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Title **Collaboration in the third space in the "Orality in Language-Conscious Subject Teaching" project: requirements and implications for the design-based research process**

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Abstract Based on the design-based research project "Orality in Language-Conscious Subject Teaching", this paper illustrates the manner in which collaboration between academic researchers and educators is conceptualised and operationalised. Collaboration between the participants is defined as a fundamental prerequisite of the project, which has a "dual focus" (Aigner & Malmberg, 2022) as the underlying maxim. The concrete concept of collaboration is presented along the sub-steps of the iterative approach, discussing for each step the implications of collaboration for the DBR process and how the participants (jointly) define and fulfil their roles within the individual phases. The central element of collaboration is the combination of conjecture maps and hypothetical learning trajectories, which, once integrated into the DBR process, enable systematic and transparent collaboration, thus laying the foundation for – among other things – a "common language". The findings presented offer insights for academic researchers and teachers who are planning or carrying out collaborative design-based research projects. They show how conjecture maps and hypothetical learning trajectories can be used in practice to structure collaboration between participants and make this collaboration tangible and visible.

Keywords Theory-practice collaboration; language-conscious subject teaching; language didactics; design-based research, conjecture map

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Collaboration in the third space in the "Orality in Language-Conscious Subject Teaching" project: requirements and implications for the design-based research process

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1.0 Introduction

The orientation of design-based research projects at the interface between development and research is largely characterised by cooperation. Sloane speaks of "reflective practice" (reflexive Praxis[1]) in which the two systems of science and professional practice react to and reflect on each other (Sloane, 2018, p. 5). On an institutional level, academic institutions and institutions of professional practice usually work together. In the field of education, these tend to include universities of teacher education and schools or the employees of both institutions. Although the integration of scientific and practical knowledge is a fundamental principle, it needs to be fleshed out and "animated" by both parties in the context of the specific project (Dilger & Euler, 2018, p. 13). As a result, the concrete organisation of such collaborations differs from project to project.

In the field of German didactics, in which this paper is located, design-based research (DBR) represents an emerging approach (Dube & Dannecker, 2024; Dube & Prediger, 2017; Topalović & Drepper, 2024). Köster (2023, p. 32) calls for examples of realised forms of cooperation that can serve as points of reference for the further development of DBR in the field. This desideratum is also formulated outside of German didactics, for example by Dilger and Euler who consider that cooperation between science and practice is widely recognised as a constitutive feature of DBR, however this cooperation has yet to materialise (Dilger & Euler, 2018, p. 5). According to Euler, the relationship between researchers and practitioners is still only addressed implicitly, at the most (Euler, 2024, p. 1).

Based on the design-based research project "Orality in Language-Conscious Subject Teaching", this paper illustrates the manner in which collaboration between academic researchers and educators is conceptualised and operationalised. Collaboration between the participants is defined as a fundamental prerequisite of the project. The integration of conjecture maps (Sandoval, 2014) and hypothetical learning trajectories (e.g. Simon, 1995) into the DBR process makes this collaboration

[1] All translations of German terms noted in parentheses are by the author.

systematic and transparent and provides, among other things, a basis for a "common language" (Euler, 2024, p. 10).

The following section begins with a general discussion of forms of participation and cooperation in DBR projects (Section 2). Section 3 demonstrates the link between conjecture maps and hypothetical learning trajectories at the conceptual level and Section 4 provides a comprehensive overview of the project context in which the collaborations on which the paper is based are situated. The concrete conception of the collaborations is then presented along the sub-steps of the iterative DBR cycle, discussing in each case the implications of the collaboration for the DBR process and how the participants (jointly) define and fulfil their roles within the individual phases (Euler, 2024, p. 2, Section 5).

2.0 Forms of participation and cooperation in DBR projects

Design-Based Research (DBR) combines theory development with practical intervention through iterative cycles of design, implementation, and refinement in authentic settings (Euler, 2017, p. 1). Central to DBR is its two-fold focus on generating domain-specific theories about learning processes while designing and improving educational interventions (Prediger, 2018). This approach operates through iterative cycles where prospective hypotheses about learning mechanisms are tested and refined based on empirical observations, allowing adjustments during implementation rather than solely in post-hoc analyses.

A key characteristic lies in its interventionist nature, where understanding and improving educational contexts are inherently intertwined (Bakker, 2018, p. 18). DBR aims to reconfigure educational environments while generating actionable knowledge about learning processes. The methodology emphasises co-creation with stakeholders through various participatory formats, ensuring that solutions address contextual needs while contributing to theoretical frameworks (Malmberg, Nestler, & Retzlaff-Fürst, 2020, p. 85). These collaborations occur through multiple iterative phases (analysis, design, and evaluation), incorporating structured reflection as well as responsiveness to emergent challenges.

The resulting theories retain their practical utility because they are grounded in real-world testing, while also being transferable to similar contexts. This symbiotic relationship between theory and practice, sustained through cyclical prototyping and stakeholder dialogue, positions DBR as a methodology that combines academic rigour with implementation relevance (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003, pp. 10–11).

The way in which teachers and researchers work together in DBR projects varies from case to case, ranging from separate work areas to a strong overlap. Cviko, McKenney and Voogt (2014) distinguish between the roles of executive teacher, re-designer, and co-designer. Executive teachers receive a design that they either did not develop

themselves or in whose development they had only minimal involvement, which they then adapt during implementation to the circumstances of their classes, the needs of their pupils, and their pedagogical values. As re-designers, teachers actively participate in the development process by, for example, revising existing design elements before they are implemented. Finally, as co-designers, they develop new components in cooperation with researchers or in teams of teachers (Cviko et al., 2014, pp. 69–70).

Drepper and Uhl make a different distinction. They see teachers as developers, implementer and/or evaluators (Drepper & Uhl, 2025). Konrad and Bakker (2018) describe in detail how the role of the teachers involved can change during the DBR process; in the specific case of the authors, from an executive teacher to a co-designer. Schäfer (2019), who analysed the role of teachers in the DBR process, states that teachers develop a stronger sense of design participation when they take a cooperative position in the design process rather than implementing a design prepared by a researcher (Schäfer, 2019, p. 67). The interaction between teachers and researchers is also an important distinguishing feature of DBR compared to action research (Dube & Hussmann, 2019, p. 29).

In all of these differently organised role relationships, however, the researchers ultimately determine the extent to which teachers are able to participate in the DBR process. The way in which the role is shaped depends on how it is defined by the researchers (Dilger & Euler, 2018, p. 14). Factors such as time, interest, and what is at stake for the researchers are (co-)decisive (Campanella & Penuel, 2021, p. 15). Aigner also notes that the role aspect has so far had little presence in the German-speaking DBR community (Aigner, 2022, p. 72).[2] Using three examples, he outlines different forms of collaboration between teachers and researchers, without taking one or the other perspective. Aigner posits that participants in DBR projects should be made aware of the importance of role issues and encouraged them to address these issues in a proactive manner: fostering a developmental research attitude and actively disclosing, describing, and considering role issues as integral elements of a DBR research approach. Furthermore, he claims that these issues should be viewed as opportunities for growth and improvement (Aigner, 2022, p. 87).

A concrete way of realising this is offered by Aigner and Malmberg (2022) with the dual pearl model (duales Perlen-Modell), which is based on the so-called “dual focus”. This expression refers to the synchronicity of theory and practical concept development as well as the awareness of the shared assumption of responsibility in these processes. In accordance with the basic assumption of dual focus, the interlocking of theory-led and practice-led is not so much conceived by one side or the other, but is rather located on a continuum (Aigner & Malmberg, 2022, pp. 29–30). Furthermore, affiliation in terms of theoretical or practical orientation, for example, is a dynamic matter that can change during a project. The dual pearl model makes these dynamics tangible and visible, which allows participants to recognise

[2] Exceptions to this are the rather recent publications by Aigner and Malmberg (2022), Dilger and Euler (2018), Drepper and Uhl (2025), Euler (2024), and Schäfer (2019).

them and find a conscious way of dealing with them (Aigner & Malmberg, 2022, p. 38).

3.0 Combining conjecture maps and hypothetical learning trajectories

The concept of conjecture maps was originally introduced by Sandoval (2004). Conjecture maps serve as a means of specifying theoretically important features of a learning environment design and visualising how these are likely to interact to achieve the desired outcomes (Sandoval, 2014). A conjecture map consists of four columns: high conjecture level, embodiment, mediating processes, and outcomes.[3] Mapping the assumptions that underpin a design can guide the systematic testing of particular assumptions about learning and teaching in a given context (Deister, Garzetti, & Schlauch, 2022; Härtel, 2024; Sandoval, 2014, p. 19).

On the one hand, Sandoval sees the potential of conjecture maps to specify a design and, to a certain extent, systematically depict the presumed learning trajectories. This also establishes the distinction between assumptions about how a design functions and assumptions about how these functions generate learning (Sandoval, 2014, p. 25), meaning that the evaluation can be carried out on this basis. On the other hand, Sandoval also mentions the communicative potential of conjecture maps within a project team: The team has to agree on the intended processes when constructing a conjecture map, as

> [d]oing this requires a research team to be specific not just about what it is trying to design but also about what particular features of the design are expected to do, how they are expected to work together, and what they ought to produce. (Sandoval, 2014, p. 27)

Additionally, Bakker (2018) frequently cites the communicative potential of conjecture maps as a means of effectively and accurately presenting DBR projects. The presumed learning trajectories of the students associated with a particular teaching sequence are summarised (in a very condensed way) in a conjecture map in the mediating processes column. Since, according to Sandoval, a design element or interaction (embodiment/design) does not lead directly to a learning objective (outcomes), the mediating processes are interposed:

Observable interactions can directly show how embodied elements of a design mediate participants' interaction, and thus learning. The second way to understand mediating processes is to analyze artifacts that participants produce from their activity. Such artifacts are proxies for learning processes; they indicate the extent to which learners are engaged in the sort of activity and thinking hypothesised to matter. (Sandoval, 2014, p. 23)

[3] Figure 3 shows an adopted conjecture map that was developed in the project on which this paper is based.

In order to explicitly name and execute the mediating processes, conjecture maps can be supplemented by so-called hypothetical learning trajectories (HLTs). Simon (1995) defines an HLT as a teacher's prediction about the hypothetical learning process of learners:

It is hypothetical because the actual learning trajectory is not knowable in advance. It characterises an expected tendency. Individual students' learning proceeds along idiosyncratic, although often similar, paths. [...] A hypothetical learning trajectory provides the teacher with a rationale for choosing a particular instructional design; thus, I make my design decisions based on my best guess of how learning might proceed. This can be seen in the thinking and planning that preceded my instructional interactions that I made in response to students' thinking. (Simon, 1995, p. 135)

An HLT will describe precisely which learning processes are assumed to result from a certain design element and how these assumed learning processes are organised (Düerkop & Bakker, 2018, pp. 241–244). According to Prediger, the presumed learning trajectory is a prescriptive theory element (Prediger, 2024, p. 10). The formulation of HLTs may give the impression that learning processes are understood as linear processes. However, Simon emphasises that this view is incorrect and that not only one goal is pursued or only one learning trajectory is considered. Rather, HLTs are intended to emphasise the importance of having a goal and a rationale for instructional decisions as well as the importance of recognising the hypothetical nature of such thinking (Simon, 1995, p. 136). Bakker and Smit (2018), who also combine conjecture maps and HLTs in their study, make the following comparison (cf. Table 1):

Table 1: *Comparison of conjecture maps and HLTs according to Bakker and Smit (2018, p. 270)*

	General features	**Advantage**	**Disadvantage**
HLTs	Research oriented, but more local than conjecture maps	- Time dimension - Developmental - Testable conjectures - Explicit attention to prior knowledge or expertise	- Tedious to report - Difficult to summarise - Trajectory sounds linear, but need not be
Conjecture Maps	Research oriented, but more general than HLTs	- Compact graphical representation - Mediating processes in focus - Testable conjectures	- Linear - No time dimension - No feedback loops

From the comparison, it can be summarised that HLTs are positioned at a very local level, but that they represent the temporal dimension of a learning process. Due to their high granularity, however, HLTs are difficult to visualise. Conjecture maps are more general than HLTs and

are therefore easier to visualise graphically, with the disadvantage that they appear very linear.

4.0 The "Orality in Language-Conscious Subject Teaching" project

4.1 Project context

This project, which includes the collaborations described here, focusses on the oral aspects (speaking and listening skills) of language-conscious subject teaching and is being carried out as a school development project. One of the reasons for setting this school development focus is the demand for consistent language education. Recent PISA studies show that 20 to 25% of pupils in the 9th grade in German-speaking countries are considered very weak readers, which means that they do not have the necessary skills to extract the essential information from (simple) factual texts (Erzinger, Pham, Prosperi, & Salvisberg, 2023, p. 25; PISA.ch consortium, 2019, p. 17). These linguistic deficits significantly impair learning, even in subjects without a specific linguistic focus (e.g. maths, science, etc.), which has a cumulative effect on performance in these subjects.

To counteract this, language-conscious subject teaching has long been cited as an educational goal, which should be designed horizontally across subject boundaries and vertically across educational levels (Gogolin & Lange, 2011; Schneider et al., 2012). The aim is to enable subject-specific learning through the conscious use of language regardless of the background of the learners (Schmellentin & Lindauer, 2020). In comparison to language-sensitive teaching, language-conscious subject teaching is not primarily about enabling language learning in the subject, but rather about focussing on subject-related learning and reducing language barriers as much as possible in the process (Schmellentin & Lindauer, 2020, p. 669). In addition, the school is addressed as an overall system, including both the meso and macro levels of the education system (Schmellentin, 2023, p. 24).

The existing didactic concepts for language-conscious subject teaching in the Northwestern Switzerland education region primarily relate to language-conscious support for pupils in the area of reading and writing comprehension (Lindauer et al., 2021; Lindauer, Schmellentin, Beerenwinkel, Hefti, & Furger, 2013; Schmellentin, Dittmar, Gilg, & Schneider, 2017). Oral language action aspects are included and partially formulated, but with a focus on teacher-led interactions (classroom discussions, teacher presentations) and monologue speaking situations (presentations, listening comprehension). Classroom discussions between peers are deliberately excluded (Lindauer et al., 2013, p. 19). Overall, the didactic concepts for language-conscious subject teaching lack differentiating aspects with regard to orality, both in terms of the forms and constellations of interaction as well as the specific didactic implementation. The project's focus on oral language areas is based not least on various findings that classroom discussions

can and should be used as an opportunity for subject-specific and linguistic learning (e.g. Harren, 2015; Heller & Morek, 2015, 2019).

4.2 The third space as the centre of collaboration

The project was a collaboration between an academic researcher (the author of the paper) and the teachers at a secondary school (grades 7 to 9) in the Swiss canton of Basel-Stadt. The school in question has been working on language-conscious subject teaching since 2015 and has already carried out several school development projects and internal training programmes and, in this context, developed its own concept for implementing language-conscious subject teaching (Löw et al., 2021). There has also been a collaboration between the school and the FHNW School of Education (Pädagogische Hochschule der Fachhochschule Nordwestschweiz) for several years as part of the practical training of students in the so-called partner school year (Fraefel, Bernhardsson-Laros, & Bäuerlein, 2017; Staub, 2019).

In organising this collaboration, the concepts of the third space (Zeichner, 2010) or hybrid space (Fraefel & Bernhardsson-Laros, 2016; Leonhard et al., 2016) are critical. In a hybrid space, experts from both practices (academic and professional field) work together with students on solutions for practice and on a deeper understanding of their conditions and backgrounds (Leonhard et al., 2016, p. 90). Overall, the aim of the third space is a stronger interlinking of the academic and school fields in teacher education (Zeichner, 2010, p. 92). The underlying premise is based on the assumption that all actors involved contribute their expertise in relation to a specific topic.

The transdisciplinary collaboration established in the third space provides a promising basis for the implementation of language-conscious subject teaching within the project, as teachers are very closely involved in the (further) development of teaching and learning arrangements from the outset (vgl. Cviko et al., 2014, p. 70; Karstens & Schmitz, 2023, p. 11; Lindauer, Schmellentin, & Beerenwinkel, 2016, p. 242; Prediger, 2022, pp. 15–17)

4.3 Methodological framework

At an overarching level, the project is dedicated to the question of the extent to which language-conscious oral aspects of subject teaching support the learning of pupils at secondary level (grades 7 to 9) in the relevant subjects. Three sub-projects, each focusing on a different subject (Physical Education, History, and English), are investigating subject-specific research questions that were defined by the teachers involved (cf. Table 2 and Section 5.2.1).

Table 2: *Research questions of the three sub-projects*

	Subject-specific research questions
Physical Education	How can language-conscious instruction support pupils in learning a "small game"[4] in PE lessons?
History	How can language-conscious modelling of the oral analysis of historical image sources support students' subject-specific and linguistic learning?
English	How can students' conversation and moderation skills be developed and promoted in English lessons in a language-conscious way?

In three cycles, teaching-learning arrangements that build on each other are developed and tested for each subject area. The scope of the project is therefore at the micro and nano level, i.e. the target dimensions are the teaching-learning arrangements themselves and the task formats used in them (Dube & Hussmann, 2019; Peters & Roviró, 2017).

The testing comprised different data types:

1. Video recordings of all lessons in which the teaching-learning arrangements are tested. They are analysed using multimodal interaction analysis (Birkner, Auer, Bauer, & Kotthoff, 2020; Deppermann, 2008, 2018; Hausendorf, Schmitt, & Kesselheim, 2016; Mondada, 2019).

2. Digital questionnaires which the pupils fill out after each tested lesson, and which are analysed quantitatively and using content analysis (Kuckartz & Rädiker, 2022).

3. Guided reflection dialogue between the teacher and the researcher conducted after each tested lesson and analysed using content analysis. A data and method triangulation (Flick, 2011) is carried out on the basis of the three data types.

The collaborations between the teachers and the academic researcher are analysed per tandem using the pearl model (Aigner & Malmberg, 2022, Section 2). Once per cycle (during the re-design sessions), the teachers and the academic researcher complete the pearl model individually in order to assess their perspectives on the DBR process. They then compare their assessment of the collaboration and hold a discussion on the basis of the completed pearl model about their perception

[4] A "small game" (*kleines Spiel*) is a term in physical education didactics which refers to a game that is played in preparation for a so-called "big game" (e.g. handball) (Kuhlmann, 2007, p. 169).

of the design of the ongoing collaboration. This procedure allows for the continuous review of participants' feedback regarding project implementation and for (self-)reflection (Dilger & Euler, 2018, pp. 14–15; Euler, 2024, p. 9).

The project comprises two project phases: In the first phase, the teachers and the academic researcher develop teaching-learning arrangements for the sub-projects as part of the DBR process (cf. Figure 1). In the second project phase, the methodological findings in relation to the DBR process and the content-related findings in relation to the thematic focus of the project (orality in language-conscious subject teaching) are adapted for practical vocational training. The teachers involved – who also work as mentors[5] in the practical vocational training programme – implement this in collaboration with the students, while the academic researcher provides support. This paper focusses exclusively on the first, the developmental phase of the project.

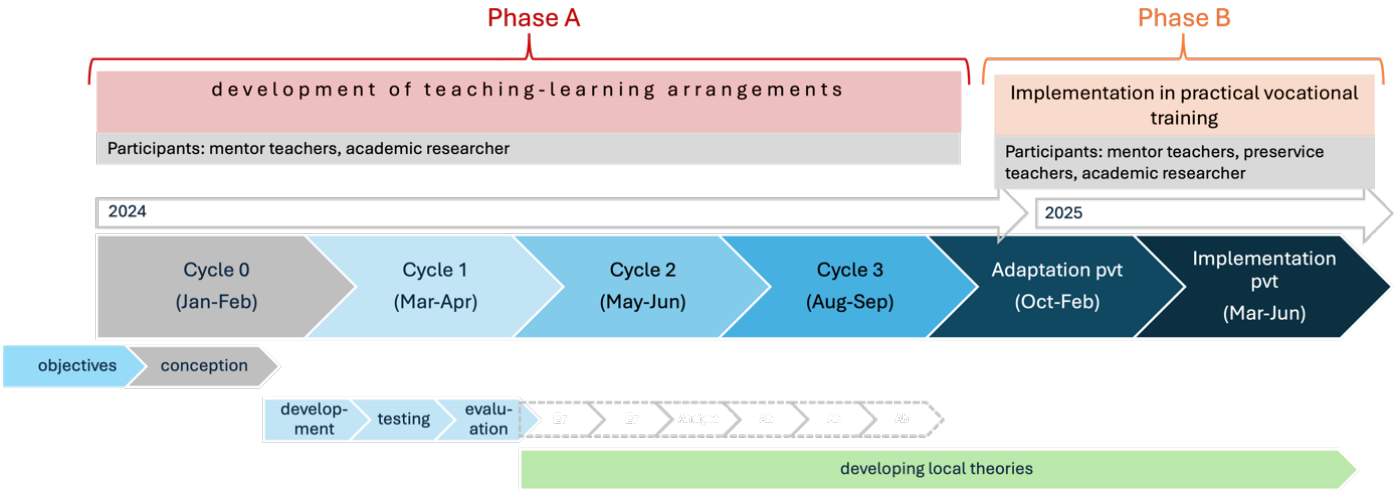

Figure 1: *Overview of the project process (pvt = practical vocational training)*

5.0 Conceptualisation of collaboration and implications for the DBR process

The following section explains the concept of the collaboration within the project, how it is organised and the implications it has for the DBR process. Firstly, general aspects of collaboration are described (Section 5.1), then the collaborative design process is outlined along the DBR phases (Section 5.2).

[5] This refers to teachers with an additional qualification who accompany and work with students during their internship.

5.1 Organisation of collaboration between teachers and academic researcher

The three teachers and the academic researcher each work on a subproject in tandem constellations (cf. Section 4.3). In a collaborative process as co-designers, they assume joint responsibility for the majority of phases within the DBR methodology, including design development, testing and evaluation, and the re-definition of design principles. Since the project, as a school development project, is particularly aimed at implementing the findings in school practice, close collaboration between teachers and the academic researcher covering all DBR phases was considered essential. Accordingly, their collaboration as co-designers was defined as one of several structural design requirements (McKenney & Reeves, 2019, cf. Table 3). In the collaboration between teachers and academic researcher, it was possible to build on the cooperation already established between the school and the School of Education as part of the practical vocational training of students (cf. Section 4.2), which proved to be very beneficial in terms of building the relationships between the participants (Dannecker, Carell, Spieß, Ambrosini, & Ziemen, 2024, p. 22; Dilger & Euler, 2018, pp. 15–16). Because the principle of transdisciplinary collaboration was considered to be both fundamental and a design requirement, the teachers received financial compensation (cf. Köster, 2023, p. 39).

Despite the teachers and the academic researcher acting as co-designers, whose content-related tasks overlap in many of the phases of the DBR process (cf. Section 5.2), a boundary is drawn in the area of project management. The academic researcher acts as the overall project manager, maintaining an overview and providing the impetus for the planning and organisation of the DBR process as well as the individual cycles and project phases (cf. Wang & Hannafin, 2005, p. 9). Schäfer (2019) maintained a similar division of roles with one of the teachers she worked with. As the overall project leader, Schäfer highlighted the importance of this "bird's eye view", which ensured that the exploration and further development of the theoretical assumptions about the design's mode of action remained a central focus, thus contributing to the advancement of scientific knowledge (Schäfer, 2019, p. 77).

Similarly, Delius (2022) collaborated with a teacher and identified the potential for role conflict among researchers, which can manifest as the "judgement effect" (Beurteiler-Effekt, Delius, 2022, p. 27). By this she means with reference to McKenney, Nieveen and van den Akker (2006, p. 83) that students react differently due to the presence of the researchers during the formative evaluation and that the researchers may (unintentionally) be less receptive to criticism. In order to minimise this effect and avoid the associated "dilemma" (McKenney, Nieveen, & van den Akker, 2006, p. 83), data sessions are held with the project team on the university side before the results of the analyses

are discussed with the teachers. These data sessions allow for an "external" view of the data and analyses by researchers who were not present during the design development or testing.

As part of the collaboration between the teachers and the academic researcher, the pupil's perspectives are also incorporated into the DBR process. They provide their assessments of the respective designs per cycle as part of the questionnaire survey (Wang & Hannafin, 2005, p. 17). The teachers and the academic researcher attach great importance to making this form of classroom participation transparent to the students. To this end, the students are informed about the most important results of the analyses – which are incorporated into the redesign – before each testing.

5.2 The collaborative design process

The fact that the collaboration of the teachers and the academic researcher is a central element and functions as a design requirement implies specific decisions and procedures in the DBR process. In addition, collaboration requires a targeted examination of the respective roles of the actors involved and the definition of their tasks within a phase (Euler, 2024, p. 2). The following section will describe the individual phases of the DBR process, taking into account the aforementioned decisions and specifics of collaboration. The DBR process is roughly based on the model of Euler (2014) (cf. Figure 2). Consequently, the ensuing subsections have been structured in accordance with the phases of the model.

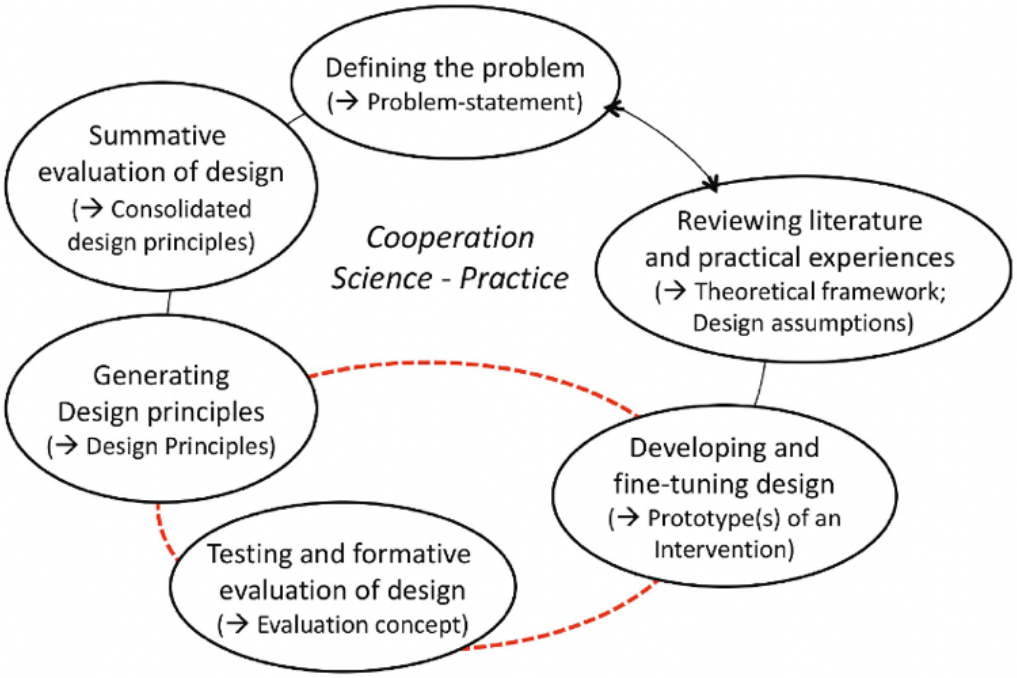

Figure 2: *Research and development cycles in the design research context according to Euler (2014)*

5.2.1 Problem definition

The overarching research question of the project, as outlined in Section 4.3, was defined by the academic researcher. The question was formulated in response to a research gap and due to a lack of didactical concepts (Schmellentin & Lindauer, 2020, p. 674, cf. Section 4.1). The thematic focus for the sub-project was then defined by the teachers, taking into account the lessons they teach, the curriculum, and the individual learning requirements of their pupils.

The teachers had already received extensive training in language-conscious subject teaching as part of several internal training programmes, which provided them with a solid foundation of background knowledge. The thematic focus was discussed and agreed upon jointly, leading to the formulation of a subject-specific question (Euler, 2024, p. 7). Moreover, the learning objectives were collectively defined. In this regard, the selection of the subject-specific development area was made in a proportionate manner (Dilger & Euler, 2018, p. 8; Köster, 2023, p. 39).

5.2.2 Design requirements

Design principles play a role in various phases of a DBR process: They serve as an orientation framework for both the starting point and the end point of a DBR process. According to Euler (2017, p. 9), design principles in the starting point (design assumptions) are the result of the theoretical foundation of the project, and are thus based on literature review. McKenney and Reeves (2019) use design requirements to describe criteria that the intervention should fulfil, often with regard to the conditions under which it must function (McKenney & Reeves, 2019, p. 129). In the lead-up to this project, the academic researcher developed interdisciplinary design requirements to serve as a guiding framework for all sub-projects (cf. Table 3). Following Malmberg et al. (2020), they are divided into structural and content-related design requirements.

Table 3: *Interdisciplinary design requirements for all sub-projects (TLA = teaching-learning arrangement; LCST = language-conscious subject teaching)*

Interdisciplinary design requirements	
Structural	Content-related
• The teachers and the academic researcher collaborate as co-designers across all DBR phases (e.g. Konrad & Bakker, 2018). • The TLA is made at the micro and nano levels, its	• The TLA is integrated into the regular curriculum. • The TLA is orientated towards the oral aspects of the school's concept of LCST. • The TLA, which includes listening comprehension elements, takes into account the four listening steps (Lindauer et al., 2021, pp. 15–16).

target dimensions are the TLA itself as well as the task formats employed and used therein (Dube & Hussmann, 2019, p. 21; Peters & Roviró, 2017, p. 27). • The TLA can be carried out in a 90-minute lesson.	• The TLA, which focusses on language production, includes means of expression (Lindauer et al., 2013, pp. 25–26). • The TLA takes into account interdisciplinary LCST characteristics according to Lindauer et al. (2021, pp. 6–7) with a focus on the two features of demonstrating and explaining (modelling) language strategies and pre-teach vocabulary, as these are directly linked to task formats.

Furthermore, the academic researcher also defined subject-specific design requirements for each sub-project based on what McKenney and Reeves (2019) termed design propositions. The latter posit that design propositions not only specify what a design should look like, but above all how certain features should appear (McKenney & Reeves, 2019, p. 129). In the present case, these subject-specific design requirements for all sub-projects are divided into a) the structuring of the learning process, which is primarily based on subject-matter didactic principles, b) subject-specific quality characteristics for the respective teaching-learning arrangement, which include language-conscious aspects of the respective subject-matter didactics, and c) ensuring coherence, whereby the school's existing concept for language-conscious subject teaching (cf. Section 4.2) was taken into account and specified with regard to the respective teaching-learning arrangements.

The subject-specific design requirements of the history sub-project are listed below as examples (cf. Table 4).

Table 4: *Subject-specific design requirements of the sub-project in history (TLA = teaching-learning arrangement)*

Subject-specific design requirements (history sub-project)

• *Structuring the learning process*: The TLA is based on the five-step method of image analysis (Gautschi, 1999, 2015).
• *Subject-specific quality features*:
  ○ The TLA deliberately varies the image types of the image sources to be analysed, as outlined by Gautschi (1999, p. 124).
  ○ The TLA focuses on the correct use of subject-specific terms and appropriate modality expression (Hartung, 2023).
• *Ensuring coherence*: The TLA takes into account the oral aspects of the school's concept for language-conscious subject teaching in the areas of speaking and vocabulary (Löw et al., 2021, pp. 22–23).
  ○ The pupils are given the opportunity to explain an issue orally.
  ○ The use of (specialised) vocabulary is specifically supported.
  ○ Pupils are offered suitable means of expression (Lindauer et al., 2013, pp. 25–26).
  ○ Pupils are taught strategies for planning the structure of the text by modelling (Lindauer et al., 2021, pp. 6–7).
  ○ Pupils are given the opportunity to acquire and apply (subject-specific) terms in context.

Bakker argues that DBR researchers should explain what they mean by design principles: “Are they intended to be values, predictions, heuristics, pieces of advice, criteria to be fulfilled, or hints for the design process?” (Bakker, 2019, p. 187) The design requirements formulated here are therefore to be understood as predefined criteria or conditions that should be fulfilled at the level of collaboration and design.

As the definition of these design requirements is closely related to the literature research, the suggestion came from the academic researcher. At the first design session with the teachers, joint agreement on the design requirements served as the starting point. Missing aspects could have been added by the teachers at this stage. However, they did not have any additions.

5.2.3 Conjecture Maps and Hypothetical Learning Trajectories in design development

Conjecture maps and hypothetical learning trajectories (HLTs) (cf. Section 3) were used in the joint design development by teachers and the academic researcher. As part of these (re-)design sessions, the co-designers each had a half-completed conjecture map of a specific cycle present, showing the overarching design assumption (high-level conjecture) in the first column, while in the last column the intended outcomes were already available due to the defined problem. In the design sessions, the co-designers were then able to orientate themselves with respect to the “still open” columns of the embodiment (i.e. the individual sequences of the teaching-learning arrangement) and the mediating processes (i.e. the HLTs). They were thus able to determine the teaching-learning arrangement on this basis (cf. Figure 3). Once the conjecture map had been defined, the “mediating processes” column was specified. For each mediating process (i.e. for each element in the corresponding column), a separate document formulated an HLT, describing how a specific learning process was expected to lead to an intended outcome.

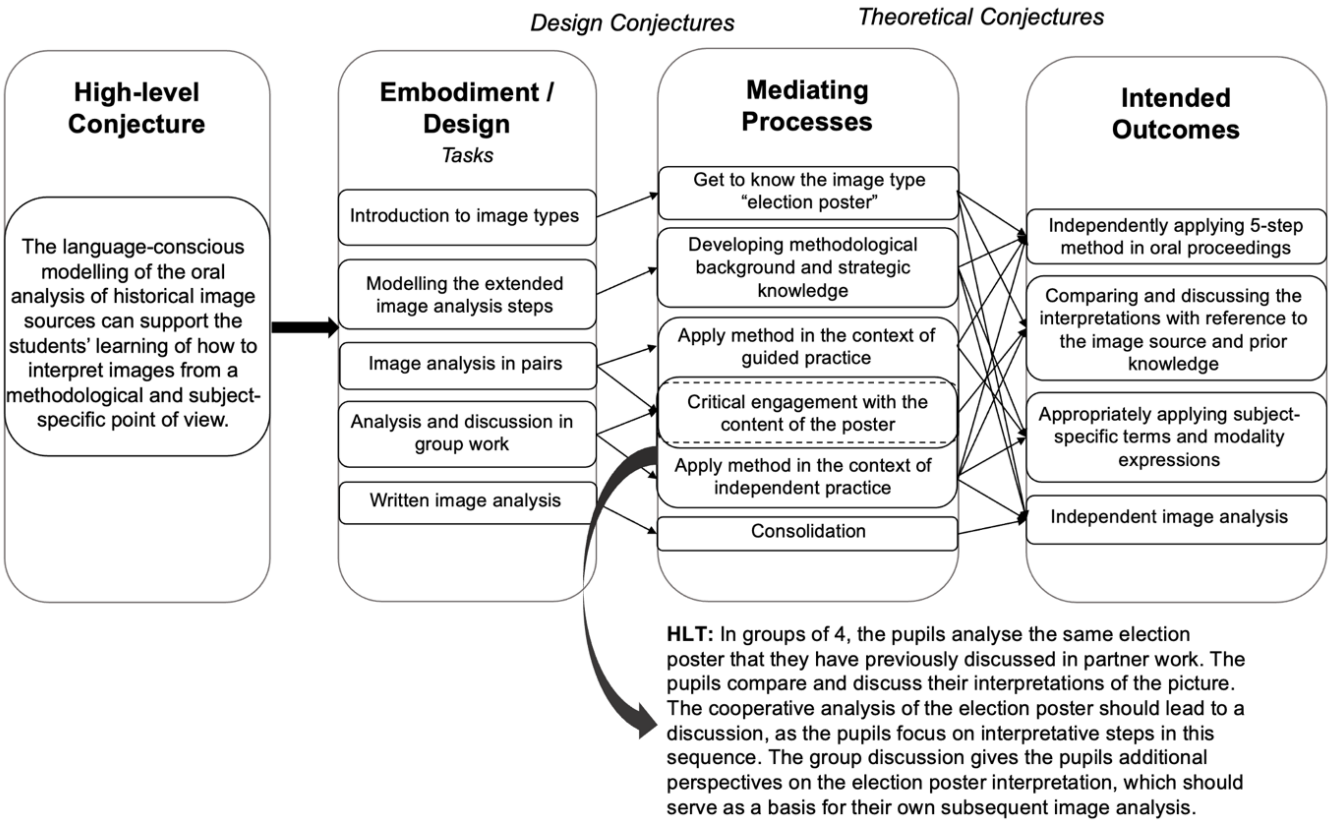

Figure 3: *Conjecture map (2nd cycle) of the sub-project in history (based on Sandoval, 2014) and exemplary hypothetical learning trajectory*

The combination of conjecture maps and HLTs is considered useful in the context of the collaborative DBR process because the graphic character of the conjecture map allows the intended processes in the teaching-learning arrangement to be visualised, thus enabling systematic access to the project and its sub-elements. In combination with the formulated HLT, a communication basis for the development process between teachers and the academic researcher could thus be created, which also facilitated the establishment of a "common language" (Dilger & Euler, 2018, pp. 15–16; Euler, 2024, p. 10).

5.2.4 (Re-)formulating design principles

At the end of the first design development phase, the design principles were formulated in the project teams. These are set out in the conjecture map and can be derived from it. Bakker (2018) sees the link between the conjecture map and design principles in the fact that "once you have such a conjecture map, you can also try to summarise it as a design principle" (p. 57). In the projects described here, however, not only *one* design principle, but several can be derived from the conjecture map.

The differentiation between design *requirements* as preliminary elements of the developmental process (cf. Section **Fehler! Verweisquelle konnte nicht gefunden werden.**) and design *principles* as outcomes of the inaugural developmental cycle is contingent upon the collaborative developmental process. This approach allows for the joint development of design principles by teachers and academic researchers, based on the theoretical foundation *and* the developed design. It also enables the integration of the diverse financial resources available to project participants, including the academic researcher's resources for a literature review and design development, and the teachers' resources for design development.

5.2.5 Testing and evaluation

The tests are carried out in the classes of the involved teachers. While the teacher teaches, the academic researcher is present throughout the process, coordinating data collection, and acting as a participant observer. Given the different expertise of the participants in research methodology, the academic researcher is primarily responsible for the analysis of the data, while the teachers act as a communicative validation instance (*kommunikative Validierungsinstanz*, Dilger & Euler, 2018, p. 11). This entails their active involvement in the interpretation of the analysed data (Dilger & Euler, 2018, p. 12). The members of the project team at the School of Education are also involved in the analysis process. Data meetings are hold on a regular basis with all team members, which allows the results of the analyses to be validated (cf. Section **Fehler! Verweisquelle konnte nicht gefunden werden.**).

As previously stated (cf. Section **Fehler! Verweisquelle konnte nicht gefunden werden.**), a conjecture map can be used as a basis for the evaluation process. In order to achieve this, the *design conjectures* are focussed, that is to say, the links between the individual design elements (in this case the individual task formats of the teaching-learning arrangement) and the *mediating processes*, i.e. the HLT (cf. **Fehler! Verweisquelle konnte nicht gefunden werden.**). Sandoval states the following about this evaluation process: "Testing such a [design, author] conjecture requires methods that can identify whether the expected mediating process does in fact emerge and that can provide evidence to trace that process back to designed elements." (Sandoval, 2014, p. 24) However, Wozniak, who also combines conjecture maps and design principles, places particular emphasis on the importance of a systematic review of the assumed learning trajectories. This is because such a review enables researchers to identify instances where design features result in unexpected outcomes (Wozniak, 2015, pp. 606–607).

The review of the design conjectures in the project is conceived in such a way that the individual task formats of the teaching-learning arrangement serve as the basis for structuring the various types of data.

This includes guidelines for the reflection discussions, questionnaires for the pupils, and the rough coding of video data. The method and data triangulation can thus be carried out on the basis of this structuring, i.e. along the tasks, and the examination of the HLTs can be carried out from different perspectives (Boelens, De Wever, & McKenney, 2020, p. 461).

While the analysis is conducted exclusively by the academic researchers, the findings are integrated into the re-design sessions, as they are pivotal for the subsequent development process. This necessitates an intermediate communicative step, whereby the analysis results are prepared in a synthesised form, thus ensuring their appropriate and purposeful utilisation in the re-design sessions (for a similar procedure cf. Delius, 2022, p. 27). For this purpose, the data matrix based on Dierdorp, Bakker, Eijkelhof, & van Maanen (2011) has proven to be helpful, as the structuring of the analysis according to the tasks or task formats can also be included in it. Dierdorp et al. propose a comparative analysis of the HLTs and the *actual learning trajectories* (ALTs) in a matrix format (cf. Figure 4). This approach allows for a systematic examination of the assumed learning processes, which, according to Prediger (2024, p.10), can be considered descriptive and explanatory theory elements.

No	Task	Conjecture	Data excerpts	Clarification	Result (+ / ±/-)	analysis focus
1	Picture introduction	The teacher shows the students different types of images (pictures, caricatures) and works with them to develop similarities and differences between the two types of pictures (e.g. "drawing" vs. "exaggeration") and addresses the technical terms of the two types of pictures in and of themselves. Through the introduction to pictures, the students become familiar with the different types of pictures and the technical terms.	Questionnaire: Pupils mainly cite the definition given by the teacher. The "devaluation" was only mentioned by pupils in task 1 (plenary introduction), as the definition results also show. Reflecting discussion: It has proven useful for the teacher to choose images that are thematically close to the content already covered (vs. current images).		+	- Questionnaire - Reflecting discussion

Figure 4: *Extract from the data matrix of the sub-project history, 1st cycle (based on Dierdorp et al., 2011)*

Prior to the analysis (highlighted in blue), the individual sequences of the teaching-learning arrangement (e.g. task 1) and the HLT (conjectures) are listed. During the analysis (highlighted in green), the data examples and findings from the individual data types and analyses are listed and, if necessary, additionally explained (clarification), which corresponds to the ALT. After the analysis (highlighted in red), the extent to which a specific task has been fulfilled is assessed.[6]

[6] The - sign is used when the analysis suggests that the conjectures are confirmed for a maximum of one third of the students. The + sign is used when the analysis suggests that the conjectures formulated in the third column are confirmed for at least two thirds of the students; while for intermediate cases, the ± sign is used (Dierdorp et al., 2011, p. 139).

5.2.6 Adapted design principles as a basis for re-design

As mentioned, design principles play a role at different stages of a DBR process. In addition to the design principles in the initial stage, they also form the end product of a DBR project in consolidated form (Euler, 2014). In the course of the iterative DBR process, they also function as sub-steps between evaluation and re-design. This is accompanied by further theoretical development, which is presented in the form of adapted design principles (Dube & Hussmann, 2019, p. 29). Although design principles are derived from the DBR process, they incorporate the theoretical findings ("refined prescriptive theory elements", Prediger, 2024, p. 9) on the object of investigation at every stage.

The design principles at this stage are initially formulated in draft form by the academic researcher based on the aforementioned theoretical foundation and the evaluation. They were then discussed with the teachers during the re-design sessions and developed further where necessary. Once all necessary adjustments had been made, the design principles were finalised. Accordingly, the teachers were also co-producers here, as they co-generated the central principles deemed significant for their future actions on the basis of the evaluated experiences (Dilger & Euler, 2018, p. 12; Drepper & Uhl, 2025, p. 105).

Table 5 illustrates the further development of one of the design principles from the sub-project history. After the first cycle, the aspect of memorising methodological steps when analysing historical image sources was added. This aspect is based on extensive discussions between the co-designers regarding the importance of memorisation in the strategy mediation process. This extension of the design principle was therefore jointly determined.

Table 5: *Extract from the design principles of the sub-project history (1st and 2nd cycle) (DP = design principle; TLA = teaching-learning arrangement)*

1st cycle	2nd cycle
DP2: Strategy communication process The TLA is largely based on a strategy teaching process of oral image analysis that leads a) from the development of declarative knowledge to b) a strategic application and c) the learning of a reflective approach (Philipp, 2015, pp. 112–116).	**DP2: Strategy communication process** The TLA is largely based on a strategy teaching process that leads a) from the development of declarative knowledge to b) strategic application and c) learning a reflective approach (Philipp, 2015, pp. 112–116). The written working steps are essential for strategic application, as they facilitate the memorisation process.

The degree to which the teachers will be engaged in the process of consolidating and refining the prescriptive design principles (Euler, 2014; Prediger, 2024) is still open, as it is contingent upon their individual interests and time resources. The intention is that the teachers will at least validate the consolidated design principles (Euler, 2024, p. 4).

6.0 Conclusion & outlook

The paper demonstrates the establishment, structuring, and design of a collaborative DBR process, which is characterised by a "dual focus" (Aigner & Malmberg, 2022) as a maxim of collaboration. The collaboration between teachers and academic researchers is established as a design requirement and considered a determining factor in the process, which entails specific procedures (Aigner, 2022). These can be summarised as follows, according to the DBR phases:

1. The **definition of the problem** is conducted in a proportional manner, albeit with a temporal lag. The academic researcher delineates the overarching problem, within which the participating teachers determine the respective topics and objectives of the sub-project.
2. The **design requirements** are initially formulated by the academic researcher based on a comprehensive literature review. Subsequently, the draft is subjected to a review by the teachers. This proved to be an efficacious point of departure for the joint design development.
3. The use of **conjecture maps**, developed jointly by the co-designers, contributes to the transparency and systematisation of the design process and facilitates communication between the co-designers.
4. The integration of **hypothetical learning trajectories** (HLTs), also jointly developed by the co-designers, facilitates comprehensive design development at the micro and nano levels, while offering a familiar perspective for the teachers involved.
5. The use of conjecture maps and hypothetical learning trajectories enables a systematic and transparent **evaluation** process.
6. The formulation of **design principles** at the end of the first cycle serves as the basis for the re-design in the subsequent cycle, facilitating a unified understanding among the co-designers.

Communication between academic researchers and teachers can only succeed if teachers are open to the different perspectives of scientific theories and, conversely, if academic researchers absorb the experiences of teachers and merge them with their own (Euler, 1994, pp. 238–242, 2024, p. 5). Beyond this fundamental openness, a necessary condition is that the participants on both sides *understand* what the actors on the other side are doing. Accordingly, the communication

and collaboration process must be transparent so that everyone involved can understand what is being worked on (Reinmann, 2023, p. 18). In contrast with the suggestions put forth by Deister et al. (2022, pp. 14–15) which propose the creation of conjecture maps for the various involved parties (namely, conjecture maps for the practice partners and conjecture maps for the academic researchers), an argument to the contrary is presented here. In light of the dual focus proposed by Aigner and Malmberg (2022), it is recommended that only *one* conjecture map be created per cycle and utilised as a means of fostering clarity for all participants while simultaneously developing a shared vocabulary.

As stated before, the teachers who took part in the project were remunerated in consideration for their involvement. Nevertheless, this aspect of establishing the third space on a material level cannot offset the time invested by the teachers. It is evident that the teachers involved demonstrate a high level of commitment to the project, extending their regular working hours. In contrast, the academic researchers engage in this activity as part of their professional responsibilities. Despite efforts to create a hybrid third space, these asymmetrical cooperation conditions cannot be entirely eliminated.

The findings presented here offer insights for academic researchers and teachers who are planning or implementing collaborative DBR projects. They show how conjecture maps and HLTs can be used in practice to structure the collaboration between the participants and make it tangible and visible (Boelens et al., 2020, p. 465). Furthermore, it would be interesting to explore the long-term development of collaboration in such projects (Prediger, 2022, p. 7), such as to what extent the design of the collaboration develops over several cycles and which factors influence this development.

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