactics move about in an area of conflict between their own referential discipline and school practice. Subject didactics developed historically as both teaching practice and normative theory (Sandfuchs, 1990; Tenorth, 2006a), and optimizing discipline-related learning processes remains their pivotal feature to this day. If still seen this way, the question of what practical implications result from research findings belongs

to their disciplinary core, minimizing their distance from the application field (Heitzmann & Pauli, 2015, p. 187).

Second, subject didactics are positioned in an area of potential conflict between scientific reflection and teaching in schools in a specific way. The idea of subject didactics as the coordination point between society, school, and science developed very early (Jungblut, 1972). The “emancipated point of view” of certain subject didactics (e.g., in mathematics education) following their internationalization in the 1980s led to an expansion of scientific interest beyond its “former tight and traditional link to teaching and learning processes in school” (Gellert et al., in press) to cultural, political, socio-historical, and technical parameters. But subject didactics — as well as other disciplines — still face the notable challenge of developing a bridge between discipline and profession. Its specific challenge is to link subject-specific academic knowledge and the pedagogical field of action. In cases in which subject didactics focuses solely on this kind of mediation as its very own subject matter — and other orientations of subject didactics do exist — it does not strive for knowledge for its own sake. In these cases, subject didactics is not committed to a mode of distanced observation but to configuring teaching and learning processes and perhaps even to improving them (Tenorth, 2012, p. 14). Schnewly (2013) sees this mediation as a constructive, cultural process. This implies a constitutive area of conflict in subject didactics between theory (as a scientific system of statements) and practice (as situational action in school) and therefore the question of how mediation is possible, despite the dignity of theory on one hand and the dignity of practice on the other (Cramer, 2014). An important subject matter of subject didactics is the problem of mediation, when its task is seen as making complex scientific knowledge accessible to society, teachers, or other scientists (Bayrhuber, 1995, pp. 312–313). On the one hand, the various subject didactics might be criticized by their referential disciplines for being too distant from them. On the other hand, school practitioners might criticize subject didactics for not being relevant enough to what happens in teaching practice. As in all other disciplines concerned with acting professionals, understanding and explaining, which both take time, are endangered when subject didactics are called upon to supply swift solutions to problems of practice (Heitzmann & Pauli, 2015, p. 193).

Understood as *scientific disciplines*, subject didactics are confronted with divergent *tasks* (Timmerhaus, 2001, pp. 55–103). The German Education Council (1970) expected the various subject didactics to permeate the entirety of their related scientific disciplines. It was subsequently assumed that subject didactics defined themselves as *part* of those related disciplines. An expert analysis from the 1990s demanded that subject didactics be both research-oriented and focused on the vocational field. This (double) orientation was to be constitutive for the identity of teacher education (Terhart, 2000). A consensus regarding the subject matter of subject didactics is found in the provisions of the former Conference of the Chairs of the Professional Societies of Subject Didactics (KVFF, 1998, p. 14): Subject didactics address the selection, legitimation, and didactic reconstruction of learning matter, the defining and justification of the goals of education, the methodological structuring of learning processes, the adequate consideration of the psychological and social starting conditions of teachers and students, and the development and evaluation of teaching and learning materials. More recent provisions have not altered this basic view (e.g., Bayrhuber, 2012, p. 231). Leuders (2015, p. 216) describes research on the development of subject didactics as “characteristic” and —

crucially for this paper — expands its subject matter to research on the development, structure, and impact of subject-related competences and *research on teachers and teacher education* (“Professionsforschung”).

2.2 Localizations of Subject Didactics and Educational Sciences

Subject didactics and educational sciences cannot be defined as consistent scientific disciplines (see 2.1), either conceptually or in terms of their object of study; they are better understood as “group categories” with specific characteristics. Due to the lack of a unified definition, the relationship between the two group categories can be analyzed from several perspectives. Because of the dynamic development of their relationship and the complex and diverse institutional contexts of teacher education, it is very difficult, perhaps even reckless, to paint a unified picture of the relationship between the fields of subject didactics and educational sciences (Terhart, 2013, p. 148).

It is possible to discern *categorical* currents in subject didactics that can also be found in theoretical traditions of educational sciences (Bayrhuber, 1995) — subject didactics as sciences (e.g., at universities), in practical training (e.g., in professional development), as “ad hoc didactics” (e.g., spontaneous use of preconceived teaching material), or as “reduction didactics” (e.g., provision of simplified subject-related content for schools). If the relationship is defined *vis-à-vis personnel*, it can be seen that professors of subject didactics are expected to have multiple qualifications, even in the field of educational sciences (Timmerhaus, 2001, pp. 219–223; Leuders, 2015). Regarding the *sociology of science*, subject didactics can be understood as being in a cross-border position even while remaining an autonomous discipline (Bonati et al., 1991, p. 224). The traits of an autonomous discipline only began to arise around the turn of the millennium (Leuders, 2015, p. 216). These traits simplify the dialogue between subject didactics and educational sciences and open the possibility of their own disciplinary socialization. Regarding a *psychological* perspective as part of educational sciences, action based on subject didactics always depends on a solid foundation of subject-related knowledge (Heitzmann & Pauli, 2015, p. 193). Shulman’s (1986) concept of pedagogical content knowledge (PCK) refers to the entirety of a teacher’s didactic knowledge and not solely to that of a specific subject (Bromme, 1995). From an *institutional* viewpoint, subject didactics are usually assigned to their related scientific disciplines. Sometimes, however, they are assigned to educational sciences (Walm & Wittek, 2014). Depending on such conditions, subject didactics can be found to enter short- or long-term organizational alliances with related scientific disciplines and various educational sciences: “Indeed, it seems to us that it is almost impossible for an isolated researcher to grasp the complexity of the learning and teaching process” (Gruson & Forest, 2011, p. 302). Networking between subject didactics and educational sciences can be seen as an important matter (Heitzmann & Pauli, 2015, p. 191).

The relationship between *subject didactics* and *general didactics* (“Allgemeine Didaktik”) that has a specific tradition as a subdiscipline of education science, was originally supposed to be a complementary alliance (Klafki, 1963, p. 27), although it subsequently proved to be strained by controversy and disdain (Plöger, 1994, pp. 25–27; Timmerhaus, 2001, pp. 156–171; Plöger, 2009, p. 439). Subject didactics no longer sees its unifying concept in general didactics but in empirically founded models of teaching and learning processes (Terhart, 2005, p. 2). If research put forth by subject didactics is understood

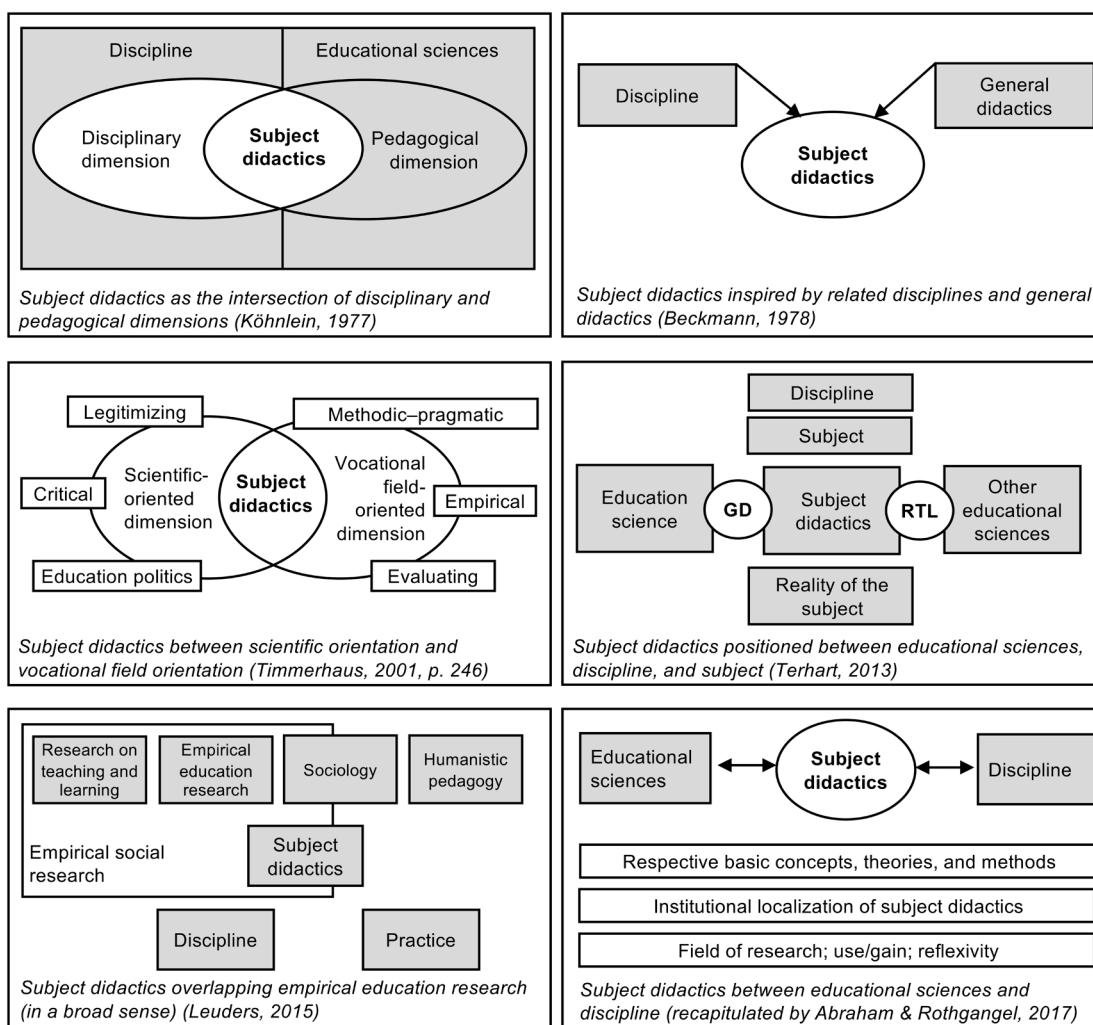
as “basic research inspired by use” (Stokes, 1997, p. 73) (e.g., design-based research), then it is positioned very close to use-inspired basic research on teaching and learning (Renkl, 2013). In this case, the contribution of subject didactics would be seen in the development of basic research regarding the various specific disciplines (Bayrhuber et al., 2012; Prediger & Link, 2012). This perspective has been criticized. Klette (2007, p. 149) makes the point that “studies of teachers and teaching detached from both studies of students’ operational learning and subject matter involved leave both sides unprobed”.

2.3 Relationships of Subject Didactics and Educational Sciences

In addition to the previous localizations (see 2.2), it is possible to propose *relationships* between subject didactics and educational sciences. From *the point of view of subject didactics*, its traditional tasks are understanding disciplinary learning processes, planning and structuring lessons, and reflecting one’s own theories and methods, whereas rehearsing teacher behavior and the choice of methods are tasks for education science (Timmermann, 1972, pp. 21–25). For Köhnlein (1977, p. 285), subject didactics is an “integration science” that utilizes disciplinary and pedagogical findings. Using physics didactics as an example, Nachtigall (1979, p. 38) shows that subject didactics as an “integration science” cannot be derived solely from either its discipline or educational sciences. Physics didactics adapts the methods and contents of other sciences and integrates them in an original way. For Timmerhaus (2001, pp. 148–149), subject didactics is situated at the center of all other occupational sciences (“Berufswissenschaften”), as it demonstrates both a science-oriented dimension and an occupational field-oriented dimension. It would fall behind current concepts of subject didactics to claim, as Zenner does (1990, p. 15), that the various subject didactics have developed as ever-clearer subdisciplines of their related scientific disciplines since the 1960s. Leuders (2015) sees subject didactics predominantly as empirical research, although it also includes scientific disciplines, humanistic pedagogy, and practice, thereby going beyond the realm of empirical educational research. For Abraham and Rothgangel (2017), subject didactics is traditionally found in an area of conflict between educational sciences and the related scientific discipline. However, they claim that this idea should be broadened, as it is unclear which elements of educational sciences and the related scientific disciplines and which basic concepts and theories are relevant for subject didactics. The most recent publications regarding this topic discuss, for instance, whether subject didactics could be defined by means of its transdisciplinary profile and whether its position should therefore be defined by *general subject didactics* (“Allgemeine Fachdidaktik”) as a meta-discipline of subject didactics (Frederking, 2017, p. 203).

From the perspective of *educational sciences*, Beckmann (1978, p. 218) sees the related scientific disciplines as reference sciences for teacher education on the one hand and the various subject didactics as vocational sciences on the other. The dignity of subject didactics is determined by its pedagogical ethos, which goes beyond its related scientific discipline. Following this perspective, the assumption of a close proximity between subject didactics and educational sciences defines subject didactics from an educational sciences perspective. Its proximity to pedagogy, whether as theory or practice, is thus seen as contaminating, at least when it comes to research. Subject didactics suffers from the

same problems regarding conceptualizing research questions from which education science as a whole suffers (Tenorth, 2012, pp. 14–15). Following Terhart (2013, p. 152), subject didactics developed from the practical element of disciplinary student teacher courses to an independent element of educational sciences and research-focused teacher education regarding content, institutionalization, and personnel. This development is also found in the international discourse, as evinced by the claim that subject didactics “developed into a recognized branch of educational sciences in Russia” (Rakhkockhine, 2011, p. 339). From this viewpoint, subject didactics is part of the broad field of educational sciences research (Terhart, 2013, p. 157). This relational definition of subject didactics sees empirical social research as its motor (Criblez & Manz, 2015; Heitzmann & Pauli, 2015, p. 188), but some representatives of subject didactics continue to define themselves through practice or normative theory (Duarte & Pereira, 2011, p. 335). Defining the relations of subject didactics and educational sciences is thus exceedingly complex and diverse (Figure 1).



Abbreviations: GD = general didactics, RTL = research on teaching and learning.

Figure 1: Relationships of subject didactics and educational sciences

To summarize, in the past, models describing subject didactics usually resorted to intersection models (e.g., between subject didactics and the related scientific discipline or educational sciences). Current models usually resort to relationships or referentiality.

The decline of intersection models may also be an indication of the increasingly independent state of the discipline of subject didactics. However, one must assume that there is still no definite and widely accepted answer to the question of how subject didactics relates to neighboring disciplines like educational sciences; the sheer number and diversity of models used to describe subject didactics makes this point. Of course, further descriptions could be used, but the six relations depicted in Figure 1 show both the variety of attempts to determine the relation of the two elements in different scientific traditions and their incompleteness.

3 Implications for the Relationship and for Teacher Education

In section 2. we discussed subject didactics and educational sciences as heterogeneous constructs, referring to various relations that can be found in the relevant literature. This outline and comparison of diverse models of the relationships will now be confronted and inspired by one possible theoretical perspective, the introduced theories of professionalism (see section 1.). As the examples above show, the disciplinary self-conception of subject didactics — if located between empirical research and practical implications — leads to several research methods, empirical approaches, and aims in the various subject didactics (Terhart, 2013, p. 159). Whether the various subject didactics are acknowledged by their reference disciplines (the related scientific discipline and educational sciences) is not enough to determine the degree of interrelations or even their disciplinary status (Tenorth, 2006b). It is also not useful to merely draw up requirements for personnel in subject didactics regarding their ability to build up interdisciplinary networks and other criteria, which are often not fulfilled in practice (Schmellentin, 2015). However, there could be theoretical concepts, terminologies, and research fields that would increase the common ground for a discourse between and within subject didactics and educational sciences. Below, we suggest the discourse on professionalism of teachers and teaching as one possible catalyst.

3.1 The Relevance of Professional Self-Conceptions for the Relationship

Subject didactics personnel undergo very different socializations, some in the academic field, others in practical teacher training, and still others as textbook authors. Communication between academic and practical personnel regarding subject didactics in everyday work is only partially possible. Different habitus prevail between and even within different subject didactics, but it appears crucial to have a clear professional self-conception to communicate between different actors in the scientific field. Occupational identity is an important prerequisite for the concentration of activities and for the systematic promotion of young researchers. Professional performance schemes comprise the knowledge and skills necessary to deal with typical issues of subject didactics that stem from different scientific disciplines and are acquired through the reflexive evaluation of one's own experiences (Heitzmann & Pauli, 2015, p. 191). The self-conception of subject didactics appears institutionalized when the professionals concerned are organized in professional societies and when publication media are developed with clear standards and the like.

For Heitzmann and Pauli (2015, p. 196), professionalism regarding subject didactics is found in the ability to link different complexes; namely, when questions of a subject didactic nature that result from teaching practice are to be dealt with against the backdrop of theoretical, historical, and empirical questions. They hold that if subject didactics distances itself from its core — identifying and dealing with its specific problems (e.g., questions of teaching methods) — it thereby retreats into a pre-disciplinary status. The same is true when subject didactics pursues questions associated with neighboring disciplines (e.g., questions of teaching quality) instead of focusing on questions germane to subject didactics. Corresponding preconditions could be formulated for educational sciences, although they are not the focus of our discussion here. We argue that implementing the terminology and research agenda of “professionalism” as one part of a scientific self-conception could go beyond simply satisfying the interests of different trends in subject didactics and educational sciences but still not become so abstract as to be describable only by meta-theory.

There is one crucial assumption regarding the self-conception of subject didactics: In its theoretical autonomy, subject didactics consists in the double nature of the knowledge system of subject didactics whereby autonomy does not mean autarky but self-sufficiency under terms of dependence and interrelation, not demarcation. Either subject didactics exists in this diverse structure of knowledge, or it does not exist as an independent discipline at all (Tenorth, 2012, pp. 16; also: Shulman, 1983). From a subject didactic point of view, while one side of the spectrum concentrates on analyzing and understanding learning stages and learning processes, the other concentrates on designing and changing teaching and learning processes (Prediger & Link, 2012, p. 29). Problems and research questions in subject didactics are not to be solved by retreating to one extreme of this spectrum but only by acknowledging the specific situation of the problem (Tenorth, 2012, p. 16). A self-conception that locates the awareness of such core problems as one dimension of professionalism would enable a close relationship with educational sciences that address similar research, such as work on the relation of theory and practice of scientific discipline and the scientific profession, on the sociology of science, or — especially — on the question of which strategies lead to a professional teacher in teacher education.

3.2 Subject Didactics, Educational Sciences, and Teacher Education

A meta and integrational scientific approach that interlocks the versatile poles and expectations of teacher education programs at universities is necessary to map efforts in subject didactics and educational sciences (Timmerhaus, 2001, p. 236). Building such a relationship, subject didactics (as a constitutive element of teacher education and as a scientific discipline) constitutes guidelines of the teaching profession that satisfy the multidimensional requirements of modern teaching realities (Timmerhaus, 2001, pp. 241–242). Referring to different theories of professionalism as outlined in the introduction (see section 1.) is one possible example of how an academic discourse can function as a base of joint research between subject didactics and educational sciences. There is particularly strong potential in the concept of meta-reflexivity, as it is an approach to professionalism that allows for combining the capabilities of those two and other approaches and relating different traditions of theory within and between the various subject didactics and educational sciences.

Professionalism understood as meta-reflexivity explicitly takes multidimensionality into account (Cramer et al., 2019). Several heterogeneous theoretical approaches and empirical findings regarding the teaching profession are the starting point of meta-reflexive teacher education. Students are encouraged to contextualize these findings and approaches to interrelate and critically analyze them. In this way, they can develop coherent (i.e., theoretical and empirical) paradigmatic typologies (i.e., exemplary and typifying interpretations) of the anticipated field of action. By referring to these paradigmatic typologies, students can develop interpretations of typical action situations in the classroom and school. Later, when working as teachers, they can refer to these typical action situations and come to situation-specific interpretations. Meta-reflexivity would therefore require students to recognize the respective axioms at the basis of each theoretical or empirical approach to questions of teacher education by subject didactics and educational sciences. This could support students in focusing on differences in the special traditions of both elements of teacher education and in each of its inherent paradigms and theories, as meta-reflexive elaborations could help them realize that theories do not have to be treated as mutually exclusive; rather, they can be treated as divergent perspectives on comparable challenges in school that face the complexity of the field of action.

Trivializing misconceptions of student teachers regarding the significance of studying subject didactics and educational sciences as an opportunity for their individual professionalization may be minimized through the *principles of meta-reflexive teacher education* (Cramer et al., 2019): a consistent multi-perspective view of the treated subjects (*multi-perspectivity*), consideration of the origin and axiomatics of a specific approach (contextuality), explanation of the mode in which scientific teacher training takes place (*meta-communication*), disclosure of the didactic program of the university (*transparency*), emphasis on the provisional nature of all knowledge (*alternativity*), assumption of a non-hierarchical relationship between perspectives (*independence*), addressing the added value of a critically constructive (i.e., distanced) view of school and teaching (*distance*) and disclosure of the selection criteria of sources (*obligation to justify*), and successively increasing complexity in studies (*dynamics*). Teacher education in subject didactics and educational sciences in the presented mode of meta-reflexivity can reduce the danger of students' seeing tension or conflicts between both elements of teacher education. Instead, students would understand that the respective contribution is *one* possible way of looking at the field of teaching practice. Meta-reflexivity also allows students to see the diverse approaches of professionalism to the teaching profession that is characterized by uncertainty (Cramer, accepted). Naive notions of subject didactics (e.g., as vocational training of master artisans) or educational sciences (e.g., as having the job to help students in case of classroom disturbance) can be replaced with evaluative or post-relativistic perspectives (Rosman et al., 2017).

3.3 Outlook

Finally, the aspects that can be taken up following the discussion regarding the dialogue between subject didactics and educational sciences are addressed. No definite determination of the *relationship* between subject didactics and educational sciences can be given. This is due to the varying self-conceptions within and between subject didactics and educational sciences. In light of the inherent multi-perspectivity of subject didactics

and educational sciences and the cultures within and between them, it is necessary to *keep the process of determining this relationship open* and tentative. To assume that the development of this relationship is completely uniform is illusory and neglects the reality of the scientific system (Terhart, 2013, p. 162).

Consequently, an *interdisciplinary dialogue* is needed (in) between the different subject didactics and educational sciences. It can be inspired by research on teachers and teacher education. Ideally, “professionalism” can serve as a transdisciplinary concept of structure and so merge parts of subject didactics with parts of educational sciences into a new research approach that has advantages over the individual approaches. Development research in subject didactics could be situated here (Prediger & Link, 2012); it combines a traditional perspective of research in subject didactics with research in educational sciences on teaching and learning. The disciplinary character of subject didactics can be defined as the intersection of theoretical-empirical development of knowledge on the one hand and the reflection of practice on the other (Schneuwly & Vollmer, 2017, p. 40). What is typical for subject didactics is therefore domain-specific and found between science and the vocational field; subject didactics fill a gap in the spectrum of scientific disciplines, but they are even more powerful if they refer to what educational sciences can contribute, for instance further research methodology.

Approaches to professionalism that originate from educational sciences (see section 1.) have potential because they constitute a *neutral horizon for transdisciplinary perspectives*, while the scientific disciplines are dyadically related to their (own) subject didactics and therefore cannot overcome their own disciplinary boundaries. The different approaches illustrate the inherent openness in modelling teachers’ professionalism; they are theoretical and empirical, highly accessible, and refer directly to questions of teacher education. Coming from transdisciplinary concepts like professionalism, corresponding research can inspire communication (in) between subject didactics and educational sciences. In this way, common ground can be identified despite highly diverse trends and perspectives. Research on professionalism can act as a binding agent. Approaches to the professionalism of teachers can be consulted by subject didactics about where, for example, reflexivity or professional competences for practice lie from a professional point of view. Meta-reflexivity can offer an opportunity to mediate between the contributions of subject didactics and educational sciences to teacher education, because it can accept different approaches side by side as constitutive elements of teacher professionalism.

A *place for transdisciplinary exchange* is vital to enable networking between the different subject didactics and educational sciences at the university. One approach could be to promote young researchers by offering qualification opportunities vis-à-vis research methods or examination of the disciplinary self-conception. It appears to be important to use existing networks and develop concepts in close cooperation with the relevant subject didactics and educational sciences. Similarities in content or methodology worth pursuing may emerge between *some* subject didactics in research projects and doctoral theses. A common core of *all* subject didactics may emerge structurally, such as a commitment to teaching and researching questions of teacher education. In this respect, a content-related focus on supporting young researchers may be fruitful.

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