



RISTAL

*Research in Subject-matter
Teaching and Learning*

Rothgangel, M. & Vollmer, J. (2020). Towards a Theory of Subject-Matter Didactics

RISTAL 3 / 2020

Research in Subject-matter Teaching and Learning

Volume 3

Citation:

Rothgangel, M. & Vollmer, J. (2020). Towards a Theory of Subject-Matter Didactics. *RISTAL*, 3, 126–146.

DOI: <https://doi.org/10.23770/>

ISSN 2616-7697



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Towards a Theory of Subject-Matter Didactics

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Abstract

The article outlines a new scientific approach developed under the title of “General Subject Didactics”. This concept is based on the existence of several scientific disciplines that can be called “subject-matter didactics” (or short: subject didactics). These are linked to certain domains like biology or mathematics and to respective school subjects.

General subject didactics can be defined as the theory of subject didactics. It observes and reflects how the individual subject didactics explore subject-specific teaching and learning. This is done both by top-down reflections and by bottom-up comparisons. 17 subject didactics in Germany are compared on the basis of six impulses, leading to new insights, e.g. on the reference sciences of subject didactics or the sources and selection of subject content.

The article develops further perspectives on the usefulness of this innovative theory as part of the philosophy of education, nationally and internationally.

Keywords

Subject-Matter Didactics, Subject-Specific Teaching and Learning, General Subject Didactics, Philosophy of Education, Comparative Approach

In Germany and many other parts of Europe we encounter the existence of what are called “Fachdidaktiken” (“subject-matter didactics” or short: “subject didactics”) as academic disciplines which are responsible for the research and development of subject-specific teaching and learning within school and beyond¹. There are more than 25 different subject didactics (at least in Germany) such as “Biology didactics” or “Mathematics didactics” (German: “Mathematikdidaktik”). The latter term is often translated into English as “mathematics education”. This is potentially misleading as it can be confused with the *practice* of mathematical teaching and learning in the classroom. The concept has therefore been extended by many scholars to “mathematics education research” accordingly. In Europe, however, except in the UK so far, we would mainly refer to the scientific study of a content area such as mathematics (corresponding to a school subject) as “didactics”, not didactics in general (as a general approach), but as “subject-specific didactics”, in this case “Mathematics didactics”².

¹ We are grateful to our colleagues Horst Bayrhuber, Volker Frederking and Werner Jank for their helpful comments and suggestions.

² In certain parts of Europe like Scandinavia the term “disciplinary didactics” is preferred by some scholars.

Since this article deals with the “theory of subject-matter didactics” across all individual subject didactics in existence, we first have to define the central notion of “subject-matter didactics” in yet more detail, because the research of subject-specific learning and teaching is structured and named differently in different parts of the world. At the same time we have to distinguish this approach from that of didactics in general (“Didaktik” or “Allgemeine Didaktik”), as it is called in Germany, which looks back on a long-standing tradition, but has been in a “crisis” for some time, according to its own self-perception (Meyer, Prenzel & Hellekamps 2009).

1 “Subject-Matter Didactics” and “Didactics” – International Perspectives on multi-faceted terms

The term ‘Subject-Matter Didactics’ and the different individual content- or subject-specific didactic research areas such as Biology didactics, Mathematics didactics or Geography didactics are well established within many parts of Europe: they have been strongly reinforced and developed over the last two or three decades, as e.g. the significant quantitative and qualitative increase in empirical studies shows (Rothgangel 2020, 528-530; Schomaker & Tänzer 2020; Schreiber & Hasberg 2020). They deal with the What (the relevant content or subject-matter), the Why (the goals and their legitimation) and the How (the specific methods appropriate and successful) of subject-specific teaching and learning above all in school, but also outside the school context, e.g. in museums, in enterprises or the public media. The individual subject didactics (thus) describe, analyze and theorize subject-specific teaching and learning in all its forms including the relevant societal as well as anthropological conditions.

The more general concept of “*Didaktik*” (as the German term reads) has a long-standing history which has been called “the German Didaktik tradition” by some international scholars like Westbury, Hopmann & Riquarts 2000 or Deng 2018, for example. Didactics does not really deal with subject-specific issues in-depth, but rather uses these to exemplify general principles or relationships within the triangle consisting of “teacher”, “learner” and “content” or “individual”, “school” and “society”. Nevertheless, there are many different theoretical approaches for modelling teaching and learning in school as such, two of which are more prominent (at least in Germany), namely an approach modelled on the basis of a particular learning theory (Heimann, Otto & Schulz, 1965/1979), and secondly, an approach based on the importance of relevant “problems” to be dealt with in school and the centrality of “Bildung” (as a personality oriented education) (Klafki 1994, cf. Hopmann 2000).

Interestingly enough, the terms “*Didactics*” and “*Subject Didactics*” are widespread within Europe (except in the UK³): not only in Germany (cf. Terhart 2009, Meyer 2012, Vollmer 2007), but, for example, also in France (cf. Brousseau 2002, Chevillard 2007,

³ In the UK the term “subject didactics” appeared in connection with a project of the European Union on the “Capabilities approach in Geography Education” (GeoCapabilities 2016; see also Lambert 2014).

2010, Ligozat et al. 2014, Sensevey 2011, 2012)⁴ or in Switzerland (cf. Schneuwly 2011; Dorier, Leutenegger & Schneuwly 2013), in Russia (Rakhkochkine 2011), in Poland (Konieczka-Śliwińska 2016), in the Czech Republic (Vondrova 2019) and in large parts of Scandinavia (cf. Klette 2007, Gundem 1992, 2008, Kasanen 1995). Here some scholars even use the original German notion “*Didaktik*” in their research (like Uljens 2009 or Kasanen & Pepin 2005) or they speak more of “disciplinary” (instead of “subject-matter”) didactics nowadays (Krogh, Qvortrup & Graf, to appear). In Italy, Spain or Portugal the terms “*didattica*” or “*didáctica/didáticos*” respectively are known and used, but it remains a task for future research to find out what kind of theoretical or empirical studies exist in the different subject-matter didactics.

The attempts to identify and overcome fragmentation and to find common ground for a joint European research perspective in this area are strong and well under way, which is exemplified by research networks such as EARLI (European Association of Research on Learning and Instruction) or others within the European Educational Research Association (EERA) with its annual European Conferences on Educational Research (ECER), especially Network 27: “Didactics – Learning and Teaching” (cf. Hudson & Meyer 2011; Ligozat & Almquist 2018b and the many individual publications resulting from that project including attempts to stretch out for a new debate with the rest of the world, namely North America; cf. Krogh, Qvartrup & Graf in print; Ligozat, Almquist, Klette & Rakhkochkine to appear).

Against the background of a such a wide understanding and spreading of didactics and subject didactics in many European countries, one has to acknowledge that in the UK and most of the (other) Anglophone research communities, but also in the Netherlands, for example, a different meaning of didactics and of didactic thinking or action prevails: the term itself is hardly used there at all, and if so it relates to “teaching methods” only (often with a pejorative connotation as relating to low level learning, to pure instruction or the transmission mode of teaching, according to both the Oxford and the Longman dictionary). This narrow view of didactical or didactics in the Anglo-Saxon world might be slowly changing, however (cf. the latest edition of the *London Review of Education*, Volume 17). In the following we will refer to the dominant European discourse on Didaktik/didactics and subject didactics and base ourselves on the wider use of this term and its meaning.⁵

As previously indicated, the term subject didactics itself is not a genuine concept of the English language; it does not denote a specific theoretical understanding or express semantically what is understood by it or associated with it beyond the Anglo-Saxon (language) space (cf. Westbury 2000, Hopmann 2007). Yet we need a term for the international exchange and communication on the topic and the many issues related to it. So “subject(-matter) didactics” is a first attempt to translate the German term

⁴ In France, we have to distinguish between the descriptive terms “*la didactique/les didactiques disciplinaire(s)*” and the specific theoretical notion of “*Le didactique*” as a collective concept.

⁵ From here on we will be using the Anglicized form “didactics” and “subject didactics” which are more and more prominent and wide-spread for cross-cultural communication on the topic, at least within Europe, instead of the German labels “*Didaktik/Fachdidaktik*”.

“Fachdidaktik” into English as a means of facilitating scientific communication worldwide, using English as a “lingua franca”: it is a linguistic paraphrase for what is usually thought of differently within the Anglo-Saxon communities, namely a theory of teaching and learning in different content areas. Most likely, among English-speaking scholars, the notion “didactic” does not contain the notion of goal setting, the selection of teachable content along plausible or scientific criteria or the evaluation of results and achievements, measured against personal aims, collective expectations or societal demands. Lee Shulman’s notion of “Pedagogical Content Knowledge” (PCK) comes closest to the meaning of subject didactics, but as much as it tries to bring content, pedagogical considerations and teaching methods together as a central knowledge area in the mind of a teacher, it does not capture enough of the interactive nature of planning, teaching, learning and evaluation process along defined goals and areas of subject-based knowledge building (cf. Vollmer & Klette, to appear).

After these necessary terminological considerations, which are linguistic as well as theoretical in nature, we would like to go one step further and present the notion of a general subject didactics (GSP; “Allgemeine Fachdidaktik” in German). This concept arose out of the need to compare and generalize different subject didactics as to their structures, research procedures, practices and theoretical insights, in an effort to formulate what is common to them and what their distinctive differences are. Thus GSP can be defined shortly as a *Theory of Subject Didactics*: looking at the different individual subject-matter didactics from a higher level of observation and bringing them together under theoretical perspectives – without losing sight of given distinctions.

2 General Subject Didactics: Concept, Development, Methodological Procedures

Within Germany the research approach called General Subject Didactics (*Allgemeine Fachdidaktik*) has developed and established itself in the last ten years within the context of the “Association for Fachdidaktik” (*Gesellschaft für Fachdidaktik*, GFD), the umbrella organization for all the individually specified subject-matter didactics (with 27 members so far). This approach was developed and introduced through the efforts of a research group consisting of six scholars from five different subject didactic backgrounds: Biology Didactics (Horst Bayrhuber), German Didactics (Ulf Abraham, Volker Frederking), English Didactics (Helmut Johannes Vollmer), Music Didactics (Werner Jank) and Didactics of Religious Education (Martin Rothgangel). They tried to reflect on the achievements and the deficits of the individual didactic disciplines, on their commonalities and differences and on ways of modelling the results of these empirical and theoretical studies. In spite of the fact that GSD is a fairly young scientific theory, there are already two major book publications on the market (Bayrhuber et al. 2017 and Rothgangel et al. 2020) alongside a number of contributions in article form describing and explaining the approach (e.g. Bayrhuber et al. 2018; Frederking & Rothgangel 2019), some of which are available in English (e.g. Vollmer 2014) or French (Vollmer 2013).

The observation that the bulk of more recent research within the various subject didactics was no longer being processed concretely or taken into account by scholars of didactics, was one of the reasons for the establishment of General Subject Didactics. In that sense GSD assumes a task that was or is insufficiently performed by didactics as a branch of education research (but cf. Meyer 2016). The word 'general' within the term General Subject Didactics refers to the act of comparing and generalizing the subject-specific findings and theories of the many different subject didactics themselves, while taking their subject-related peculiarities into account as well (Rothgangel 2020c). General Subject Didactics thus follows a logic that maps the interplay of top-down reflections and bottom-up analyses, focusing on learning (and teaching) within and beyond the different school subjects and on the specific theories about subject-based learning that one or the other subject didactics had already developed about it (Rothgangel & Vollmer 2017).

Our first publication of 2017 (Volume 1 of “Allgemeine Fachdidaktik”), for example, contained a number of top-down reflections on the following topics: „Allgemeine Fachdidaktik im Spannungsfeld von Fachdidaktiken und Allgemeiner Didaktik“ [Relationship between Subject Didactics and Didactics in general] (Rothgangel 2017a), „Allgemeine Fachdidaktik im Spannungsfeld von Fachwissenschaft und Fachdidaktik als Modellierungswissenschaft“ [Relationship between Academic Disciplines and Subject Didactics as a modelling science] (Bayrhuber 2017) and „Allgemeine Fachdidaktik – Metatheorie und Metawissenschaft der Fachdidaktiken“ [GSD – Metatheory and Meta-Science of Individual Subject Didactics] (Frederking 2017).

Regarding these theoretical reflections, the philosophy of science by Niklas Luhmann (1992) has proven helpful, particularly his distinction between three levels of observation (Luhmann 1992, esp. pp. 274, 508–512; cf. Rothgangel 2014, 2017a). Applied to the topic of subject didactics, the three levels can be understood as follows:

- first order observations are, for example, (self-)observations of teachers and pupils in subject-specific teaching and learning processes,
- second order observations are, for example, systematic observations within subject didactics, in which the observations of different teachers and pupils in subject-specific teaching and learning processes are observed and researched on their part,
- third order observations are, for example, research on the level of General Subject Didactics, where the observation is now directed towards the respective research and theory-building as done within different subject didactics, reconstructing how they arrive at that their results through observing the subject-specific teaching and learning processes taking place in the classroom.

These different levels of observation according to Luhmann and then applied to Subject Didactics can be illustrated as follows (see Figure 1):

Luhmann (1992)	Observers on the first level observe something or someone	Observers on the second level observe observers on the first level and their observations	Observers on the third level observe observers on the second level and their observations
Applied to Subject Didactics	Subject-matter teaching and learning (first order observations: Subject Education)	Theories of subject-matter teaching and learning (second order observations: Subject Didactics)	Metatheories of subject-matter teaching and learning (third order observations: General Subject Didactics)

Fig. 1: General Subject Didactics in view of Luhmann (1992); cf. Rothgangel 2020a, p. 19.

As to the second layer of Figure 1 (application to subject didactics), the three different levels involved can be paraphrased in a simplified way, they are: 1) subject-specific teaching and learning within the classroom on the one hand, 2) the theories developed by subject didactics about these on the other hand and finally 3) the theories produced by general subject didactics about the existing subject-didactic theories. Their hierarchical structure can be shown in an illustrative diagram (see Figure 2):

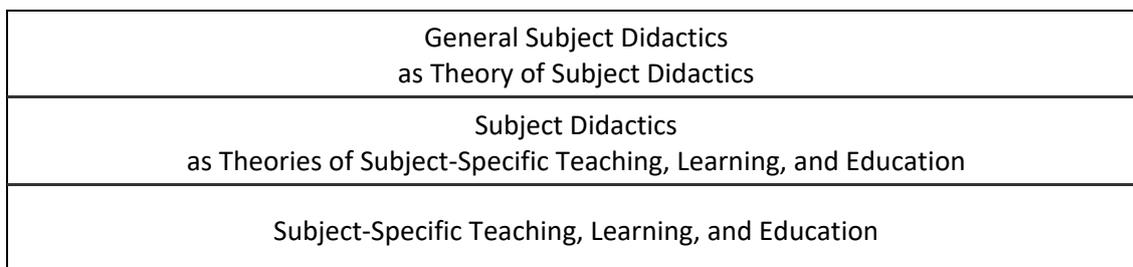


Fig. 2: Three levels of didactic activities (from the classroom to general subject didactics)

Concurrently with the theoretical approaches mentioned above, empirical bottom-up analyses in comparing the different subject didactics also formed the second, equally important basis for developing GSD as a generalized theory of subject didactics from the start. Volume 1 of “Allgemeine Fachdidaktik” therefore already included this second research approach as a complementary avenue: it compared the five different subject didactics represented through the members of the work group by using the Grounded Theory as a qualitative research method in which comparison plays a fundamental role (Rothgangel 2017b; Strauss & Corbin 1996).

At a later stage, we continued with this bottom-up approach and extended it in order to gain more specific information. Accordingly, the following three topical areas and the six impulses listed were used for self-reports and comparative analysis of the different subject didactics (cf. Rothgangel 2020a, p. 15-16):

Historically significant contexts, developments in the subject and its related subject didactics

1. *History and defining of the subject-matter*
2. *Origins and development of the specific subject didactics*

Learning within the subject and its scientific study

3. *Goals, content and competences of the subject*
4. *Perspectives of didactic research and development*

Learning beyond the subject area and researching it

5. *Linking content across subjects and generalising subject-specific competences*
6. *Networking research in subject-matter didactics*

Ultimately, the six impulses related thematically to the three main areas of investigation in Volume 1, but these were now further differentiated in order to capture more of the specifics of each school subject and of the respective subject didactics. So the subject-specific self-reporting had to focus on subject-matter issues on the one hand (impulse no 1, 3 and 5) and on research within the corresponding subject didactics on the other hand (impulse no 2, 4 and 6). These reports were produced by key representatives of the respective subject didactics themselves; the resulting text corpus was then analysed in-depth, providing the data base for Volume 2 as well as for this article. The method of analysis was again the Grounded Theory, in particular open and axial coding.⁶

It should be noted at this point that the impulses listed were deliberately limited in scope. They were chosen in a selective, exemplary manner so as to highlight some important sections of the various subject didactics and the discussions and work done within these areas. In this way, a basis for comparison was formed which was manageable overall in size – independent of possible extensions in the scope of issues to be included for later comparisons which are already planned for and will follow. At the same time, Volume 2 also expanded the number of subject didactics involved, so that a total of 17 subject-specific texts were produced: they came from Biology Didactics, German Didactics, English Didactics, Music Didactics, Didactics of Religious Education, Chemistry Didactics, Geography Didactics, History Didactics, Computer Science Didactics, Art Didactics, Mathematics Didactics, Physics Didactics, Didactics of Political Education, Didactics of Elementary Science and Environmental Studies⁷, Sports Didactics, Technology Didactics and from Economics Didactics. These formed the basis for the current comparison.

The following presentation of some selected results from this comparison illustrates the strength and productivity of a bottom-up analysis and shows how subject didactics operate within themselves and across disciplines which otherwise could not be accessed easily, if at all. This analysis was done again by using the Grounded Theory, as

⁶ The concrete methodical procedures cannot be outlined here in detail for reasons of space; but see the basic descriptions of procedures in Rothgangel & Saup 2017 and Hermisson & Rothgangel 2020.

⁷ This school subject is called “Sachunterricht” in German and is particularly difficult to render in English, since it is a fairly new and highly integrated area of study in primary school, anchored in a holistic view on local conditions and experiences which are transformed into a scientific understanding of the world. In addition, it is a very culture-sensitive subject.

already applied in Volume 1 of GSD and now with more depth and precision in Volume 2. From a methodological point of view, it should be noted, however, that the Grounded Theory is only one method of comparison among others in terms of bottom-up procedures available.

3 Comparison of Individual Subject Didactics: Selected Results

The selected results presented in this article are summaries from the comparative research described in German, based on the impulses 2, 3, 4 and 6, as mentioned above (for details see Rothgangel 2020b). The four sections following are intended to illustrate the procedures taken and the quality of findings gained and thus to underline the powerful potential of comparisons for subject didactic theory-building as such.

3.1 *Development and Establishment of Subject Didactics*

A comparison of the 17 texts shows first of all that subject didactics essentially originated under very diverse historical circumstances, namely between the era of Enlightenment (e.g. Didactics of Religious Education, cf. Riegel & Rothgangel 2020) and the 1990s of last century on the other side (Computer Science Didactics, cf. Magenheimer & Romeike 2020). The process of establishment took place step by step and it was typically marked by such events as the first systematic appearance of didactic publication(s) (in English Didactics, cf. Vollmer & Vogt 2020) or with the founding and institutionalization of a first professorship (in Mathematics Didactics, cf. Reiss et al. 2020).

In addition, three factors could be identified, which had a positive effect on the development and establishment of subject didactics (see Rothgangel 2020b, p. 491-494): First, specific conditions in time (e.g. Enlightenment, turn of the century around 1900, Sputnik shock and the 1970s as a decade of reform), secondly, certain favourable institutional circumstances (establishment of subject didactics at universities, founding of subject didactic associations, founding of the Institute for the Pedagogy of Natural Sciences, IPN, in Kiel) and thirdly the influence of important persons (e.g. Wilhelm Viëtor for foreign language didactics, cf. Vollmer & Vogt 2020; Leo Kestenberg for music didactics, cf. Jank, Knigge & Niessen 2020; Johann Amos Comenius for various subject didactics).

The outstanding importance of Johann Amos Comenius (1592-1670) should be underlined once more. The fact that Comenius is explicitly mentioned in the historical reviews of the Didactics of Biology, Chemistry, Art, Physics as well as in the Didactics of Elementary Science and Environmental Studies (German: "Sachunterrichtsdidaktik") is one of the remarkable findings of these comparative analyses (Rothgangel 2020b, p. 493-494). The significance of Comenius for chemistry didactics, for example, is explained in the following words: "More than anyone else J. A. Comenius has influenced many generations with his work, in which he dealt with the process of teaching and learning about the natural sciences in a very nuanced way". (Parchmann & Ralle 2020, p. 55) But Comenius is also appreciated outside the natural sciences, as evidenced in this statement from the field of Art Didactics: "Beginning with Johann Amos Comenius in the 17th century pedagogical considerations occur which link the act of drawing

with the development of imagination, with the senses and the memory and which consider it at the same time as preparation for writing” (Kirchner 2020, p. 208). As this illustrates, Comenius can thus be described not only as the 'founding father of didactics' (Meyer 2016, p. 57), but also as the '*founding father of subject didactics*' (Rothgangel 2020b, p. 493), since he provided important impulses for the various didactic fields or disciplines. In this respect, future historical didactic research could look for more and other early traces of educative, subject-specific thinking or reflections about personal or practical “Bildung”. And in doing so they could further pursue the question of the relationship between (general) didactics and subject didactic considerations, not only in the work of Comenius, but also in that of others.

3.2 Content of the School Subject: Sources and selection

The analysis of the five school subjects in Volume 1 has already revealed the following four sources for choosing subject-specific content: Academic disciplines, subject-matter practices, societal demands and requirements and anthropological aspects. It was by no means self-evident that this result would be confirmed in principle by Volume 2 (with slight modifications only), yet this is exactly what happened: so the following four sources of content selection for subject-specific teaching and learning emerged again from the comparison of the 17 subject descriptions (Rothgangel 2020b, p. 506-509):

- Academic disciplines (e.g. literary analysis in German as a mother-tongue; cultural studies in foreign languages),
- Practices in the subject-matter area (e.g. reading and writing in German or other languages, religious rituals in religion, activities in music or sports),
- Subject-related societal, cultural and every-day life contexts (e.g. religious individualisation and pluralisation in religion, pop culture based on the use of English),
- Subject-related anthropological aspects (e.g. identity issues in religion or foreign language learning).

It should be added, however, that these four sources are by no means equally important for all the subject didactics or equally distributed among them. Rather, as documented in the different contributions of Volume 2, the subjects accentuate and weigh these four sources unevenly, certain aspects or considerations lead to distinct decisions within individual subject didactics. For example, referring to the respective academic disciplines has a very different relevance for Physics Didactics than for Computer Science Didactics, as will be illustrated under Impulse 6 in more detail. In some cases subject didactics has to make up for a certain missing academic content and provide those areas of knowledge themselves (e.g. Vollmer 2017b, p. 103).

In contrast to the previous point, where the results of 2017 and 2020 were very similar, the analysis of other issues such as the selection of content led to more nuanced findings, when looking at the texts of the 17 subject didactics studied, in comparison to the evaluation of only five subjects in Volume 1 (see Rothgangel 2020b, p. 509-512):

The interesting result was the insight that the selection and structuring of content can focus on either the academic discipline (example Biology) or on practices within the subject (example Music) or on both at the same time (academic disciplines as well as common practices like (hand) writing in German as a mother-tongue, for example) (Rothgangel 2017b, p. 140). With the addition of further subjects and subject didactics under scrutiny and more diverse texts to look at, it became clear that, in principle, each of the four sources of subject-specific content can equally have an influence on or determine the selection, transformation and structuring of the subject-matter to be taught in school. There are different ways in which two sources (e.g. 'academic disciplines' and 'subject-related socio-cultural contexts') can be related to one another or mediated with each other: e.g. the starting point could be either academic disciplines or it could be subject-related socio-cultural contexts, but the actual form of integration or rather mediation between both seems to be equally important (e.g. Schecker 2020, p. 300-301). Other variations are also possible. In the subject descriptions presented so far, however, we do not find a mediation model for *all* the four sources simultaneously. But nevertheless, in addition to sometimes turning towards 'general' didactics, there are interesting solutions offered in the texts for the problems of selecting content within individual subject didactics (cf. Reiss et al. 2020, pp. 241-242; Magenheimer & Romeike 2020, pp. 188-189). These could also be of relevance for other subject didactics, if they only knew about them. Generally speaking, the selection of subject-specific content for teaching proves to be a core issue for subject didactics (as it is for 'general' didactics). This insight could in turn lead to a revived exchange between the two: subject didactics and didactics 'in general'. The present findings clearly indicate that the subject-specific concerns about the selection of subject content have been insufficiently taken into account in previous theories of general didactics – a result that had already shown in Volume 1 (Rothgangel 2017) and which is now confirmed in the second round of analysis.

3.3 Development, Conditions and Formats of Subject Didactic Research

Concerning this important area of comparison (based on impulse no 4), again only a few exemplary results can be presented here because of limited space. We will concentrate on the positive developments of research in subject didactics and on the conditions supporting it as well as on the research formats which have developed over time and which are available nowadays.

The enormous progress achieved in subject-didactic research is well reflected and documented in the 17 subject-specific contributions. This can particularly be observed in the increase of demanding research projects with complex designs as well as in the presence of empirical expertise. This empirical orientation follows the previously dominant phase of developing materials largely on the basis of experience only and giving didactic recommendations in combination with designing abstract theoretical concepts. However, theoretical work and pragmatic approaches are by no means completely superseded or replaced by empiricism. To a certain extent, the existence of Volume 2 (of General Subject Didactics) could be seen as a proof for the fact that theoretical and empirical approaches of research can complement each other in a productive way: So there are good reasons why General Subject Didactics can be defined as a

basic theory of subject didactics, as stated earlier (Frederking 2017; Rothgangel 2017). Reflections and ‘observations’ can be carried out either theoretically or data-based, with an empirical approach, as both the descriptive and the analytical parts of Volume 1 and Volume 2 show.

In addition to these methodological considerations the significance of factors influencing research also emerges once more, as was the case before (with the previous impulses in 2017): especially the impact of third-party funding, of public research agendas and of activity priorities within (subject-)didactic associations could be identified as important factors, in addition to the demands and effects of internationalisation (Rothgangel 2020b, pp. 531-533).

As to the different formats of subject-based didactic research, the following table could be of considerable relevance for the systematisation of subject didactic research in the future (see Figure 3. below): As early as 2016 the “Association for Fachdidaktik” (*Gesellschaft für Fachdidaktik*, GFD) already provided an important impulse for the cross-disciplinary discussion about such “formats of research in subject didactics” (cf. GFD 2016). However, the individual descriptions of the different subject didactics do not show any consensus under this heading. Such a consensus has yet to be found on this important topic, which is both fundamental for the self-definition of subject didactics and complex in nature. Roughly speaking, there are two basic trends: On the one hand, formats can be more or less equated with certain methodological approaches applied in didactic research, but the term ‘formats’ can also be understood, on the other hand, as more than ‘just’ methodological approaches, namely as research areas (cf. GFD 2016; Krüger et al. 2014).

On the basis of both trends, as analyzed in Volume 2, an integrated proposal for organizing and representing the formats of subject didactic research was developed, which will be discussed below: Even if it is true that methodological approaches cannot be clearly separated from each other and that they usually do not occur in distilled form, they have a certain ‘framing’ or ‘formatting’ effect on the research done in subject didactics, so that empirical studies, for example, can be distinguished in principle from historical or theoretical studies etc. This does not contradict with the fact that combinations of different research methods can be applied and are usually applied, depending on the research question(s) stated. However, a clear tendency or preference and thus a certain strength in one or the other methodological orientation normally becomes obvious and is often dominant: This is precisely what is meant by a ‘frame’ or by ‘formatting’ in the original sense. Therefore, those publications which equate the types or ‘formats’ of subject-didactic research with methodological research approaches or preferences are justified within certain limitations. Nevertheless, one cannot deny that the respective research areas within a subject can also have a ‘framing’ or ‘formatting’ effect, as indicated above. Data collection and processing methods or interpretation procedures may vary greatly depending on the respective research area in question (such as teachers as a study object versus primary school pupils or attitudes towards self-efficacy versus achievement testing, for example). In short, it seems necessary to

give an equally fundamental function to content areas as objects of study as to research methods chosen.⁸

3.4 Interdisciplinary Dialogue Partners of Subject-Matter Didactics

The responses to the last impulse no 6 "Networking research in subject-matter didactics" (see above) brought results which had already shown up similarly after the fourth impulse regarding the reference disciplines of subject didactics. In both cases, the analysis of the subject-specific self-reports reveals four constitutive interdisciplinary dialogue partners or reference disciplines across all subject didactics (see Rothgangel 2020b, p. 567):

- academic disciplines,
- other subject didactics,
- educational science,
- empirical educational research.

One result of this analysis might be particularly striking: Why do many reports distinguish between educational science on the one hand and empirical educational research on the other?

Indeed, the empirical dimension can be understood as part of all educational sciences, as much as the different theoretical approaches or dimensions; so why emphasize the label "empirical" for one particular sub-section of that field? At least in Germany, there is a tendency mainly of representatives from educational psychology, particularly those with a quantitative expertise, to claim a strict and cohesive handling of empirical orientation in research for themselves. They are also the ones who often take over certain posts (professorial chairs) within education faculties. This is sometimes perceived by colleagues from the educational science as a confrontation or even as a "hostile takeover", with educational psychology, for example, being seen as a competitor. Besides those tensions in appointment committees and career policies, this difference can also be observed on the organisational and representational level: In addition to the long established "German Association for Educational Science" (*Deutsche Gesellschaft für Erziehungswissenschaft*, DGFE), a new association entitled "Association for Empirical Educational Research" (*Gesellschaft für Empirische Bildungsforschung*, GEBF) was recently founded, reflecting once more this division. Such self-definitory reasons or institutional backgrounds could have played a role in the reports on reference disciplines in subject-related didactic research, which in the comparative analysis resulted in the present distinction between educational science on the one hand and empirical educational research on the other hand.

⁸ In the meantime, these ideas have been further developed. A significant result is that, in addition to research methods and content areas, also the reference theories chosen have a formatting effect on the types of research in subject didactics (Rothgangel & Riegel 2020).

Overall, it is remarkable how many reference disciplines are mentioned as dialogue partners for the different subject didactic activities, although some list more than others. It should be noted, however, that *not* mentioning a certain reference discipline in the subject-specific reports of Volume 2 does not mean or imply irrelevance of that particular discipline.

Another category of interdisciplinary dialogue partners is also relevant for subject-matter didactics, the so-called “contingent” reference disciplines. These are mentioned only sometimes as additional dialogue partners, for example ethics (cf. Biology Didactics), media studies (cf. Computer Science Didactics) or neurosciences (cf. English Didactics) (in detail *ibid.*, pp. 575-576). Depending on the topic and the research question(s) of the projects, their role can vary in terms of relevance and impact, but they do not necessarily play a central role for a specific subject-matter didactics over a longer period of time. Therefore, cooperation can vary considerably in intensity and time span.

So far, existing theories of subject didactics as well as didactics in general have not sufficiently taken this distinction between constitutive and contingent interdisciplinary dialogue partners into account. One reason for this could be the fact that they operate on a rather abstract level and with fixed reference disciplines of subject didactics in mind, but that they do not really look concretely enough at the existing research practices in modelling their metatheory. The research reality is often more complex, diverse and dynamic than imagined by abstract and deduced modelling on theoretical grounds only.

The distinction between constitutive and contingent reference disciplines of subject didactics can be visualized again through an illustrative graph (see Figure 3):

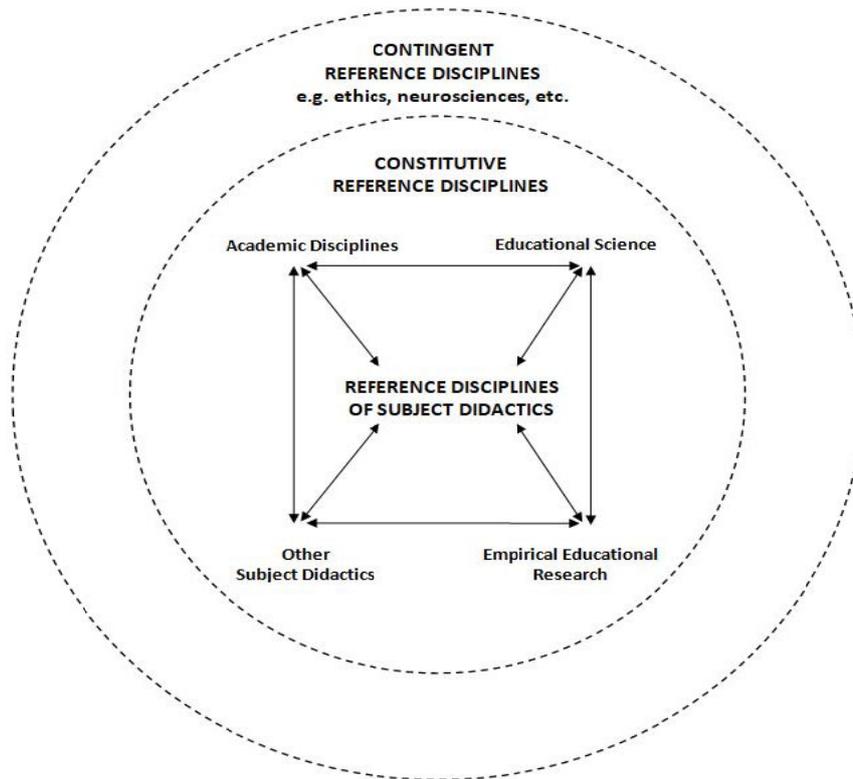


Fig. 3: Reference disciplines and dialogue partners of individual subject didactics (inner and outer circle; cf. Rothgangel 2020b, p. 583).

A closer look at the individual subject didactics shows that they engage in different ways and to varying degrees with their interdisciplinary dialogue partners. This can be underlined by pointing to the difference of value placed on contemporary scientific developments and the evolving knowledge system between the Didactics of Physics and that of Computer Science respectively. While in Computer Science Didactics the confrontation with the current state of computer science as a dynamic academic discipline is essential (Magenheim & Romeike 2020, p. 187), in Physics Didactics hardly any new or recent piece of knowledge gained after the middle of the 20th century was introduced and dealt with in school. This is true even for the level of upper secondary education (Schecker 2020, p. 300).

This difference of intensity in cooperating with academic knowledge also applies to the dialogue of subject didactics with the three other constitutive dialogue partners, namely with other subject didactics, with educational science and with empirical educational research. The reasons for this may be manifold, but the consequences are also far-reaching in each case: they have a decisive influence on how the different subject didactics reflect on their own subject-matter teaching and learning, on the processes involved and on the research necessary to study them and make progress.

It is remarkable that general didactics is not explicitly listed as a dialogue partner in any of the 17 contributions. In no way can one conclude from this observation, however, that the interdisciplinary dialogue with didactics does not take place at all, that it is not desired or does not make sense. On the contrary, the contributions often refer to educational science (paraphrased in German as “Erziehungswissenschaft” or “Bildungswissenschaften”), and this includes an implicit reference to general didactics as part of it, which becomes obvious particularly when referring to teacher education in this context (Vollmer & Vogt 2020, p. 122). It remains nonetheless surprising that at this point in time general didactics is not explicitly mentioned nor considered as a major dialogue partner. This is actually already happening in pockets of academic exchange and discourse, a process which may well continue into the future (cf. Bayrhuber et al. 2018; Frederking & Rothgangel 2018; Vollmer 2019).

4 Perspectives of General Subject-Matter Didactics

The comparison between different subject didactics within one particular country and educational setting (as presented here for Germany) has already proven quite fruitful. Each subject didactics could now apply some of the findings individually and reflect systematically, for example, on the importance of their relevant dialogue partners, considering a possible clarification of interdisciplinary cooperation. It may also be worth for them to look at the use of different sources for content decisions or at the use of alternative formats in researching subject-specific issues within or outside the classroom. These are good examples of acknowledging the usefulness of comparative results, as derived from the survey, and making use of insights offered by General Subject Didactics. In this perspective, additional surveys among the existing subject didactics are planned for, relating to other central issues or common concerns which have not yet been dealt with so far (e.g. teaching concepts, classroom interaction, evaluating teaching/learning achievements, digitalization, inclusion, professionalization of future teachers⁹ etc.). Through regular exchanges between the different subject didactics (during thematic conferences, annual membership meetings etc.) as well as by joint publications each subject didactics will be stimulated and supported even more in their own self-reflection and scientific development, as is already the case today (to some extent at least, cf. Vollmer 2017a). The relationship between General Subject Didactics and the individual branches of subject didactics could become one of mutual acknowledgement, inspiration and learning because all of them have a similar goal and a function to fulfil which cannot be replaced by any other.

From another more international perspective, comparative subject-based research could relate the conceptual frameworks and teaching traditions in different parts of Europe to one another and analyse the related discourse about didactics and subject didactics in more systematic ways (see developments in that direction, cf. Hudson &

⁹ The *Journal of Curriculum Studies* is dedicating a special issue to a comparative view on the professionalization of teachers (in the US, the UK, Germany, South Africa and Austria) under the title “Towards Powerful Educational Knowledge: Perspectives from Educational Foundations, Curriculum Theory and *Didaktik*” (Hordern, Muller & Deng to appear; see also Vollmer to appear).

Schneuwly 2007, Hudson & Meyer 2011; Ligozat & Almquist 2018a+b; Krogh, Qvartrup & Graf, in print; Ligozat, Almquist, Klette & Rakhkochkine to appear; also Hordern, Muller & Deng, to appear). The platform for such an exchange and better mutual understanding could be existing conference series (such as the annual European Conference on Educational Research (ECER), international research projects (cf. Almquist et al. undated) or international journals like the “European Educational Research Journal”, “Research in Subject-Matter Teaching and Learning” (RISTAL) or “Journal of Curriculum Studies”(JCS). Such a development could bring relevant didactic players into contact: institutions and associations such as the German *Gesellschaft for Fachdidaktik*, its Austrian, Swiss and Scandinavian counterparts, representatives of the French didactic traditions, namely from the ‘Joint Action Theory of Didactics’ (Sensevey et al. 2019) and in the future maybe even some players from the UK like the University College London with its influential journal “London Review of Education”.

In the long run, more exchange and comparative research is necessary between different socio-cultural areas or continents – in continuation of what had already been started in the 90s of last century (cf. Hopmann & Riquarts 1995, Gudem & Hopmann 1998, Westbury, Hopmann & Riquarts 2000). There still seems to be quite a lack of common understanding between the Anglo-Saxon / North American and the continental European world of what didactics and subject didactics means and how powerful these scientific disciplines are by now as guarantees for claiming subject-specificity in education and as tools for subject-based “Bildung” – on a personal as well as on a functional level (cf. Bayrhuber & Frederking 2017, Schneuwly & Vollmer 2018).

For these reasons, the notion of General Subject-Matter Didactics is presented here to an international audience as a new concept, as a ‘meta-level’ of scientific study, as a theory of subject didactics, processing and comparing their theories and findings, identifying their commonalities as much as their individual differences in theoretical terms. All of these features have been partly demonstrated in this article: we hope to have contributed to the establishment of GSD as an interculturally sustainable scientific concept and to the advancement of our professional discourse about it in an international perspective.

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