

CROSS-CONTEXTUAL LEARNING THROUGH STUDENTS' EYES -
A case study of problems and supporting measures in cross-contextual learning scenarios

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The President:

Prof. Dr. Bernhard Ehrenzeller

Acknowledgments

This dissertation on the student perspective of cross-contextual learning developed from personal experiences with and an interest in the role that context plays in learning experiences that are ‘touching’ and also sustainable. I have been interested in the concepts that combine learning about the world around us with learning in that world already for long. Next to that, the student perspective and educational design are of special interest in my work on higher education. The opportunity to broaden and expand upon my awareness of these areas over the past 5 years has contributed significantly to the development of my overall understanding, which I am pleased to share with you as readers through this monograph. However, this would not have been possible without the support of many people that are deserving of my sincere appreciation for their various contributions and encouragement.

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Summary

This study addresses the student perspective of cross-contextual learning in higher education. Due to several societal changes, students' learning biographies have become (and still become) increasingly cross-contextual. It was assumed that cross-contextuality carries the potential to foster student learning. However, it was also assumed that spreading learning over yet more and different (kinds of) contexts bears with it certain risks to the fragmentation of learning, when relatedness and the integration of learning experiences are not actively considered. This study was borne from the current literature seeming to offer little about how students perceive problems and supportive measures in cross-contextual learning scenarios, how the student perspective differs from that of the teacher, and how the student perspective becomes a part of the educational design process for cross-contextual learning scenarios.

A multiple case study design was implemented in order to address these research gaps and academic questions. Four projects were researched, in which students' current learning contexts were analysed, and supporting measures were developed with regards to cross-contextual learning. The processes were taken under the loop to enquire and compare perspectives, and to research the involvement of the student perspective within the educational design processes. In the study, both single case and cross-case analyses were applied.

The results show that students experience problems across different dimensions. Students reported cross-contextual learning, especially through the involvement of authentic learning contexts and tasks (both physical and digital), having the potential to support and foster student learning. However, the relations between contexts and the integration of learning experiences across these contexts need to be actively supported. The different problems and supportive measures were therefore identified and presented in the study.

The student and the teacher perspective were found to be partly similar and partly different. Teachers derived different consequences from the problems they (often) similarly recognised to the students, but valued the problems and supportive measures in different ways. Students and teachers were, independent from their means of involvement, satisfied with the involvement of the student perspective in the design processes. However, reflection and interpretation of the results led to questioning the need for more collaborative approaches between students and teachers in the design of (even more) cross-contextual learning scenarios. Based on the results, a model for a collaborative approach is suggested that considers both the potential and the inherent risks of cross-contextual learning.

Zusammenfassung

Aufgrund verschiedener gesellschaftlicher Veränderungen findet Lernen zunehmend in unterschiedlichen (Arten von) Kontexten statt. Die vorliegende Arbeit untersucht dieses Phänomen. Dabei fokussiert sie sich auf die Perspektive von Studierenden. Kontextübergreifendes Lernen bietet Potenzial, studentisches Lernen zu fördern. Allerdings kann es zur Fragmentierung führen, wenn der Zusammenhang und die Integration von Lernerfahrungen nicht aktiv berücksichtigt werden. Das Forschungsvorhaben greift drei Fragestellungen auf:

- Wie nehmen Studierende Probleme und unterstützende Massnahmen in kontextübergreifenden Lernszenarien wahr?
- Wie unterscheidet sich die Perspektive von Studierenden und Dozierenden?
- Wie kann die Studierendenperspektive in den Designprozess kontextübergreifender Lernszenarien einbezogen werden?

Zur Adressierung der drei Forschungsfragen wurde ein komparatives Fallstudien-Design implementiert. Dabei wurden vier Projekte bzw. Designprozesse untersucht und verglichen, in denen die Lernkontexte der Studierenden analysiert und unterstützende Massnahmen in Bezug auf das kontextübergreifende Lernen entwickelt wurden. Die Projekte wurden erforscht, um die Studierendenperspektive besser verstehen und vergleichen zu können. Weiterhin wurde der Einbezug der Studierendenperspektive in die Designprozesse erforscht.

Die Ergebnisse zeigen, dass Studierenden Probleme in verschiedenen Dimensionen erfahren. Kontextübergreifendes Lernen hat aus ihrer Sicht –insbesondere durch die Einbeziehung von authentischen Lernkontexten und Aufgaben (sowohl analog als auch digital)– das Potenzial, Lernen zu fördern. Voraussetzung ist hierbei jedoch die aktive Unterstützung der Beziehungen zwischen den einzelnen Kontexten und die Integration von Lernerfahrungen. Die verschiedenen Probleme und Massnahmen werden in der Studie ausgeführt.

Obwohl Dozierende und Studierende Probleme vergleichbar wahrnehmen, leiten Dozierende durch eine unterschiedliche Bewertung der Probleme andere Konsequenzen und Massnahmen ab. Studierenden und Dozierenden waren zufrieden mit der aktuellen Einbeziehung der Studierendenperspektive in die Designprozesse. Reflexion und Interpretation der Ergebnisse führen allerdings zu der Frage nach der Notwendigkeit von mehr kollaborativen Ansätzen für die Gestaltung von kontextübergreifenden Lernszenarien. Basierend auf den Ergebnissen wird ein Modell für einen kollaborativen Ansatz vorgeschlagen, der das Potenzial und die Risiken des kontextübergreifenden Lernens berücksichtigt. Die Ergebnisse stiften theoretische Mehrwerte für die Wissenschaft und praktische Empfehlungen für die hochschuldidaktische Praxis.

Content

Acknowledgments	2
Summary.....	4
Zusammenfassung	6
List of Figures.....	12
List of Tables	14
1. Introduction	16
1.1. Introducing the Subject.....	16
1.2. Research Gaps and Questions	20
1.3. Situating the Research.....	24
1.3.1. Research Objectives.....	24
1.3.2. Higher Education	26
1.3.3. Actual Relevance	28
1.4. Structure of the Dissertation	30
2. Cross-contextual Learning	34
2.1. The Role of Contexts for Learning	34
2.2. The Role of Cross-contextuality for Learning	41
2.2.1. Cross-contextual Learning Theories and Concepts.....	42
2.2.2. Discussion about Cross-contextual Learning.....	49
2.3. Competences for Cross-contextual Learning.....	50
2.4. Consolidation: Assumptions and Concepts towards Cross-contextual Learning in the Study	51
3. Educational Design for Cross-contextual Learning	56
3.1. Design Principles: Changing Context.....	56
3.2. Design principles: Changing competences.....	60
3.3. Design process models and frameworks	62
3.4. Design on the institutional level.....	67
3.5. Consolidation: Assumptions and Concepts towards Cross-contextual Learning Design.....	68
4. The Student Perspective.....	72
4.1. Students Experience with Cross-contextual Learning	72
4.2. Discussion about Student Orientation.....	74
4.3. Integration of Student Perspective in Design Processes	78
4.4. Consolidation: Assumptions and Concepts toward Student Orientation in the Study	80
5. Methodology.....	84
5.1. Research Paradigm.....	84
5.2. Case Study	87
5.3. Field Description	88
5.3.1. Case Definition: Sampling Strategies.....	91
5.3.2. Participants.....	95
5.4. Methods and Instruments	97
5.4.1. Quality Criteria	98
5.4.2. Focus Groups	101
5.4.3. Teaching Analysis Polls.....	105
5.4.4. Questionnaires	108
5.4.5. Interviews with students who participated in the design process.....	110

5.4.6.	Document Analysis	114
5.4.7.	Interviews with Teachers	115
5.4.8.	Informal Data Strategies: Reflective Diary.....	117
5.4.9.	Naturally Occurring Data and Contrived Contexts of Data Collection	118
5.4.10.	Included and Excluded Data	119
5.4.11.	Correlation of Different Data Types	120
5.5.	Data Analysis	121
6.	Results.....	130
6.1.	Case A	132
6.1.1.	Teacher Perspective on Cross-contextual Learning.....	134
6.1.2.	Student Perspective on Cross-contextual Learning.....	137
6.1.3.	Comparison and Interpretation of the Student and Teacher Perspectives	143
6.1.4.	Involvement of the Student Perspective in Educational Design Processes.....	145
6.1.5.	Interpretation of the Involvement of Student Perspective	149
6.2.	Case B	151
6.2.1.	Teacher Perspective on Cross-contextual Learning.....	153
6.2.2.	Student Perspective on Cross-contextual Learning.....	154
6.2.3.	Comparison and Interpretation of the Student and Teacher Perspectives	159
6.2.4.	Involvement of the Student Perspective in Educational Design Processes.....	160
6.2.5.	Interpretation of the Involvement of the Student Perspective.....	164
6.3.	Case C.....	166
6.3.1.	Teacher Perspective on Cross-contextual Learning.....	167
6.3.2.	Student Perspective on Cross-contextual Learning.....	168
6.3.3.	Comparison and Interpretation of the Student and Teacher Perspectives	173
6.3.4.	Involvement of the Student Perspective in Educational Design Processes.....	174
6.3.5.	Interpretation of the Involvement of the Student Perspective.....	181
6.4.	Case D	184
6.4.1.	Project Leaders Perspective on Cross-contextual Learning.....	185
6.4.2.	Learner Perspective on Cross-contextual Learning.....	187
6.4.3.	Comparison and Interpretation of the Learner and Project Leaders Perspectives 191	
6.4.4.	Involvement of the Learner Perspective in Educational Design Processes.....	192
6.4.5.	Interpretation of the Involvement of the Learner Perspective.....	197
6.5.	Case Comparison.....	197
6.5.1.	Students' Perception of Problems with Cross-contextual Learning.....	199
6.5.2.	Students' Perception of Supporting Measures	203
6.5.3.	Students' Perception Compared with Teachers' Perception.....	208
6.5.4.	Students Perception in Educational Design Processes.....	210
7.	Discussion	214
7.1.	Problems with Cross-contextual Learning.....	214
7.2.	Educational Design Including the Student Perspective.....	218
8.	Implications.....	230
8.1.	Practical Relevance	230
8.2.	Theoretical Relevance	232
8.3.	Research Agenda and Outlook.....	239
8.3.1.	Based on the Results and their Implications.....	239
8.3.2.	Based on the Limitations of the Study.....	241
9.	References.....	246

Appendices.....	260
Appendix A: Interview Guide for Focus Groups.....	261
Appendix B: TAP Material	263
Appendix C: Questionnaire.....	266
Appendix D: Interview Guides for Interviews.....	267
Appendix E: Guide for Transcription	275
Appendix F: MAXQDA File	276
Curriculum Vitae.....	283

List of Figures

Figure 1: Anna's Learning Contexts and (Problematic) Relations between them	18
Figure 2: Learning Contexts, (Problematic) Relations between them, Supporting Measures.	20
Figure 3: Structure of the Dissertation	32
Figure 4: A Learning Experience within a Context with different Contextual Aspects (Dilger, 2019).....	36
Figure 5: The Three Dimensions of Learning and Competence Development (Illeris, 2009)..	37
Figure 6: Visualisation of the 10 MSL Dimensions (Wong & Looi, 2011)	46
Figure 7: The FSL Process Framework (Wong, 2013).....	61
Figure 8: Four Approaches of Students-orientation (Reinmann & Jenert, 2011).....	76
Figure 9: Ladder of Student Participation in Curriculum Design (Bovill & Bulley, 2011)	79
Figure 10: Structure of the Lab: Management, Base Project, and the Subprojects	89
Figure 11: Design-Based Research (Euler, 2014)	90
Figure 12: Overview of Overall Correlation of the Data	121
Figure 13: Thematic Qualitative Text Analysis Process (Kuckartz, 2018)	122
Figure 14: Scaffolded Collaborative Design for Cross-contextual Learning.....	225
Figure 15: The Student Perspective in Educational Design	238

List of Tables

Table 1: Overview of Different Mechanism and According Characteristic Processes of Boundary Crossing Activities (Akkerman & Bakker, 2011).....	59
Table 2: The Seamless Learning Design Paradigm (Rusman, 2019).....	65
Table 3: Overview of Relevant Case Characteristics.....	93
Table 4: Overview of Research Foci and Respondents.....	96
Table 5: Overview of Relations between Research Instruments and RQs.....	97
Table 6: Overview of Quality Criteria.....	100
Table 7: Overview of Focus Groups.....	102
Table 8: Overview of TAPs.....	106
Table 9: Overview of Questionnaires.....	109
Table 10: Overview of Interviews with Participating Students	111
Table 11: Overview of Interviews with Teachers	116
Table 12: Overview and Relationships between Problems and Supporting Measures from the Student Perspective in Case A.....	141
Table 13: Overview and Relationships between Problems and Supporting Measures from the Teacher Perspective in Case A.....	142
Table 14: Overview and Relationships between Problems and Supporting Measures from the Student Perspective in Case B	158
Table 15: Overview and Relationships between Problems and Supporting Measures from the Teacher Perspective in Case B	159
Table 16: Overview and Relationships between Problems and Supporting Measures from the Student Perspective in Case C.....	172
Table 17: Overview and Relationships between Problems and Supporting Measures from the Teacher Perspective in Case C.....	173
Table 18: Overview and Relationships between Problems and Supporting Measures from the Learner Perspective in Case D.....	190
Table 19: Overview and Relationships between Problems and Supporting Measures from the Perspective of the Project Leaders in Case D.....	191
Table 20: Relationships between Problems and Supporting Measures across Cases (Student Perspective)	208
Table 21: Overview of of Cross-contextual Learning Dimensions from the Student Perspective.....	234

1. Introduction

In this study the question is taken up, how students perceive learning across different contexts and how cross-contextuality influences their learning. Since students (can) learn more across different contexts, the answer to this question is considered to be of benefit in helping researchers, educational designers, and teachers to better understand students' cross-contextual learning experiences. The study builds upon the assumption that learning in different contexts offers the potential to foster learning, because different contexts can provide different affordances and experiences for learning (Rusman, 2019). However, on the other side, it is also assumed that to spread learning over different contexts can generally complicate learning, due to the potential for fragmentation of learning (Dilger et al., 2019; Sharples, 2015).

The problems that students may experience from cross-contextual learning form the basis of the current study. It is perceived that a better understanding of students' cross-contextual learning experiences can help to design better cross-contextual learning scenarios. Ultimately, this could help foster learning in today's contemporary educational formats, which make use of the potential from learning across and through different contexts.

1.1. Introducing the Subject

The following real-life case typifies a scenario in order to further introduce the topic. The case describes a first-year undergraduate student named Anna, who studied at a university of applied sciences, and was interviewed in the context of the, then proposed, current study.

Anna

Anna studied at a school of engineering, and the interview was about her maths class. Before enrolling at the university, Anna had undertaken an apprenticeship in business administration (in German: Lehre im KV), and had worked for a few years within the administration offices of a retail business. She was therefore a newcomer to the field of engineering and experienced a hard time refreshing her prior knowledge from her K-12 school days. However, Anna's teacher had helped her to bridge the gap between prior and new knowledge through recapping the learning content required to understand the upcoming content. Anna had also tried using learning apps as a means to refreshing her prior knowledge in mathematics; however, the apps were often neither an exact match to the course content, nor to her personal learning preferences. Every now and then, Anna would recognise formulae from calculations that she had performed during her working experience, which helped her somewhat when she needed to apply them in her

course. Anna explained that sometimes it was hard to be self-motivated, because she did not always see the direct relevance of the in-depth maths content in terms of the potential engineering jobs that she intended to seek out in the future. In this regard, Anna found it helpful when her teacher introduced practical examples from daily life, which helped to make what was rather dry learning content more relevant to her. Although she had yet to need the learning content from her maths class in other courses, she had heard from previous students that this would be the case later on in her study programme.

In this example of Anna, different learning contexts came into play: Anna's previous schooling, her former place of work, the university, her maths class, other classes, self-studying at home, and various online learning contexts with the apps she had used. Although not all students change their disciplinary field, Anna is not alone in moving between different contexts before, during, and after her studies. It is a representative combination of different learning contexts that students move within (Kuh, 1996). Next to those contexts where Anna moved in, other examples of learning contexts are internships, study exchanges, and private learning situations. Yet, this short elaboration shows that students like Anna learn across many different contexts within their learning biographies.

In these varied contexts, students gain learning experiences. Different environments and settings can offer different experiences and afford different opportunities for individual and/or collaborative learning (Kim et al., 2014; Rusman, 2019). Beyond that, a learning experience in one context influences a learning experience in another. In order to develop and elaborate competences, learning experiences spread over different contexts are required (Bakker & Akkerman, 2016). This points to the interdependency of learning experiences across different contexts, which therefore makes learning cross-contextual.

The current study builds upon the assumption that learning takes place across time, by revisiting knowledge that was previously gained within a different context, by moving from topic to topic, and managing a range of learning experiences (following Sharples et al., 2007). However, Dilger et al. (2019) emphasized that the learning outcomes of different experiences need to get integrated in a students' competence. The extent to which relations between and the integration of learning experiences can be achieved influences students' learning and competence development (Dilger et al., 2019).

The cross-contextuality of learning is the reason why not only learning within a single context is noteworthy, but also learning across different contexts. If we understand learning and the development of competences as cross-contextual, then we must also strive to understand the relations and processes between these differing learning contexts.

In the example given, Anna explained that learning in her maths class was challenging, and that this was perceived to be due to the time lag between her K-12 school-based maths classes and her studies at the applied sciences university. However, she also explained how her work experience had helped her to recognise maths formulae in calculations she had performed when working at her office job. Thus, Anna pointed to problematic relations between learning experiences and contexts, as well as to the relations that she perceived to support her learning (see Figure 1).

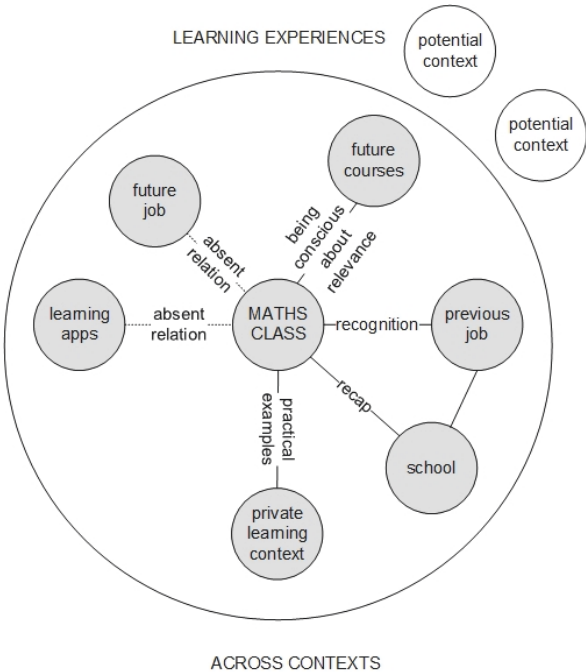


Figure 1: Anna’s Learning Contexts and (Problematic) Relations between them

Currently, the learning contexts that learners move through are still separated in many ways (Rusman, 2019; Wong, 2015). Whilst each can be used dependent on the learning objectives, so long as the (potential) learning contexts remain separated, the potential for cross-contextual learning is largely neglected. From the student perspective, this influences how easy or difficult it is to relate and integrate learning experiences from different learning contexts. Relations between learning contexts and experiences are of significant importance with regards to the risk of fragmented learning in cross-contextual learning scenarios.

However, the relations between learning contexts and experiences are also important with regards to the potential for cross-contextual learning. In an expert interview in 2017, Sharples explained that,

In order to make sense of different fragments of knowledge, one needs to connect them with each other. There are settings where it is hard to do that, because to “fully” understand a certain theme or topic, fragments are needed that are spread out in different contexts.

As Bakker and Akkerman (2016) and also Dilger et al. (2019) explained, integration is required with regards to a student’s competence development.

In summary, student learning is a cross-contextual practice. However, competence development is dependent upon (among others) the relatedness between contexts and the integration of learning experiences which occur within those contexts. Next to that, learning in different contexts has the potential to offer different learning experiences. A closer look is therefore required at the relations between learning experiences across different contexts in order to better understand students’ cross-contextual learning experiences. By offering an improved understanding of the inherent risks and also the potential for cross-contextual learning, it is expected to help researchers, educational designers, teachers, and students to develop supportive measures to prevent fragmentation of learning, as well as to make best use of the potential afforded by cross-contextual learning (see Figure 2).

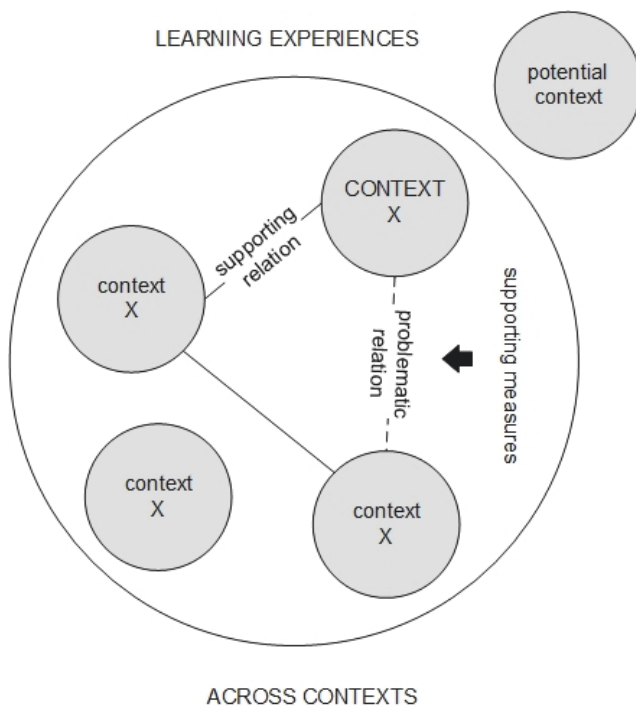


Figure 2: Learning Contexts, (Problematic) Relations between them, Supporting Measures

1.2. Research Gaps and Questions

To be able to place the current study in its research context, it is important to introduce the research project that influenced the current study's evolution.

The research project in question was formed around the concept of seamless learning. Seamless learning is one of the notions within the literature that relates to cross-contextual learning. The seamless learning community takes its focus on how educational technology can help to align or bridge contexts, with the aim that learning experiences are continued and become integrated, despite what may be various changes of context (Chan et al., 2006; Wong, 2015). In seamless learning, the differences between contexts which result in problems for learning are called seams. Seams can negatively influence the continuity and integration of the learning experience due to the change in context. Rusman (2019) summarised the rationales and characteristics of a seamless learning design, stating that it aims to:

- Facilitate ‘cross-over’ and continuity of learning in, from and between environments, boundaries and (social) practices, making most of the characteristics of each environment to enhance (situated) learning, in order to reach a specific set of learning objectives.
- Facilitate personally meaningful learning, through contextualised, active, socially-embedded and experience-based learning.
- Increase differentiation and flexibility of learning and support processes, through time, pace, space/place and practice (in)dependent learning, spanning both formal and informal learning environments.
- Optimise learning processes across environments and settings through the well-considered use of (a combination of) personal mobile devices and digital technology (p. 136).

In the research project that influenced the current study, different supporting measures which foster seamlessness were developed and researched. The project’s focus was mainly on higher education; hence the aim was to work on seams for students at the higher education level. Within the project, a study was undertaken to analyse seamless learning problems (*the learning problems behind the seams in seamless learning* – Dilger et al., 2019). During this study, whilst reviewing the literature and reflecting upon the empirical data, two research gaps were identified, which are presented in the following sections.

Departing from the student perspective

For seamless learning, the experience of the student is central. The students’ learning experiences and competence development should be continued and therefore requires support across different learning contexts. However, there has been very little academic research conducted that has departed from the student perspective. In the literature, the developed seamless learning interventions are built upon, or reasoned from, the researchers’ or the teachers’ perspective. These types of study have therefore built upon the seams that researchers and teachers ‘think’ may hinder student learning. In other literature that has taken a focus on cross-contextual learning in higher education (e.g., boundary crossing), the students’ perspective has also not been explicitly central either. This awareness led to the focus on the student experience with cross-contextual learning in the present study. Two questions that led to the formation of the current study were, ‘How do students experience cross-contextual learning scenarios?’ and ‘How does cross-contextuality foster or hinder learning?’

As described in Section 1.1, the problems that students may experience due to cross-contextual learning form the basis of the current study. In the literature, it

has been described that cross-contextual learning can cause problems with regards to the relatedness and integration of learning experiences (Akkerman & Bakker, 2011); however, such problems and challenges have only been rather briefly described. This is remarkable, because, for instance, in the seamless learning literature, these problems are seen as multifaceted and extensive. They include different dimensions such as the influence of different contextual factors on learning processes, and the different modes and approaches for learning within different contexts (Dilger et al., 2019). The problems have, therefore, not been adequately conceptualised to date (Dilger et al., 2019). Also, normative questions which may help to evaluate the problems, have not been conclusively discussed (e.g., What are the final objectives of seamless learning?). Compared to the seamless learning literature, the boundary-crossing literature has certainly proved that there is a greater depth to some of these questions (e.g., normative discussions about the desirability of continuity and discontinuity for learning) (Bronkhorst & Akkerman, 2016). However, although both streams have designed and tested supportive measures and solutions to the (so far) analysed problems, there still remains considerable potential to analyse these problem areas more deeply and systematically.

The current study, therefore, aims to address this research gap and to contribute to a better understanding of the problems from the student perspective. Can students help us to further conceptualise cross-contextual learning problems? How do they experience problems when learning across different contexts? And what do they perceive as supporting factors for cross-contextual learning?

The research questions (RQs) with regards to this research gap are formulated as follows:

RQ1: How do students experience problems when they learn across different contexts?

RQ2: What aspects do students perceive as being supportive when they learn across different contexts?

Students' perspective in educational design processes

Researching the student perspective enables the comparison of the student perspective with other perspectives, such as those of teachers, educational designers, and also researchers. The extent to what the student perspective differs from this of teachers and educational designers is important to consider with regards to processes to design cross-contextual learning scenarios. Knowledge about the

various differences between perspectives could help improve educational designs through adapting them in ways that are the most supportive for student learning.

The fact that the students' perspective was not explicitly described in terms of research towards cross-contextual learning, raised interest in the question of if and how information about the student perspective is considered within educational design processes. In the context of seamless learning, Kuh (1996) described it being critical to understand the social context under which students learn because, 'if this culture is not properly addressed, any seamless learning effort will fail' (in Bell, 2000, p. 51).

Reinmann and Jenert (2011) described that both teachers and students sometimes find it difficult to see things from the other's perspective. They explained that the growing expertise of teachers (who often also research their subjects) somewhat naturally alienates them from the students' novice perspective. This makes it inherently difficult to structure content and to then teach it with methods that are compatible with students' needs and preferences (Bromme & Rambow, 2001; Reinmann & Jenert, 2011). Reinmann and Jenert (2011) went on to explain that teachers usually do not have access to how students experience their educational designs, because teaching evaluations focus on variables that are easier to collect, and which do not provide adequate insight that would make any perceivable impact. Conversely, students often do not understand the intention of the teaching and learning scenarios that are selected for them, and perhaps then evaluate and use a learning environment in quite a different way than was originally intended by the teacher (Reinmann & Jenert, 2011; Vermunt & Verloop, 1999). As a result, didactic interventions do not always work as expected, which can frustrate innovative teachers (Reinmann & Jenert, 2011).

In response to the discrepancies between the different perspectives, both Kuh (1996) and Reinmann and Jenert (2011) argued for increased collaboration between faculty members and their students in order to be able to focus more upon what students need to learn, and also to create the necessary conditions that will make the desired learning occur.

To be able to bridge the various differences between the perspectives of both students and teachers, it is important to understand how the student perspective is enquired and implemented during the designing of cross-contextual learning scenarios and measures. Some previous research focused upon the integration of the student perspective within educational design processes, and ranged from looking at the student perspective through feedback to the co-design of learning environments (Bovill & Bulley, 2011; Brooman et al., 2015). However, what kind of collaborations have been implemented or even what

would be appropriate in order to optimise the design of cross-contextual scenarios has yet to be researched. This inevitably raises questions about educational design processes for cross-contextual learning. What do the design processes look like in practice? Does a focus on cross-contextual learning scenarios demand a different design process? And does a focus on cross-contextual learning demand a different kind of collaboration with students?

Especially where the student perspective differs from that of their teacher, it is important to find systematic ways to approach the issue of educational design which can adequately consider the student perspective in order to better address students' cross-contextual learning problems. Even where this is not the case, it is interesting to understand what makes design processes successful.

In summary, the second research gap focused upon in the current study regards the role that the students' perspective plays in processes for designing cross-contextual learning scenarios. The research questions formed with regards to this second research gap are as follows:

RQ3: How does the student perspective differ from that of their teachers?

RQ4: What role does the student perspective play in educational design processes in designing cross-contextual learning scenarios?

1.3. Situating the Research

1.3.1. Research Objectives

The described research gaps and research questions form the pillars of the current study. First, there is the research gap regarding students' experience of (relations between different) learning experiences in different contexts. Second, there is the research gap respecting the student perspective in educational design processes for cross-contextual learning scenarios. Based on these, the primary objectives of the study can be derived:

Research Objective 1: To better understand the problems and supportive measures that students experience when learning across different contexts

The current study intends to describe in-depth how students experience problems and supportive measures when they learn across different contexts. When it has been shown to what extent students experience problems and how they experience those problems, the required corresponding supportive measures can be better designed. Therefore, armed with a better understanding of stu-

dents' cross-contextual learning experiences, the endeavour is to enable teachers and educational designers to better support cross-contextual student learning (see Research Objective 2).

Theoretically, the answers to the research questions contribute to actual discussions in the higher education literature. Although there are numerous new studies being published in the field of cross-contextual learning, the perspective of the student is often only indirectly considered. The current study aims to make a significant contribution in this area, and may therefore be regarded as complementary to the existing literature. Due to its specific research focus, the current study will consider a different perspective, so that cross-contextual learning can be interpreted from different perspectives and improved as purposefully as possible. The research aims to help explain the similarities and differences between the student and teacher perspectives, and to explain both larger and smaller discrepancies noted between the two. The clarification of the research questions will expand upon the existing knowledge in the field of cross-contextual learning. The current study does not intend to directly eliminate any problems that surface during the study, but aims in the first place to describe, analyse, and compare those problems as well as the implemented supportive measures.

The second objective of the current study is to find out how the student perspective has been taken up in the design processes for cross-contextual learning scenarios:

Research Objective 2: To better understand how the student perspective has been used within educational learning design processes for cross-contextual learning

In-depth descriptions of the involvement of the student perspective in educational design processes for cross-contextual learning address RQ4. Educational design processes which specifically focus upon the design of cross-contextual learning scenarios are considered in terms of being able to increase understanding about the actuality and desirability of design processes that address the student perspective. The endeavour is to offer reflections and lessons learned for consideration by educational designers and teachers when they come to design cross-contextual learning scenarios in the future.

Theoretically, the answers to the research questions contribute to actual discussions in the higher education literature, both towards educational design and student participation (Martens et al., 2019). The current research may even contribute to the discussions about the shift from teaching to learning (Barr & Tagg, 1995), which has already been discussed for some time in the higher education

community. Discussions about the desirability of student-centeredness and student-orientation are still current, followed by discussions about the involvement and participation of students within the educational design processes themselves. Although there have been several recent studies published in the field (e.g., Li et al., 2020; Tuhkala et al., 2020), there has still yet to be any focus upon cross-contextuality. The current study therefore aims to contribute to this area, and hence may be regarded as complementary to the existing literature. The clarification of the research questions will expand upon the existing knowledge in the field of educational design.

1.3.2. Higher Education

The current study focuses upon cross-contextual learning at the higher education level. One question worth asking is why the student perspective has not already become more explicit in the field. This may be explained by most research having been conducted within the primary, secondary, and vocational education contexts. Seamless learning has been described as one of the important theories with regards to cross-contextual learning. However, within the seamless learning community, the focus has primarily been on primary and secondary education (Durak & Cankaya, 2018). The literature regarding boundary crossing has focused on different levels of education. However, there are different understandings and applications of boundary crossing within higher education, which differently include the student perspective. Next to that, per study, the focus has been on only one dimension of cross-contextual learning (e.g., Owen & Zwahr-Castro, 2007).

It is perhaps remarkable that there has not been more (integrative) research in terms of higher education, because it can be safely assumed that students in higher education learn (or have learnt) across a broader variety of contexts than younger learners (e.g., because of elective courses taken, internships, study exchanges, work experience, private lives). Higher education students can therefore be asked to reflect upon their cross-contextual learning experiences. Although it cannot be excluded that younger learners may also be able to do the same, older students are more likely to offer more potential in this regard, partly because their metacognitive competences are assumed to be further developed (Schneider, 2010), as well as their assumed broader life and study experience. As the current study focuses on the higher education context, this potential to research the student perspective unfolded. The current study focuses upon higher education, as well as including the relations with both prior and future learning contexts.

The field of higher education has certain specific characteristics with regards to cross-contextual learning, which are briefly described as follows. However, it

should be noted that the descriptions concern the field of higher education in Switzerland and Germany, where this empirical study was located. The descriptions are included here for the purpose of situating the current study and to elucidate the cultural background in which the study took place.

In both Switzerland and Germany, students can access higher education through different educational paths (from a certain level achieved in either secondary or tertiary education) (Edelstein, 2013; Staatssekretariat für Bildung, Forschung und Innovation [State Secretariat for Education, Research and Innovation], n.d.). In the actual higher education system, the focus is on formal education. Following the Bologna Process, which laid down agreements between European countries to ensure comparability in the standards and quality of higher-education qualifications, most institutions offer different study programs at the Bachelor's and Master's degree level, which are both constructed on a modular basis as a set of different courses (Staatssekretariat für Bildung, Forschung und Innovation [State Secretariat for Education, Research and Innovation], n.d.). Each course has a corresponding credit value, and gaining a certain amount of credits (in certain subject areas) leads to a diploma being awarded for the applicable programme of study (Staatssekretariat für Bildung, Forschung und Innovation [State Secretariat for Education, Research and Innovation], n.d.). The credits can be collected through a combination of both compulsory and elective courses. Students often also have the possibility to gain a certain amount of credits through studies undertaken at different higher education institutions, either nationally or internationally. The modular system, coupled with the credits system leads to students being able to arrange their own individual learning biographies.

The faculty members that teach students in the study programmes, often have a disciplinary and content-based background, combined with work experience of varying lengths. Most are anchored within their disciplines, and often possess specific expertise in the subject that they teach. Teachers are responsible for their own subjects and often have limited contact with teachers from other subject areas and disciplines. For the purposes of cross-contextuality, this means that the programme managers are responsible for the structure of the study programme, and for the alignment of the subjects with regards to the learning objectives.

Teachers do not necessarily have a didactical or pedagogical background themselves, and consequently may possess limited knowledge about both the risk and potential of cross-contextual learning. Institutions may offer didactical courses; however, they are not always compulsory. Next to that, it is unclear to what extent cross-contextuality is an actual topic within didactical courses.

Last, higher education institutions are influenced by different and varying external factors, such as the employment market, the local, national, and international political system, and societal changes, also at varying levels. This variability means that educational institutions are dynamic in nature, and also that they are likely to have variable relations when it comes to influencing contexts (see also Section 1.3.3).

The outlined characteristics of higher education (can) influence cross-contextual learning; normatively, strategically, and operatively. They are each important to bear in mind as the background to the current study, as well as for the interpretation and implications of the study's results.

All further texts from this point on are written with regards to and within the context of higher education. However, only where it is specifically relevant to mention the (characteristics of the) field explicitly, will this be done¹.

1.3.3. Actual Relevance

As described in Section 1.1, learning is understood to be generally cross-contextual, both within formal educational contexts and elsewhere. Interest in the relations between learning contexts has existed for decades (e.g., Engeström et al., 1995). For instance, the construct of seamless learning was introduced a quarter of a century ago by Kuh (1996), who explained and initiated that:

The word seamless suggests that what was once believed to be separate, distinct parts (e.g., in-class and out-of-class, academic and non-academic; curricular and co-curricular, or on-campus and off-campus experiences) are now of one piece, bound together to appear whole or continuous. In seamless learning environments, students are encouraged to take advantage of learning resources that exist both inside and outside of the classroom. Students are asked to use their life experiences to make meaning of material introduced in classes. (p. 136)

Cross-contextual learning is therefore not some new phenomena by any means. In the following text, it is elaborated why cross-contextual learning is of interest and meaningful with regards to current higher education. What and how actual societal changes influence cross-contextual learning is discussed in terms of today's higher education.

Several societal changes such as increased technology availability, digitalisation, globalisation, connectivism, and mobility have led to an increase in the number of contexts to which today's students have access to (Zukunftsinstitut,

¹ In addition, it should be noted that the term 'teachers', in the context of the current study, refers to faculty members who design lessons and teach/lecture at the higher education level, as opposed to instructors or school (K-12) teachers.

2020). Erstad et al. (2016) described how those changes have led to expanded practices of learning that stretch across both space and time, and that this has led to significant changes in young people's learning practices and ecologies. Also, Looi et al. (2010, p. 156) stated that the learning space is no longer defined by the 'class', constrained by scheduled class hours or specific locations, but by 'learning' across spaces. One example of this is how today's students have access to learning contexts in almost everywhere they go.

Students now have access to formal educational offers such as MOOCs, as well as systems such as Coursera and Open Badge. If learning finds its place more beyond the (base) higher education institution (e.g., online, study exchanges, and internships), this may question what role this kind of learning plays when it comes to learning at the base higher education institution. How do higher education institutions want to make use of these resources? It could, for example, be questioned if the formal higher educational context may be conceptualised as a place where educational designers and faculty aim to explicitly bind together or integrate the experiences that students have gained from several different contexts. According to the literature about high-impact pedagogies, the formal higher educational context could be the place where periodic, structured opportunities to reflect and integrate learning take place (Kuh et al., 2017). It could therefore be one possibility to deal with the increased learning opportunities that today's students have, and with the increased amount of learning across different contexts.

The described societal changes not only offer potential for cross-contextual learning, but may also demand educational innovation when aimed at more modern educational formats (see Kukulska-Hulme et al., 2020). Conservative, classical, mainly instruction-based formats intended for knowledge transmission are now being replaced by high-impact pedagogies that intend to create applied, hands-on, integrative, and more collaborative forms of learning experiences (Kuh et al., 2017) that result in different learning contexts coming into play. For instance, informal learning has gained interest with regards to the development of problem-solving skills (e.g., Nygren et al., 2019). Another example is the innovative educational format at Minerva School at KGI (<https://www.minerva.kgi.edu/>), where it has become visible that cross-contextual (e.g., making use of authentic learning contexts) and interdisciplinary learning is much more relevant. Therefore, the relation between learning contexts becomes a new meaning. A conceptual change towards the perception of educational design, mostly including only one context at one time, and not making use of other resources which actually could play a relevant role in learning, may become necessary in order to meet the requirements of applied, hands-on, integrative, and

more collaborative learning experiences. It could therefore be questioned what role cross-contextuality has when it comes to modern-day educational formats.

Societal changes have also influenced how knowledge is spread and how it is rapidly changing and ultimately evolving. This development demands lifelong learning and the development of lifelong learning competences by students (Tett, 2014). Lifelong learning in fact means cross-contextual learning over time, and demands that higher education institutions prepare their students for life-long learning. Often, issues are raised to promote lifelong learning among individuals and communities within and across formal, non-formal, and informal contexts (Erstad et al., 2016). One consideration with regards to cross-contextual learning over time could be if the formal educational context is conceptualised as the place where educational designers and faculty address students' competence development in order that they begin to learn cross-contextually by themselves.

In terms of the current study, the aim is not to discuss the societal changes themselves, but it is clear that learning has become more cross-contextual, and thereby has the potential and even need for students and teachers to think more cross-contextually. As described, cross-contextuality has significant potential and is even necessary; however, it also increases the risk of fragmentation of learning. The current study aims to contribute to the discussions about how higher education institutions can react to the increasing cross-contextuality from the student perspective, and how students can be best supported so that they are able to learn and make the most of their cross-contextual learning experiences.

1.4. Structure of the Dissertation

The following chapters can be divided in two parts. Part I includes Chapters 2, 3, and 4, and covers the fundamental literature and concepts upon which the study is grounded. The following chapters in Part II then present the empirical investigation, which seeks to answer the aforementioned research questions.

In Part I, the relevant literature of the study is reviewed and presented. It is explored what meaning context has with regards to learning, with a particular emphasis on the meaning of learning in a variety of contexts, and what it means to move across them. The understanding of context and cross-contextuality is covered in Chapter 2. Chapter 3 then considers the varying approaches and design principles that are known to support cross-contextual learning. This includes theories from both a learning theoretical point of view, as well as from an educational design point of view. In Chapter 4, specific focus is placed on the

student perspective, and also on how the student perspective can be assimilated within the design of measures to support and foster cross-contextual learning.

In Chapters 2, 3, and 4, the relevant literature and the meaning for the study (i.e., assumptions, understanding, central concepts, and further use of the concepts in the study) are presented separately. The latter can be found in the consolidation sections presented at the end of each chapter and form the conceptual framework for the current study. The conceptual framework of the study helps readers to understand the empirical part of the study, reveals which assumptions underpin the study, and also what theories have been used in terms of the study's research design.

Part II begins with the description of the empirical aspects of the study. The research design is presented, having been derived from the aforementioned research questions. The field, sampling methods, research methods as well as the corresponding instruments, data analysis techniques, and the quality criteria are all described in Chapter 5. In Chapter 6, the results of the study are presented, after which the results are discussed and reflected to the current literature in Chapter 7. Lastly, Chapter 8 presents a discussion of the implications for the educational practice as well as for the research community. Based on the study's results, an outlook is presented on potential future research activities. Finally, reflections on how the research design of the study may have influenced the reported results are presented, together with the researcher's thoughts on what this may mean in terms of future research on this topic of study. An overview of the structure of the dissertation is provided in Figure 3.

Introduction (Chapter 1)	• Introduction of the Subject • Research Gaps and Questions • Situating the Research
Conceptual Framework (Chapters 2, 3, 4)	
Cross-contextual Learning in Higher Education (Chapter 2)	Educational Design for Cross-contextual Learning in Higher Education (Chapter 3) The Student Perspective (Chapter 4)
Methodology (Chapter 5)	• Research Paradigm • Case Study • Methods and Instruments (Quality Criteria) • Data Analysis
Results (Chapter 6)	
Case Analysis	Case Comparison
Discussion (Chapter 7)	• Problems with Cross-contextual Learning • Educational Design including the Student Perspective
Implications (Chapter 8)	• Practical Relevance • Theoretical Relevance • Research Agenda and Outlook

Figure 3: Structure of the Dissertation

2. Cross-contextual Learning

2.1. The Role of Contexts for Learning

This chapter is about cross-contextual learning. In order to be able to study the phenomena of students' experiences of problems with cross-contextual learning, a deeper understanding of both context and learning is required. Taking both constructs together, this leads us to the question what meaning context plays for learning. In the literature, discussions have focused on the role that context has on learning processes and learning. The most fundamental epistemological assumptions about learning influence how the role of learning context is understood. In this chapter, the relevant assumptions are elaborated upon in terms of how learning is anchored in context. From the one side, the aim is to gain a better understanding of (cross-) contextual learning, whilst from another it is to reveal which assumptions underlie the current study.

Socio-constructivism

Learning theories attribute important value to learning contexts and environments. In all learning theoretical streams (behaviourism, cognitivism, and (socio-)constructivism), learning happens through a form of interaction with the environment of the learner (Reinmann, 2013). However, both the overarching streams and single learning theories differ in their understanding of the role that the context plays for learning. In the behaviourism and cognitivism paradigms, learning is understood as the result of experiences gained in an objective world (Kirshner & Whitson, 1997; Reinmann, 2013). In the constructivist paradigms, learning is understood as a process that occurs in a subjective and socially constructed world (Kirshner & Whitson, 1997).

These different understandings of learning and the world around us have led to different understandings of what the learning context can look like. Learning in a stable, objective world means that knowledge can be decontextualised and transmitted; whereas, in a socially constructed world, knowledge and the context in which it is learnt are inseparable (Kirshner & Whitson, 1997). In a socially constructed world, a student constructs meaning from their experiences within a context according to how they perceive this context. The current study builds upon a (moderate) socio-constructivist understanding. Notably, it is assumed that learning is a socially situated process, which attributes significant value to the context in which the learning takes place.

Situated cognition and situated learning

To deepen the meaning of context for learning as a socially situated process, the theories of situated cognition and situated learning offer rich descriptions. Brown et al. (1989) described knowledge as being situated (situated cognition). According to their theory, knowledge is a product of an activity, as well as the context and the culture in which that knowledge is developed and subsequently used or applied (Brown et al., 1989). Therefore, knowledge, the activity, the context, and the culture are all seen as interdependent (Brown et al., 1989). This means that knowledge will always be developed and influenced through its use in the context, framed by the way that members of that community view the world (Brown et al., 1989; Lave & Wenger, 1991). Consequently, learning about this knowledge and how to use it, is connected to social practices (Semin & Smith, 2013). This means that not only knowledge is situated, but also the construction of knowledge; and learning is always situated within its application and the community of practice (Mandl et al., 1995; Specht, 2008). The social practice or context can be interpreted as a 'space' in which learning experiences are made (Wenger, 1998). Learning experiences will therefore always be embedded within its context.

Dilger (2019) explained how a learning experience is influenced by its context and how a learning experience reciprocally influences the context. The model of this is presented in Figure 4 and explained in the following sections.

Whilst the starting point is the model of Dilger (2019), other literature is also included for the purposes of describing the different aspects of the model; and this other literature also forms part of Dilger's (2019) integrative model.

Learning is experience-based

The inner cycle of the model describes the understanding of learning, which is based on the understanding of learning described by Illeris (2009).

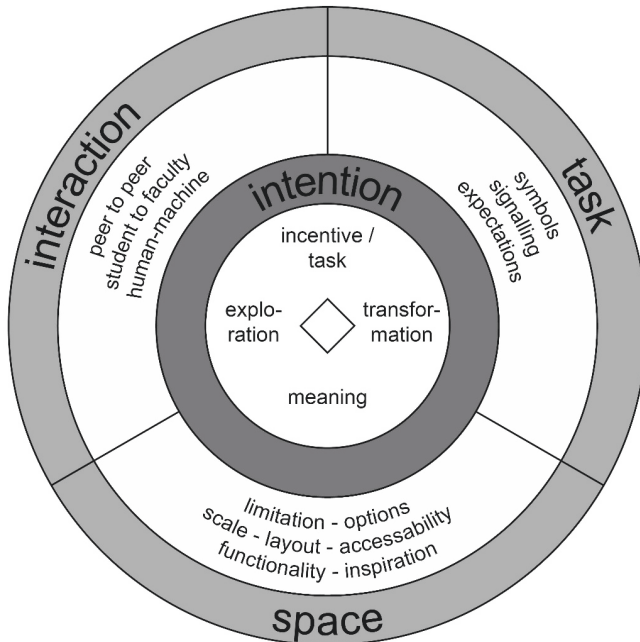


Figure 4: A Learning Experience within a Context with different Contextual Aspects (Dilger, 2019)

Illeris (2009) described four types of learning:

- **Cumulative learning:** This type of learning is characterised by being an isolated formation, something new that is not a part of anything else.
- **Assimilative learning:** By far the most common type of learning is termed assimilative or learning by addition, meaning that the new element is linked as an addition to a scheme or pattern that is already established.
- **Accommodative learning:** This type of learning implies that one breaks down (parts of) an existing scheme and transforms it so that the new situation can be linked in.
- **Transformative learning:** Transformative learning implies what could be termed personality changes, or changes in the organisation of the self, and is characterised by simultaneous restructuring of a whole cluster of schemes and patterns in all of the three learning dimensions. (pp. 13-14)

Dilger (2019) described how learning processes can range from exploration through to transformation. Thus, the model considers all four different types of learning.

Illeris (2009) also described how this learning happens, according to the interaction of three dimensions (Figure 5).

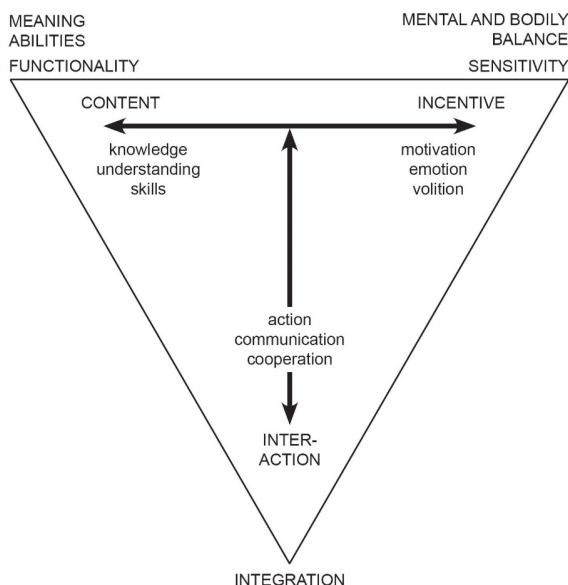


Figure 5: *The Three Dimensions of Learning and Competence Development (Illeris, 2009)*

The first dimension is the ‘content dimension’, which concerns what is to be learnt (knowledge, understanding, and skills). With the content, a learner aims to construct meaning and the ability to deal with challenges of practical life (functionality). The second dimension is the ‘incentive dimension’. This refers to the incentive that a person experiences, and is represented in terms of their feelings, emotions, motivation, and volition (sensitivity). The functionality is in reciprocal interaction with the sensitivity that a student perceives (Illeris, 2009).

These two dimensions interact with the third dimension, which is called the ‘interaction dimension’. This dimension provides the impulse that initiates the learning process (through action, communication, and cooperation), and the triangle of these three dimensions mirrors the interaction between the individual and the context. The dimensions ‘content’ and ‘incentive’ are initiated by impulses from the interaction processes, and those impulses are integrated within the internal processes of the learner (Illeris, 2009). Conversely, the interaction between the individual and the environment serves as the personal integration within the environment, and thereby also builds up the sociality of the learner (Illeris, 2009).

Dilger (2019) represented the incentive described by Illeris (2009) as well as the overall meaning that a learner experiences through the interaction between these three dimensions. Thus, in the model of Dilger (2019), learning is reached through learning experiences, and learning is understood to be experience-based (Kolb, 1984). A learning experience emerges through the interaction of the three dimensions, and is influenced by the outer circles.

Contextualised learning experiences

Going further outwards in the model, Dilger (2019) deepened the understanding of what context-aspects play a role. As a moderating component between learning processes and the context, Dilger (2019) described the intention that a learner has (e.g., a formal or personal learning objective). This intention can be triggered by the context; however, it can also be triggered from internal aspects of the learner (e.g., incentive, interest).

The context influences both the learning intention and the learning process of the overall experience that a learner has (e.g., transformative learning). In order to be able to understand how the context influences the learning intention and the learning process, the following sections elaborate upon what is actually meant by context, and also what aspects play a role in describing a certain context.

Description of context and aspects of context

Context is a hard entity to define at the general level (Dourish, 2004; Middleton, 2018; Oers, 1998). Mostly, descriptions of context are limited by the relevant features for a specific experimental setting of a study or a certain situation (Cobb & Bowers, 1999). Following the socio-constructivist paradigm, this can also be argued for, because the meaning or the relevance of the aspects in the context will always be constructed by those involved in this context. Departing from meaning and relevance, the description of other (i.e., irrelevant for them) contextual factors does not make actual sense.

Still, in order to be able to broadly analyse students' experiences of problems with cross-contextual learning, as in the current study, it is important to define the research object and to look at what possible contextual factors play a role with regards to learning experiences. Next to that, it is the role of social science to recover the formal analytic categories that operate behind the scenes of daily life (Cobb & Bowers, 1999).

In the literature, context is sometimes broadly defined based on its physical (spatial) characteristics. Designations of learning contexts based on this understanding are, for example, the school (as in the building/s itself), the classroom,

or the workplace. Some theories use this kind of definition as the starting point when describing context. For instance, some theories regarding formal and informal learning use this to describe and distinct contexts for in-school (formal) learning and for out-of-school (informal) learning (e.g., Eshach, 2007). Descriptions of the physical aspects can, for example, include the room, its furniture, the positional flexibility of the furniture, access points to other rooms, as well as the light, sound, and materialistic resources. In the model of Dilger (2019), a space can have a different scale, a different layout, and different accessibility. With regards to the influence of these aspects, a space can be more limiting or open in terms of the options it offers for each learning experience. With regards to learning intention, this can be either functional or inviting.

Other theories have argued that the social aspects of a context hold as much relevance as the physical context, because learning is, after all, a social process (Brown et al., 1989; Chaiklin & Lave, 1993; Lave & Wenger, 1991). Consequently, such theories have described learning contexts more as social practices. Following this understanding, context can also be described or distinguished based on the social aspects of the context. For example, a context can offer possibilities for both individual or social learning. The social aspects of a context are sometimes described as the learning culture or as the climate for learning. In the model of Dilger (2019), different forms of interaction are taken up. Students can interact with their teacher and/or with each other, but they can also interact with technology (as an institution). Like the physical aspects, the social aspects can influence the learning experience as well as the learning intention.

Of course, today's learning contexts can also be digital, with technological infrastructure having created new (virtual) contexts, which enable and allow access to various digital contexts and resources. However, not only have new contexts emerged, but existing learning contexts could now also have become enlarged (Chan et al., 2006; Erstad et al., 2016). In this case, technology has become integrated in the former learning contexts, and most learning contexts are no longer conceivable without at least some element or influence of technology. Sometimes, the technological aspects are described as isolated contextual aspects in their own right. In the model of Dilger (2019), technology is seen as an integrative element along with other contextual aspects within the spatial, interaction, and task dimensions.

Dilger (2019) also described the learning task as an influencing contextual factor for a certain learning intention and learning experience. Like Brown et al. (1989), Dilger (2019) interpreted the task (note: Brown et al., 1989 used 'activity' rather than 'task') as an interdependent part of both the learning experience and the

learning content. Glahn and Gruber (2020) defined the learning activity as follows, and describe the correlation of activity and task:

Educational tasks including necessary resources, environment, intended performances, expected outcomes, as well as relevant feedback. Learning activities typically consider a learner role and a facilitator role but can also address multiple roles in different social interactions. Learning activities abstract beyond individual performances and refer to planned educational interventions. (p. 37)

In the model of Dilger (2019), the task includes, for example, symbols, signaling, and expectations, which are all related to the learning activity that influences or is influenced by a certain learning intention and the personal aspects of the learning process.

Whilst it may be discussed if task is the right construct for informal learning contexts, a task or activity can be influenced by or can influence learning intention, as well as the personal aspects of the learning process. Therefore, it forms part of the context as it embodies the overall learning experience.

Overall, the aspects that help us to understand and describe a context also influence each other. Like the description of the learning activity aspect of Glahn and Gruber (2020), an activity or task also considers certain social aspects. This shows the reciprocal interaction of the different aspects of a certain context, which is also assumed by Dilger (2019).

The role of the context

Through the model of Dilger (2019), it can be explained that learning contexts with different aspects afford different experiences and opportunities for learning (Kim et al., 2014; Rusman, 2019). The various opportunities that are enabled by the configuration of aspects of context can be summarised in the construct of 'affordance'. Although this construct is not too familiar within educational studies, it is, however, common in studies about materiality and in more technology-based disciplines. The affordance of the context for learning concerns the question, 'What kind of learning is enabled to or invited by the context?' Glahn and Gruber (2020) defined affordance as the quality or property of objects or tools that define their possible uses or makes clear how they can or should be used (p. 36). They also defined contextual affordance as the properties of objects or tools that bind usages to contexts, and that these properties are connected to contextual dimensions (Glahn & Gruber, 2020, p. 36). For instance, in terms of the physical aspects of a context, the focus is on what kind of learning is pushed, pulled or intensified by or because of the specific physical aspects. Looking at

the social aspects, the interest shifts to what kind of social setting stimulates or intensifies what kind of learning takes place.

Learning experiences or activities can also be contextualised within a certain context. Glahn and Gruber (2020) defined contextualisation in education as the use of context for selecting learning activities, as well as for changing the conditions of one or more learning activities (p. 36).

In summary, each context (with specific contextual aspects) invites and enables different learning experiences, which can fit better or worse depending on the learning intention.

From contextualised learning experiences to cross-contextual learning

The differences between contexts and their affordances make learning in different contexts interesting. What is not visible in the visualisation of the model of Dilger (2019), is that it is also possible that students move through more than one context with regards to a singular learning intention. As described in the Introduction chapter of the current study, this has potential, because of the potential for different kinds of learning experiences. The following section addresses the meaning of the differences between contexts for learning.

2.2. The Role of Cross-contextuality for Learning

Cross-contextuality as a requirement for learning

In order to understand complex phenomena and to develop competences, it is significant to concede that there is often no single context that reaches out to acquire certain knowledge or competences (Bakker & Akkerman, 2016). As described, different contexts for learning lead to different experiences. In different contexts, the different physical locations, social situations, and learning tasks can each help to foster learning to the same intention or objective in different ways. For instance, in order to be able to utilise knowledge and competences flexibly, it may sometimes be necessary to gain experience with certain knowledge or competences within different contexts. By continuously moving back and forth between learning experiences (and reflection), the knowledge, competences, and flexibility with them can each be elaborated and as such they become (further) developed. Situated cognition and situated learning theories see learning in different contexts as an important requirement for learning. They argue that knowledge and competences will continually evolve according to each new occasion of use, situation, negotiation, and activity (Brown et al., 1989).

Integration as a requirement for competence development

The (further) development of competences through an accumulation of learning experiences requires that some relation those learning experiences needs to exist. A competence can be defined as an integration of certain knowledge, skills, and attitudes (Dilger et al., 2019, p. 30; Lizzio & Wilson, 2004), meaning that the integration of the knowledge, skills, and attitudes which are developed within learning experiences in different contexts is a requirement for competence development.

To integrate learning experiences, the learner needs to be able to connect learning experiences despite a change of context (Sharples, 2015). Individuals do have the capacity to make such connections by making sense, translating, and integrating or actively introducing elements from one practice into another (Bronkhorst & Akkerman, 2016, p. 20). However, making connections becomes more difficult when the differences between the contexts wherein learning experiences have been gained are more significant (Bronkhorst & Akkerman, 2016). Fragmentation of learning may occur if learning experiences take place across distinct and different contexts, and where the learner themselves is unable to integrate the different learning experiences according to their own competence (Dilger et al., 2019, p. 30). Thus, learning across and within different contexts carries the risk for fragmentation of learning experiences where the differences between the contexts are more significant.

In summary, cross-contextual learning often becomes a necessity and certainly presents potential for learning. However, as cross-contextual learning requires the relation and integration of learning experiences, and because contexts differ from one another, this may influence how easy or difficult it is to integrate learning experiences within a certain competence, and cross-contextuality may therefore hinder the learning process. When more effort needs to be performed to integrate learning experiences from different contexts, the learning process becomes somewhat interrupted or discontinuous. In the following section, different theories that deepen this ‘momentum’ are described in order to aid understanding of the relation and processes between different contexts of learning.

2.2.1. Cross-contextual Learning Theories and Concepts

Transfer, seamless learning, and boundary crossing

Researchers of transfer, seamless learning, and boundary crossing work on problems that arise when learning (experiences) become spread over different contexts. Transfer theories help in the understanding of what processes take

place when contextualised learning experiences need to be used within (or connected with learning experiences from) another context. Both the community of seamless learning and the community of boundary crossing work on the ‘phenomenon’ of why and where additional efforts are needed in order to learn across contexts (e.g., to switch between contexts, to transfer competences from one context to another, and/or to integrate conflicting experiences). Recognition of a relation between contexts therefore becomes necessary to be able to see that the learning experiences can be used for competence development. This recognition is a requirement for transfer, which is necessary when working on a single learning intention over two or more contexts. Beyond that, recognition of the relation is a requirement in order to be able to integrate learning experiences within competences.

Transfer

In general, learning transfer means that competences that are acquired in a specific learning context (the learning field), can be applied within other contexts (other learning fields or functional fields) whose aspects differ, to a greater or lesser degree, from those of the learning environment (Mandl et al., 1992; Solga, 2008). For this purpose, what has been learnt must be generalised in order to change context conditions and to remain effective or applicable over a longer period (Baldwin & Ford, 1988; Laker, 1990). Situated knowledge needs to be abstracted from the context first, in a process known as decontextualisation (Brown et al., 1989). However, decontextualised knowledge from one context needs to be adapted and applied to the subsequent context in order to become context-bounded and relevant to the new context. This process is referred to as recontextualisation (Brown et al., 1989; Oers, 1998). The processes of decontextualising and recontextualising are therefore important for cross-contextual learning scenarios.

From the constructivist perspective, learning in different contexts is the way to abstract knowledge (Solga, 2008), and learning in different contexts is the way to develop competences. Learning across different contexts, and thus repeatedly going through the processes of decontextualising and recontextualising, helps to generalise abstract knowledge and helps to apply the knowledge within different contexts, which helps to make knowledge more and more usable in different contexts (Brown et al., 1989). Beyond that, by decontextualising knowledge from different contexts, the knowledge and competences (e.g., applying and evaluating knowledge) become elaborated or, for example, revised with each new learning experience. In this way, different fragments of knowledge become related and, ultimately, integrated.

Transfer theories centralise what can be achieved, to foster the process of transfer and thereby influence the use of a particular competence learnt in one context in another (e.g., horizontal transfer, vertical transfer, negative transfer) (Solga, 2008). Therefore, transfer theories offer certain design principles which foster the processes of this transference. These design principles will be addressed in Chapter 3. In the next section, seamless learning and boundary crossing are considered. They are described because they help to deepen the differences between contexts and how each may influence learning and, for example, transfer processes.

Seamless learning and boundary crossing

The theories of seamless learning and boundary crossing work on the ‘phenomenon’ of why and where a change of context may hinder learning. A seam or boundary is created by changing aspects between contexts and which thereby influence the continuity of learning. The theories analyse this phenomenon in their aim to support cross-contextual learning.

Research has shown that continuity across contexts is not always self-evident. Even despite our best efforts, students may be faced with differences in the various learning experiences which they attempt to connect, which leads to discontinuities across contexts (Bronkhorst & Akkerman, 2016). Discontinuity is when learning does not result in the desired level of progress, or requires a non-self-explanatory effort (Bakker & Akkerman, 2016, p. 10). In that case, experiences that are learnt in one context cannot always be related to, or may be in conflict with what one experiences and learns within another context (Bakker & Akkerman, 2016, p. 20).

Boundary crossing theory was developed by Engeström et al. (1995). It is the process that takes place at the borders of contexts in order to guarantee or restore continuity within the learning process (Bakker & Akkerman, 2016, p. 8). The community of boundary crossing especially focuses upon the connection between in-school and out-of-school learning, both of which are multifaceted contexts in themselves. This leads to a variety of reasons for discontinuity in learning across both kinds of contexts. In the next section, the seamless learning ‘model’ provides insight in which dimensions of similarities and differences between contexts are discussed. In order to understand the model, a brief background to the evolution of seamless learning and the model is provided in the following excursus:

Excursus: The historical development of seamless learning

The actual field of seamless learning merged from two different streams of research. The first concerns research within higher education, which developed from a historical focus on improving the integration of different domains of student life. The second stream concerns research on mobile and ubiquitous learning, where specific personalised learning activities across space were enabled with technological innovation (Wong, 2015). This second stream gained attention in a study by Chan et al. (2006), who described the following:

Seamless learning is a learning model where students can learn whenever they are curious in a variety of scenarios and in which they can switch from one scenario or context (such as formal and informal learning, personal and social learning, etc.) to another easily and quickly using a personal device as a mediator. (p. 6)

It is a reaction to the fact that learners themselves have become much more mobile (Otero et al., 2011). Studies in this stream explore the potential that technology has to foster learning across contexts with regards to this expanded mobility.

Due to this second stream's influence, the role that technology plays in the field is also recognised in the model that considers the visualisation of the dimensions of *mobile-assisted seamless learning (MSL)*.

In 2015, Wong provided a literature review that summarised the history and development of seamless learning research (Wong, 2015). The community of seamless learning researches how contexts can be aligned or bridged in support of processes like boundary crossing, and thereby restore continuity of learning even where there has been some change of context. Wong and Looi (2011) abstracted 10 features that had been discussed in the literature that foster seamlessness. In the following section, a model is presented that helps to provide a broader understanding of the different kinds of dimension where seams have been known to emerge according to the seamless learning literature (see Figure 6). These seams are structured along the various different contextual aspects of the model which was developed by Dilger (2019).

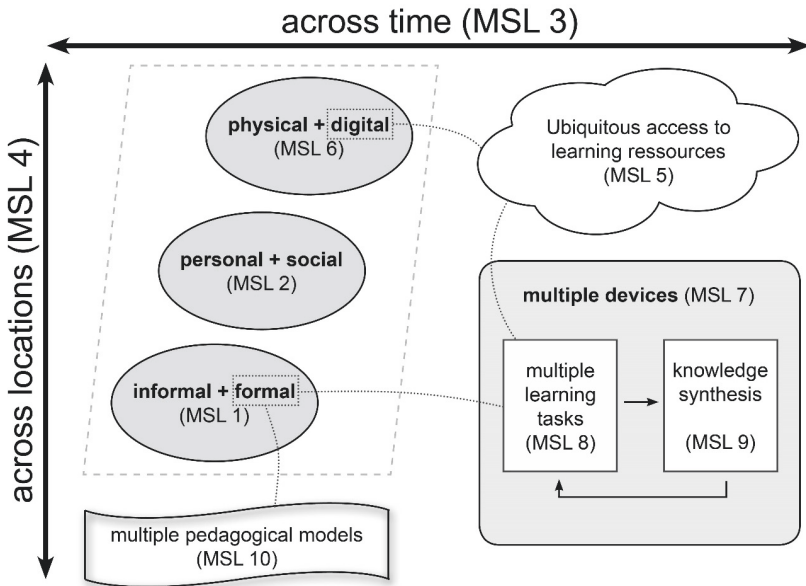


Figure 6: Visualisation of the 10 MSL Dimensions (Wong & Looi, 2011)

Seams due to physical, material, and technological differences between contexts

MSL 3 (learning across time) and MSL 4 (learning across location) are the two most physical dimensions where seams emerged. Learning across different geographical spaces or at different times automatically means that learning becomes cross-contextual. Learning across place and time expands the range of options that today’s students have for learning (see the other MSLs). However, as described, more options (in different contexts with different characteristics) can also lead to the risk of fragmentation and to the poor integration of learning experiences.

Another dimension where seams have emerged is between the physical and digital worlds (MSL 6). For example, an analogue context is often structured quite differently from a digital context. An analogue context tends to follow a semantic logic, whereas an (informal) digital context can also be structured according to its data, algorithms, or patterns. This can significantly influence how learning content is structured and presented, which makes it all the more difficult to recognise connections between analogue and digital learning contexts. Beyond that, technology leads to ubiquitous access to learning resources (MSL 5), which can also of course be structured differently. Seams have

emerged due to learning with different learning resources and have therefore disrupted continuity in learning processes (e.g., because of more effort to find, compare, link, and integrate different resources).

The community of seamless learning uses (among others) multiple devices (MSL 7²) to bridge contexts; however, this can also lead to new seams and boundaries with regards to the relation and integration of learning experiences. When students gain new learning experiences, it is important for them to also have access to their former learning experiences too. The idea is that learning experiences can then be reused and combined when a new learning activity or task needs to be mastered or further developed. Today's technological devices and cloud-based solutions can help make learning experiences, resources, and artefacts more accessible to learners. However, seams have emerged where devices have been shown to be incompatible across different contexts.

Seams due to social aspect differences between contexts

As described in Section 2.1.1, the physical and technological aspects of contexts can influence the social aspects of learning contexts. MSL 2 describes seams between individual, personalised, and social learning. In an individual learning setting, the learning content is interpreted subjectively, but individually. In a more social learning setting, a shared understanding is developed inter-subjectively. This form of shared understanding can of course vary from the individual perception, which has resulted in complicating the integration of individual and social learning experiences.

Seams due to learning task and activity differences

Thinking back to situated learning and Dilger's (2019) model; the task or activity as part of the context plays an important role in learning experiences. Wong and Looi (2011) identified studies in which authors had focused on seams between formal and informal learning activities (MSL 1). A formal learning activity is more instructed, whereas an informal learning activity is more concerned with the experience in a situated context. If learning content for a formal activity is considered, it is mostly structured according to a subject and some disciplinary logic, but beyond that, the learning content is didactically structured. However, in an informal context, this is usually not the case, as the knowledge and how it is processed largely depends on the situation. Informal contexts are, for instance, more interdisciplinary in their nature. Seams have therefore emerged

² MSL 7 was revised to a 'learning hub' by Wong (2013). This learning hub can be seen as a cloud that is accessible through the different devices.

with regards to the relation and integration of learning activities across formal and informal learning contexts.

Also, learning across contexts with differences between pedagogical models (MSL 10) and tasks (MSL 8) have become areas of academic research interest in the past decade (Wong & Looi, 2011). Students today are confronted with different pedagogical models and approaches such as instruction-based learning, problem-based learning, experience-based learning, and also game-based learning during their academic studies. Therefore, students have to transfer and integrate learning experiences gained under one pedagogical approach with those from other pedagogical approaches. This adaption, required due to different pedagogical approaches, can hinder the relation and integration of these learning experiences. In the same way, students are confronted with different learning tasks. Students study the literature, they collect and analyse data, draw conclusions, document the results, and then present their findings. Not only does the type of task change, but the level of complexity can differ too. It is not always self-evident for students to combine the various (sub-)tasks with each other, which has led to the formation of seams between different learning tasks.

On the level of knowledge, MSL 9 points to seams between different fragments of knowledge. There are situations where it is perhaps difficult for students to understand fragments of knowledge where they cannot relate them to other fragments or to an overall structure. Seams occur where students do not understand new material simply because they lack certain prerequisite knowledge in order to understand the new material. Seams can also occur where fragments of knowledge are basically of a different nature (e.g., relating theoretical knowledge to practical knowledge).

Different MSL dimensions tackle very different aspects when it comes to learning experiences. Dilger et al. (2019) categorised these dimensions accordingly:

- Different context factors (e.g., learning in different time and place conditions, learning in different social structures, or having access to different learning resources and/or multiple tools).
- Different modes of learning (e.g., formal and informal learning, analogue and digital learning, or multiple pedagogical approaches).
- Different learning methodologies (e.g., multiple learning tasks or knowledge synthesis) (p. 31).

Dilger et al. (2019) argued that in order to better understand the problems that emerge in terms of relating and integrating learning experiences, contextual variables and the deeper significance for the learning process has to be carefully analysed (Dilger et al., 2019).

2.2.2. Discussion about Cross-contextual Learning

Continuity or discontinuity

In this section, the negative interpretation of seams and boundaries is questioned, as seams and boundaries are not necessarily always negative in every situation. This section attempts to explain why certain seams and boundaries are not always meant to be countered.

First, in practice, it is not always realistic or possible to reach a state of seamless-ness. The different nature of different contexts can never be fully eliminated. Beyond that, seams and boundaries are ambiguous by nature, and differences between contexts can lead to discontinuities in learning in various ways at various times (Akkerman & Bakker, 2011). By defining seams and boundaries as meaningful analytic concepts, it becomes clear that boundaries are real in their consequences, although both seams and boundaries remain malleable and dynamic constructs (Akkerman & Bakker, 2011, p. 152). They can be overcome, even if temporal and partial. They are not identically problematic in different situations, and neither are they identical for different students. From the technological perspective, Chalmers and Maccoll (2003) explained that users have different needs with regards to overcoming seams.

Second, to achieve a situation of having no seams or boundaries is also considered undesirable (Bronkhorst & Akkerman, 2016; Dilger et al., 2019). For example, when the experience of seams and boundaries themselves can be positively utilised as a trigger for learning; hence, seams and boundaries can also be conceptualised as a source of learning (Dilger et al., 2019). For instance, because the ambiguity between fragments of knowledge provokes thinking and the rethinking of prior knowledge (Mezirow, 1997; Brown et al., 1989), it can be seen as intended for assimilative or transformative learning (Illeris, 2009).

Related to desired seams, in the technological stream, seamful design is actually purposefully introduced. Seamful design requires explicit seams and then uses them in a positive way (Andersson, n.d.). According to Andersson (n.d.), in some cases it is meaningful to recognise and maintain the characteristics and uniqueness of seams, because edges add clarity. In the seamful design literature, the principle of appropriateness is introduced (Andersson, n.d.; Chalmers & Maccoll, 2003). If designers know how certain seams affect interactions, they can then incorporate them and direct their effects towards useful features of the system (Broll & Benford, 2005).

Third, attempting to apply what has been learnt in one context can also degrade performance in another. If performance-related knowledge and skills are not

learnt accurately or if training content is poorly aligned with the challenges of a system, then action errors or delays are certainly possible (Solga, 2008). The absence or invisibility of seams and boundaries could in this case lead to negative transfer (Mandl et al., 1992; Solga, 2008).

This list of arguments against removing seams and boundaries raises the question if seamlessness is indeed appropriate for educational design processes in terms of cross-contextual learning. In accordance to the vision of Lackner and Raunig (2016), a better term might be 'seam-aware learning'. Their vision of seam-aware learning is more in line with the principle of appropriateness in the theory of seamful design. How this is handled in the current study will be discussed in Section 2.4. Next, the meaning of seam-aware learning for students as lifelong learners will be discussed.

2.3. Competences for Cross-contextual Learning

When the objective is for students to learn seam-aware, they also need to learn how to relate and integrate learning experiences from different contexts. In this case, the students themselves should learn how to deal with seams, boundaries, and discontinuity. In this section, the literature regarding student competences for cross-contextual learning is discussed. In advance, it can be stated that the researcher found only minimal evidence of literature in this area of research, neither for seamless learning or boundary crossing (Walker & Nocon, 2007)³. In the literature on boundary crossing, it has only been discussed how boundary crossing can be used to support the development of other competences (Nygren et al., 2019).

In the literature on seamless learning, some learner characteristics have been described, which are required in order to be able to learn cross-contextually. In the study of Brockmann and Loer (2016), the authors reported on the need for students to be able to learn in a self-directed manner. Also, Sha (2015) studied self-regulated learning skills as a prerequisite for seamless learning, whilst D'Aniello et al. (2015) focused on situation awareness as a requirement for seamless learning. What these studies do offer is a starting point for the development of cross-contextual learning competencies.

Dilger et al. (2019) described how the cross-contextual learning process includes the following:

³ In this article the lack of research with a focus on competence development for boundary crossing is described; however, in the study itself, a different understanding of competence development is maintained.

- Being aware of the context-bounded nature of experience;
- Reflection-competences on specific conditions within a certain context;
- Awareness of the necessity for decontextualisation from one learning setting;
- Constructing a link between different contexts;
- Adapting for the requirements of different contexts and recontextualisation within another learning context.

These points can also be read as the competences that students need in order to have or to be developed whilst learning across different contexts. However, no publications were found that provide a full overview of competences that are required for students to be able to learn cross-contextually.

2.4. Consolidation: Assumptions and Concepts towards Cross-contextual Learning in the Study

In this section, the meaning of the presented literature in terms of the current study is explained. Based on the literature, the assumptions (e.g., understanding of learning) that the current study was grounded upon are revealed. Next to that, the theories and concepts that will play a specific role in the methodology, analysis, presentation of the results, and the discussion of the current study are summarised. Although all theories and concepts as previously described are relevant to the understanding of the topic, those presented in this section are considered to be the most central. According to the structure outlined in Chapter 2, the first part of the conceptual framework of the study is presented as follows.

The role of context in learning

- *The study builds upon a socio-constructivist understanding of learning.*
- *Knowledge and learning are understood to be context-bounded and situated (theory: situated learning; Brown et al., 1989).*
- *Learning and competence development find place through meaningful experiences (experience-based) across time (visiting and revisiting knowledge and competences) and in different contexts (theories: Illeris, 2009; Kolb, 1984; Sharples et al., 2007).*
- *Learning experiences and the context in which they are embedded are interdependent (theory: Dilger, 2019; Brown et al., 1989).*
- *Relatedness and integration (within a competence) between learning experiences (across different contexts) is required for competence development and elaboration (theory: Dilger et al., 2019; Bakker & Akkerman, 2016).*

- Contexts can differ from each other in different dimensions, such as physical aspects, social aspects, and the task/activity that defines the context (theory: Dilger, 2019).
- Different contexts offer different opportunities for learning (experiences; affordance) (theory: Dilger, 2019).
- Differences between contexts influence how easy or difficult it is for students to relate and integrate learning experiences from different contexts (theories: transfer; seamless learning and boundary crossing; different authors).
- Differences between contexts influence continuity or discontinuity in learning processes (theory: boundary crossing; different authors).
- Both continuity and discontinuity can be intended (theories: seam-aware learning and boundary crossing; different authors).
- Fragmentation that hinders the relatedness and integration of learning experiences can hinder competence development and learning (theories: seamless learning and boundary crossing; different authors).

Understanding of learning in the study and actual higher education practices

In the actual higher education system, different paradigms (behaviourism, cognitivism, (socio-)constructivism) and understandings of learning can be observed. Although the paradigms are often presented as incompatible (Dourish, 2004; Kirshner & Whitson, 1997), different actors (e.g., institutional leaders, faculty developers, programme managers, teachers, and students) have different epistemological beliefs about learning and the role that learning context plays. Based on their various beliefs, the actors each design and derive learning contexts as well as teaching and learning approaches. Consequently, it is not possible to describe or explain the actual variety of learning approaches, learning methods, or learning outcomes through one single theory or paradigm (Reinmann, 2013).

Although the socio-constructivist paradigm underlies the current study, teaching and learning approaches and methods belonging to other paradigms can also be applied here. These approaches and methods inevitably form part of the research field. However, they are looked at through the socio-constructivist paradigm, which leads to the normative understanding that learning is and will always be situated (see Section 2.1).

Definition of context

With regards to cross-contextuality as the main topic of the study, it is important to define how different contexts can be distinguished from each other. Careful

consideration is needed in order to be able to explain where problems in learning can occur within different contexts. Consequently, first, the construct of context needs to be defined.

In Section 2.1, possible aspects in the construct of context that influence learning were described (physical/spatial, social, task, and activity). In this study, technology is assumed to be omnipresent and integrated as a fixed aspect of daily life contexts (as in the model of Dilger, 2019). This leads to an integrative perception of technology.

In the current study, context is seen as a specific assembly of contextual aspects, which reciprocally influence each other, the learning intention, the learning processes, and the learning experience (see Dilger's model in Section 2.1). The specific compilation of contextual aspects has a specific affordance to gain learning experiences.

In the current study, it is recognised that the meaning or relevance of the aspects, will always be situated and socially constructed in the minds of those involved. That is why, in the empirical part of the study, contexts are only enquired and described from the perspective of the student. However, for interpretation and discussions, other aspects (than those described by the students) can be involved as well.

Definition of cross-contextual

As previously described, the definition of a learning context used in the current study is that a learning context is a specific assembly of physical, social, and task or activity-based aspects which together influence the students' intention for learning, the learning processes, and on the (perception of meaningfulness of the) learning experience. Knowing that context is a rich construct, this means that differences between contexts can be attributed to different aspects. However, the question remains, how is one context distinguished from another?

In general, depending on the aspects which are included in defining a context, they can be distinguished from one another in different ways. For instance, when a student moves from an instruction-based to a group work setting, the social aspects of the context also change. Depending on how the context was defined, the group work setting may be defined as a new context, a sub-context within the context of the course or class, or a new setting or situation.

In the current study, learning contexts are considered as distinct as soon as one of the contextual aspects changes. There is no hierarchy of contexts or sub-contexts; thus, a learning context is not only physical, such as a classroom, but can also be an instruction-based or experimental context that takes place within a

classroom. Therefore, the group work setting as described in the earlier example is seen as being a new context (rather than a sub-context within a course or class context). In order to fully understand a concept, it may be required to be situated within an instructive setting, but afterwards to exercise a concept within another context, namely a context where the concept needs to be applied. In the current study, this would include two equal contexts. Consequently, students move across a significant level of context during their learning biographies.

Seams and boundaries between contexts

To describe different dimensions of seams and boundaries, and therefore to describe where problems may emerge whilst learning across different contexts, the model of Wong and Looi (2011) was adopted in the current study. Although there is no specific technological focus in the current study, the 10 dimensions for mobile-assisted seamless learning have been used:

- MSL 1 Encompassing formal and informal learning
- MSL 2 Encompassing individualised and social learning
- MSL 3 Across time
- MSL 4 Across locations
- MSL 5 Ubiquitous knowledge access
- MSL 6 Encompassing physical and digital learning
- MSL 7 Combined use of multiple device types
- MSL 8 Seamless switching between multiple learning tasks
- MSL 9 Knowledge synthesis
- MSL 10 Encompassing multiple pedagogical or learning activity models

The dimensions are used as a shared language in the seamless learning literature, and will also be employed in that way within the current study (e.g., for the development of instruments and data analysis).

The meaning of seams in the current study

As described in Section 2.2.2, some seams or boundaries are productive, whilst others may be considered undesired. In the current study, this differentiated understanding of seams and boundaries is applied. Next to that, seams and boundaries are understood to be context-bounded and situated (following Akkerman & Bakker, 2011). This is why, and in accordance with the vision of Lackner and Raunig (2016), the preferred term of seam-aware learning is used. However, to work in line with the shared language of the field, the word ‘seamless’ is used throughout the current study (meaning the understanding of seam-aware learning for the current study).

In the current study, seams and boundaries that are (in certain situations) explicitly negatively experienced come to the fore. The understanding is followed that seams in general should be conceptualised as context-bounded, and that each seam should be evaluated in regards to its context and learning experience. That is, among others, the reason why understanding the students' experiences of seams and boundaries within their learning is considered of such importance in the current study.

However, the student experience is, in the current study, always evaluated based upon the learning intention or objectives. It will, therefore, always be necessary to mirror the student perspective with that of the faculty members and educational designers. So, does a seam or boundary that is negatively experienced by students make any more sense from the teachers' perspective? A deeper understanding of both perspectives and the interconnection between these two perspectives is needed in order to meet the requirements of the learning environment. In design processes that develop supportive measures and interventions for cross-contextual learning, the focus can be applied to the collaboration-seeking aspects of the learning environment that support students' positive experiences with seams, and to foster an integrative way of learning. This discussion is further elaborated in Chapter 4.

Potential and risk for cross-contextual learning

In general, cross-contextual learning is assumed to have the potential to foster learning. However, it also requires an explicit countering of the risks of cross-contextual learning, namely the risks for learning fragmentation, which can hinder the relation and integration of learning experiences, which is required for learning and competence development (see Section 2.2). This 'countering' of the risk to cross-contextual learning includes the consideration of competences which students require for cross-contextual learning (themselves).

Passage to the next chapter

Three factors are concerned as to how such a risk may be countered:

- The importance of cross-contextual or contextualised, integrative learning, in combination with,
- the increased and innumerable number of contexts in which students (can) learn in (potentially), and
- the risk of fragmented learning experiences.

These all lead to the question of how cross-contextual learning can be supported through the educational design of supportive measures. The topic of educational design for cross-contextual learning is taken up in the next chapter.

3. Educational Design for Cross-contextual Learning

Chapter 2 discussed how learning contexts should be valued as a significant contextual matter for the design and quality of teaching and learning. Also, it was discussed that not only single contexts, but different contexts as well as combinations of contexts matter, because different contexts are often required for learning, and have the potential to offer different affordances for learning. In educational design, different kinds of contexts and the relations between contexts may be considered, and the integration of learning experiences across different contexts can be fostered. The current chapter discusses what is known about educational design that may support cross-contextual learning.

In the following sections, design principles considered relevant for cross-contextual learning scenarios are addressed. These are derived from the various theories and concepts presented in Chapter 2 (constructivism, situated learning, transfer theories, seamless learning, and boundary crossing).

There are two schools of thought that have a different orientation with regards to the support of cross-contextual learning. First, it could be said that learning contexts can be designed to relate with each other and thereby to foster the integration of learning experiences. The design principles that have this orientation are discussed in Section 3.1. Second, it could be said that interventions for competence development can be designed to foster the integration of learning experiences by students themselves. The design principles that have this orientation are discussed in Section 3.2.

3.1. Design Principles: Changing Context

Design Principle 1: Establish identity between a learning context and other learning or application contexts

This principle stems from the literature about transfer theories in the field of further education (Thorndike's theory of identical elements). The theory builds upon the assumption that transfer of learning can be promoted if the learning context is as similar as possible to the context in which the knowledge or competences will subsequently be applied. The theory states that if learners recognise elements in the various contexts, it will be easier for them to recognise which and how knowledge and competences can then be applied within the application context (Mandl et al., 1992; Solga, 2008). The idea is, therefore, to better align contexts to each other.

One idea within the notion of seamless learning is also the alignment of contexts. As in the theory of Thorndike's identifying contexts or elements in the

context, continuity is promoted because the contexts (which can be both learning and application contexts) are kept as similar as possible to each other. In the seamless learning community, educational technology plays a key role, hence, a typical example is one where one context takes over tools from another in order to eliminate seams between the devices or software that students use privately.

Critical notes

There are a few critical notes to add with regards to the theory of Thorndike and the idea to align contexts within seamless learning. It may not always be possible or even desired to align contexts with each other (see Section 2.2.2). First, from a didactical perspective, there are solid arguments put forth to simplify learning environments in order to build up complexity during the learning process; and also, to not align contexts to each other, but to use learning contexts in different ways. Second, the alignment of contexts does not foster students' competences in learning to transfer or relate knowledge and competences from different contexts. The establishment of identical aspects between contexts might act to relieve discontinuity; however, it may also reduce opportunities for learning. This inevitably can make learners inflexible, which could be evaluated as negative, because reality will not be aligned either.

Beyond that, if a learner recognises the aspects of a context (which are provided to establish recognition) is dependent on their subjective perception (Solga, 2008). From an educational design point of view, this makes it difficult to handle heterogeneity across students (and to 'hit the mark' overall).

In summary, as previously described, discussions in the literature about the extent to which learning contexts should be aligned are not yet conclusive.

Design Principle 2: Bridge contexts with technology, boundary objects, boundary persons or brokers, or boundary activities

If aligning contexts is critical, yet inappropriate for several situations, the question remains how relations between different contexts can be supported, so that the relation and integration of learning experiences can take place. The seamless learning and boundary crossing literature presents discussions as to what bridges between contexts can look like. Bridging contexts is not the same as alignment, but concerns relating different contexts with each other, and to support the processes for learning across those contexts.

In the seamless learning literature, the focus has been especially concerned with the question of how technology can be used to bridge contexts. Technology can,

for instance, be used to transfer (external representations of) learning experiences from one context to another (Otero et al., 2011). In this regard however, no explicit design principles were described⁴.

Next to transferring learning experiences, it is important that learning experiences become related and integrated. The fact that technology makes it easier to transfer and use learning experiences across different contexts does not automatically mean that learning experiences are either related or can become integrated.

The literature on boundary crossing offers three didactical interventions to foster relations and integration, namely: boundary objects, boundary persons (also referred to as brokers), and boundary activities.

- Boundary objects are artefacts fulfilling a bridging function to assist a person to achieve a mental connection between their experiences in different social practices and settings, thus enriching and enforcing their mental model (e.g., a portfolio that binds theories from schooling and experiences from an internship);
- Brokers facilitate others in taking different stances and changing perspectives, thus encompassing two worlds (e.g., teachers that use practical experience to explain theories in the classroom)
- Boundary crossing activities are a person's (conscious) transitions and interactions that occur across different contexts (Akkerman & Bakker, 2011; Rusman, 2019).

Teachers can design boundary objects, function as brokers, or organise brokers to support their students. For this same purpose, they can also utilise boundary crossing activities. By reviewing the boundary crossing literature, Akkerman and Bakker (2011) identified four mechanisms of learning at the boundary. An overview of the mechanisms and the attributed boundary crossing activities is presented in Table 1 (for an extensive description of the mechanism, see Akkerman & Bakker, 2011).

⁴ Some explicit design principles for seamless learning can be found in the articles of Zhang et al. (2010) and Looi and Seow (2015). These principles are, however, very abstract (e.g., design for seamlessness – bridging across contexts), and do not make explicit how to design seamlessness.

Table 1: Overview of Different Mechanism and According Characteristic Processes of Boundary Crossing Activities (Akkerman & Bakker, 2011)

Identification	Othering
	Legitimizing coexistence
Coordination	Communicative connection
	Efforts of translation
	Enhancing boundary permeability
	Routinisation
Reflection	Perspective taking
	Perspective making
Transformation	Confrontation
	Recognising a shared problem space
	Hybridisation
	Crystallisation
	Continuous joint work at the boundary

Akkerman and Bakker (2011) described how the categorisation presented in Table 1 is intended not as a complete or fixed model of learning at the boundary, but as a conceptual means to facilitate, and for interdisciplinary dialogue about, the different ways in which scholars have approached learning at the boundary (pp. 150-151). Still, the ideas of boundary objects, boundary persons, and boundary crossing activities are assumed to offer possibilities for seam-aware learning. The activities could be applied in order to overcome boundaries between learning contexts:

- **Identification:** e.g., legitimising the coexistence of different contexts and the differences between them.
- **Coordination:** e.g., translating knowledge from one context to make it understandable for another.
- **Reflection:** e.g., taking perspective from persons in different contexts.
- **Transformation:** e.g., recognising problems shared by both contexts.

For example, concrete activities and tasks can be designed, such as a learning diary used to stimulate situated reflection (Dalsgaard, 2020). Tasks such as assignments where students compare different reflections can be utilised to deal explicitly with differences between learning contexts.

In a study by Veltman et al. (2019), boundary crossing was implemented in a higher professional education context. In their study, the importance to balance leverage with what students can handle at any particular moment in their learning process was highlighted (Veltman et al., 2019). Next to that, it should be

ensured that the main focus remains on the students' learning through the provision of feedback, fostering reflection on the learning process, and eliciting learning experiences at the boundary points (Veltman et al., 2019). For instance, placing learning upfront helps to contribute to a safe learning climate. Veltman et al. (2019) also described the importance of aligning learning aims, the assessment of learning outcomes, and the activities of both students and teachers.

Critical notes

When researchers, educational designers, and teachers redesign learning designs or develop interventions, they can use boundary activities in order to show how boundaries can be dealt with, and to deal with those boundaries themselves. However, less focus has been placed on how students can gain competences through boundary crossing, and this competence development should be taken into account as well. The interventions focus especially on helping people in practice to deal with and learn from the coexistence of different contexts (learning from boundary crossing). However, little has been described as to what competence development (process) is necessary for students to be able to learn through boundary crossing themselves, or what design principles can be used to foster students' competence development through boundary crossing.

Analysis of the requirements for boundary crossing could help to derive competences in which students need to deal with seams and boundaries, similar to the competences discussed in Section 2.3. However, they were not found in the literature. In the following section, the focus shifts to design principles that aim to design scenarios wherein students develop cross-contextual learning competences.

3.2. Design principles: Changing competences

Design principles that facilitate relations between contexts (by changing aspects in the contexts) have been discussed. However, as has also been noted, some can be detrimental to the learning possibilities for students learning how to deal with differences between contexts. Others did not take up how the development of cross-contextual learning competences can happen. In this section, this is discussed, because, since learning across contexts will never be 'seamless', students will always have to deal with different (kinds of) contexts, seams, and boundaries themselves.

Design Principle 3: Develop cross-contextual learning competences

Wong (2013) argued that in order to nurture genuine self-directed seamless learners, practitioners should develop and enact systematic and cyclically facilitated seamless learning processes in order to enculture students. In this way, seamless learning can become not only a pedagogical ‘strategy’ to be designed and enacted by educational designers and faculty, but also a self-nurtured habitual process in the minds of learners (Wong, 2013). The facilitated seamless learning process framework (FSL) was developed by Wong (2013); which put forth the notion of seamless learning with the aim of self-directed seamless learning as the desired outcome. The framework, as visualised in Figure 7, presents an ‘ideal’ seamless learning cycle that is meant to facilitate enculturation in learning environments, including learning scenarios as described by the dimensions presented in the former model. The framework points to the different phases that are important when designing seamless learning environments and the connections between them.

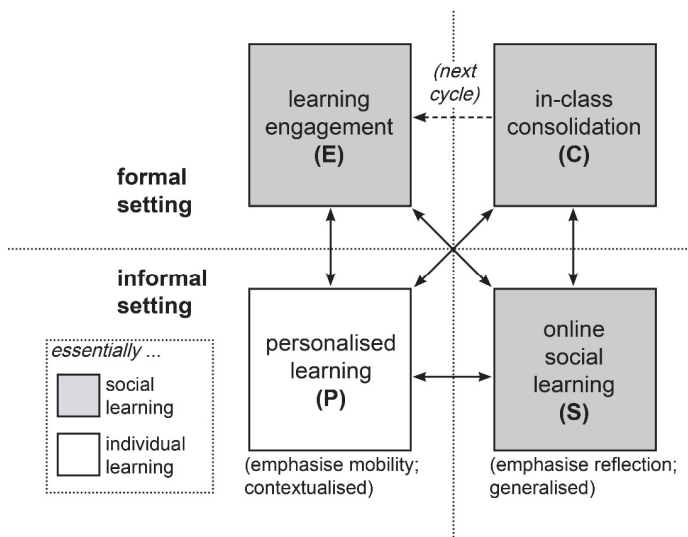


Figure 7: The FSL Process Framework (Wong, 2013)

A circle starts within a teacher-facilitated setting, where learning engagement is first initiated ('C'). Here, learners prepare for the subsequent phases. Personalised learning ('P') is the phase where learners observe, record, make sense of, and reflect upon their daily encounters, and then associate or contrast those with their prior knowledge, or apply the knowledge in their daily life (Wong,

2013, p. 322). The so-called 'personalised learning' phase is named as such because learners are immersed within authentic contexts here, and are therefore able to exercise greater autonomy than in the teacher-facilitated 'E' phase (Wong, 2013, p. 322). The cycle continues with (online) social learning ('S') phase; in which learners conduct online peer reviews or discussions mediated by their pooled knowledge, any given resources, learning encounters and experiences, as well as their thoughts and reflections, and artefacts created during phases 'E' and 'P' (Wong, 2013, p. 322). Wong (2013) described the interplay between 'P' and 'S' as potentially constituting an effective informal learning space whereby individual contributions shape and reshape the social meaning. After this, in-class consolidation is important, and is the setting where teachers facilitate learners by scaffolding the consolidation process. All forms of knowledge artefacts that are accessed or created throughout the FSL cycle should then be consolidated through group or class-wide discussions (Wong, 2013, p. 323).

This however, seems to be specific to the learning process rather than metareflective (regarding the development of cross-contextual learning competences). Although the underlying ideas fit to the ideals of competent students, it does not explicitly show how students learn to deal with seams by themselves. In this regard, Wong (2013) confirmed that further research was needed with the aim to distil more design guidelines in order to assist seamless learning designers in further fine-tuning their learning designs to nurture students into becoming better self-directed seamless learners.

Eventually, the described boundary activities could offer points of reference; offering different options for activities and tasks, which could then be taken up in the process as described by Wong (2013). In classes, tasks such as othering, perspective taking, or confrontation could be introduced for the personalised and (online) social learning phases. Next to that, they offer considerable potential for the consolidation phase (referring to the idea of the integration of learning experiences as an objective of higher education institutions). In this way, students could learn explicitly through boundary activities, as well as at the meta-level: developing and reflecting boundary crossing strategies and competences (as also proposed by Veltman et al., 2019).

3.3. Design process models and frameworks

Next to design principles, design (process) models and frameworks are also relevant in order to reveal what is known about the support of students' cross-contextual learning. It is important to learn what design parameters, elements,

and mechanism are to consider how to proceed whilst designing cross-contextual learning scenarios. In the literature on boundary crossing, there has been no apparent focus on design process models and frameworks.

In the numerous publications on seamless learning interventions, the focus appears not to have been on how they were designed, what the design process looked like, or what should be learnt from them. Instead, if something has been written about the design, it must be looked for within the method or discussion sections of published studies. There, some points of references can sometimes be found such as ‘a principle-based design has been applied’ (Kong & Song, 2013, 2014) or ‘we implemented co-design with the teachers’ (Zhang & Looi, 2011, p. 2150). However, these explanations remain rather brief and project-specific, and the same can be said for the literature on boundary crossing. In other articles, the focus has been strongly maintained on technology itself (e.g., Specht, 2008). However, the current study sought to offer a more overarching and integrative design perspective through addressing both didactics and technology.

Glahn and Gruber (2020) reviewed educational design models with regards to contextualised learning. They described how different design models build upon different interpretations of context and its influence on learner experiences. They categorised four different model variants:

- **Context-agnostic:** those that lack explicit representation of context (e.g., van Merriënboer & Kirschner, 2013);
- **Context as delivery mode:** those which typically do not mention context or the learning environment explicitly, but differentiate interaction modes that are implicitly connected to an environment or setting (e.g., Gagne et al., 2005);
- **Context as a passive environment:** those which consider context as environments that frame or constrain learning activities (e.g., Romiszowski, 1981);
- **Socio-centric context:** those which focus upon or include socio-centric contexts (e.g., Dillenbourg, 2015; Engeström, 2015).

Based on the review of different educational and instructional design models, Glahn and Gruber (2020) proposed a perspective that:

...highlights the functional design elements of seamless learning with context as the focus point for design decisions. It visualises that contextual designs depend more on learning tasks and rules in order to situate activities in contexts or to bridge between contexts. (p. 31)

Glahn and Gruber (2020) described that the proposed perspective demands further research before implications for educational design can be deduced. Consequently, for the exact description of the perspective (based on the model of Engelström, 2015), readers are directed to review the study of Glahn and Gruber (2020). For the current study, the seamless learning design paradigm of Rusman (2019) is taken up as follows.

Rusman (2019) described that the notion of seamless learning can be seen as a design paradigm, which is part of the broader family of instructional and learning design paradigms. Looking from that stance, Rusman questioned the distinctive features of the 'Seamless learning' design paradigm in terms of its rationales, criteria guiding design decisions and design elements, processes and mechanisms. Table 2 provides an overview of the identified characteristics of the Seamless Learning paradigm.

Table 2: *The Seamless Learning Design Paradigm (Rusman, 2019)*

<i>Factors of the design space</i>	<i>Attributes</i>
Design rationales and characteristics	▪ Facilitating ‘crossover’ and continuity of learning in, from, and between environments, boundaries and (social) practices, making the most of the characteristics of each environment so as to enhance (situated) learning, in order to reach a specific set of learning objectives, e.g., develop applicable knowledge (link theory and practice); awareness of alternative perspectives on the world (e.g., looking from various domains at the same phenomenon) and own identity; development of skills (e.g., self-regulation, collaboration, enquiry,... skills). ▪ Facilitating personally meaningful learning, through contextualised, active, socially-embedded and experience-based learning, tapping into and reckoning with personal identity, experiences and talents, emotions/states, phases, ability, behaviour and characteristics of learners. ▪ Increase differentiation and flexibility of learning and support processes, through time, pace, space/place and practice (in)dependent learning, spanning both formal and informal learning environments. ▪ Optimising learning processes (more effective, efficient and enjoyable) across environments and settings through the well-considered use of (a combination of) personal mobile devices and digital technology.
Design parameters and dimensions	▪ Degree of continuity of learning process. ▪ Pedagogy and didactics. ▪ Degree of authenticity/contextualisation. ▪ Degree of technology enhancement. ▪ Time (sequenced or non-sequenced, paced, spaced, phasing, frequency). ▪ Space/place (digital and/or physical, synchronous and/or asynchronous). ▪ Level of control and ownership of control/agency. ▪ Level of (un) structure. ▪ Individual and/or collaborative/networked.
Design elements	▪ <i>‘Trigger’</i>: Cause/reason to start learning activities (e.g., a learning objective, (emerging)question, interest, ‘spark’ or ‘wonder moment’, critical incident, need to solve a problem/make a decision, a personal concern, ...). ▪ <i>Intent</i>: Determination and specification of a specific goal or objective. ▪ (Set of) goal-oriented/intent-driven <i>activities (designed or emerging) and interactions</i>: - Learning, monitoring and organisational activities. - Support, supervision/monitoring, facilitation and (formative/summative) assessment activities. - Emerging exchanges between actors (e.g., communication, collaboration, (co-)construction); between actors, instruments and objects (e.g., feedback) and between instruments and environments.

	▪ <i>Nudges</i>: Suggestions/recommendations based on activities and environments actors engage with or move through, e.g., dependent on a learners' learning path or location. ▪ <i>Actors</i>: A person in a specific role, which is not fixed and (ex)changeable across practices (e.g., learner, coach, teacher/instructor, expert, friend). ▪ <i>Objects/artefacts</i>: A natural or designed/(co)-constructed (set of) item(s) with a specific individual or social function that is available in the real and/or virtual world. Objects can be either available (just there) or be co-constructed (e.g., a book, the Eiffel Tower, a car, a collection of documents, a collectively written report). ▪ <i>Instrument</i>: Something with which a person can influence and alter the state of the (real or virtual) world. ▪ <i>Environment</i>: Virtual or physical spaces and places. ▪ <i>Acknowledgement</i>: A sign of fulfilment of an intent or objective, based on a formative/summative evaluation/assessment against a set of quality criteria (e.g., badge, diploma, grade, feedback report, benchmark, points/credits).
Learning and support processes	A specific set/selection of learning and support activity patterns, supporting: ▪ Individual and collective/group (meta)cognitive processes (e.g., knowledge (co-) construction, self-co- and collaborative- regulation, reflection). ▪ Individual behavioural processes (e.g., flow, reflection, skills development, practicing). ▪ Individual and collaborative interactive processes (between actors, objects and instruments in an (overarching) environment and between environment(s) (e.g., communication, organisation, feedback, collaboration, coaching, facilitating, personalisation, differentiation). ▪ Individual and collective specific/dedicated intentional processes (e.g., enquiring, designing, (co-)creating, experimenting, networking, discovering (e.g., talents), deciding, problem solving).
Design mechanisms	Mechanisms to support <i>continuity</i> and/or benefit from <i>contextualisation</i>: ▪ <i>Broker</i>: facilitate others in taking stances and changing perspectives, thus supporting learning processes. ▪ <i>Boundary crossing activities</i>: a person's (conscious) transitions and interactions across different social practices and settings. ▪ <i>Discontinuity</i>: what a person experiences and learns in one context cannot be related to or conflicts with what they learned in another context. ▪ <i>Boundary objects</i>: artefacts fulfilling a bridging function to assist a person to make a mental connection between their experiences in different social practices and settings, thus enriching and enforcing their mental model. ▪ <i>Framing/alignment (e.g., thematically, contextually)</i>: conscious selection of a task with a specific purpose in a (set of) specific environments, facilitating a limited (but effective) number of interactions ▪ (to be elaborated upon).

According to an expert interview conducted⁵, Rusman explained that the points raised were inductively derived from projects detailed in the literature. However, although it already summarises many different aspects of cross-contextual learning, Rusman also stated that there was still potential to improve and elaborate the paradigm through additional systematical analysis. The paradigm lends considerable support to the question of what design parameters, elements, and mechanism should be considered with regards to the designing of cross-contextual learning scenarios.

3.4. Design on the institutional level

Cross-contextual relations should not only be viewed starting from the perspective of one micro-didactical context (as the design paradigm also does), but also starting from the study programme or institutional level. This is paramount because cross-contextual learning includes different contexts, and therefore a management or coordinative perspective is both interesting and also considered necessary too.

With regards to seamless learning, Kuh (1996) described the need for a seamless learning culture within educational institutions. In detail, Kuh described how all members of a higher education institution must work together in order to link programs and activities across both the academic and out-of-class dimensions of students' lives (in Bell, 2000, p. 51). In order to create a seamless learning culture, Kuh (1996) provided six principles:

- Generate enthusiasm for institutional renewal
- Create a common vision of learning
- Develop a common language
- Foster collaboration and cross-functional dialogue
- Examination of the influence of student cultures on student learning
- Focus on systematic change

In the eyes of Kuh (1996), an institutional culture that values partnerships and cross-functional collaboration would be needed (in Bell, 2000, pp. 51-52).

However, the principles proposed by Kuh (1996) were not taken up in the literature afterwards. No studies have reported on the experiences with or the further development of these principles. Only Bell (2000) conceptually applied the principles in the development of libraries.

Some seamless learning experts confirmed that the design and implementation of seamless scenarios demands systematic change. The following details some

⁵ Interview with Rusman conducted on 13 March, 2020 by the researcher of the current study.

of the most relevant aspects that were mentioned during expert interviews that were conducted by a project team that included the researcher:

- Lung-Hsiang Wong (12 May 2017);
- Ulrich Hoppe (28 November 2017);
- Mike Sharples (28 November 2017);
- Howard Nicholas (01 December 2017);
- Chee-Kit Looi (12 December 2017).

Nicholas described that no innovation was ever singular, and in delivering sustainable innovation, different aspects of the learning environment are always affected. Sharples described as well that ‘you have to change the whole system’. Wong and Looi both described that it is important to have the support and stimulation from a school’s board, whilst Looi mentioned the importance of teachers’ positive attitudes to be able to attempt new things. With regards to educational design processes, Wong described having implemented co-designs with teachers in order to implement changes from a bottom-up approach.

A systematic approach

The call for a systematic approach is not only found in the seamless learning literature. The points as they came up in the aforementioned expert interviews were also notably in line with more general (non-cross-contextual learning-specific) change management and school leadership literature. For example, the model of Pedagogic Higher Education Development (Brahm et al., 2016) described that innovation should align across the micro-didactical level, the study programme, and also the institutional level. This does not seem to differ to (the design of) cross-contextual learning, which may be the reason that no other specific design principles at the institutional (or meso/study program) level were found.

3.5. Consolidation: Assumptions and Concepts towards Cross-contextual Learning Design

In this section, the meaning of the literature to the current study is explained. Based on the literature, the theories and concepts that play a specific role in the methodology, analysis, results, and discussion are summarised. Although all of the theories and concepts previously described are relevant to the understanding of educational design for cross-contextual learning scenarios, the theories and concepts which are presented in this section are central to the current study. Based on the structure of Chapter 3, the second part of the conceptual framework of the study is presented as follows.

First, a list of the identified potential principles was established; as derived from Section 3.1:

- *Establish identity of learning and application environment (help students to recognise or relate contexts to each other (theories: Thorndike in Solga, 2008; seamless learning; different authors);*
- *Bridge contexts with each other through the usage of technology that supports the transition/connection from learning experience in one context into or with another (theory: seamless learning; different authors);*
- *Use boundary objects or brokers to support students to deal with different contexts or discontinuity (theory: boundary crossing; different authors);*
- *Implement boundary activities (theory: boundary crossing; different authors);*
- *Take students through processes where they practice cross-contextual learning explicitly and develop competences to learn cross-contextually (to deal with seams and boundaries) themselves (theory: Wong, 2013).*

Summarised (and linked with the Introduction in Chapter 1 and also with Chapter 2), it can be concluded that the facilitation of learning in different contexts can be achieved through:

- Conscious use of context within educational design processes, by;
- Involving authentic contexts, and;
- Using contexts that students move within anyway (in-class and out-of-class), or;
- Designing new contexts.

However, most importantly, the relations between context should be taken into account and explicitly designed, so that learning does not become fragmented, despite the distribution of learning experiences over different contexts.

Relations between contexts

In order to design relations between contexts, the theory of boundary crossing is central to the current study. The distinction between boundary objects, brokers, and boundary activities will be applied and also revisited more than repeatedly.

Competence orientation before context orientation

The twofold focus of the design principles also plays an important role in the current study, with the actual assumption that higher education institutions should have an objective to prepare students for lifelong cross-contextual learning. It could therefore be understood that there should in fact be a focus on students' competence development for cross-contextual learning. However, in the

current study, an integrative learning outcome is understood to have the first priority. When learning experiences become fragmented and not integrated in students' (sustainable) competences, it is true that cross-contextual learning does not make overall sense. Second, processes to develop students' cross-contextual learning competence should be taken into account.

Design framework

The design framework of Rusman (2019) helps to structure the different aspects of educational design that may be taken into consideration with regards to cross-contextual learning. Especially the design elements and design mechanism will form part of the further development of the current study (see Table 2).

Design Elements

- Triggers
- Intents
- (Set of) goal-oriented / intent-driven activities (designed or emerging) and interactions
 - Learning, monitoring and organisational activities
 - Support, supervision/monitoring, facilitation and (formative/ summative) assessment activities
 - Emerging exchanges between actors (e.g., communication, collaboration, (co-)construction); between actors, instruments and objects (e.g., feedback) and between instruments and environments
- Nudges
- Actors
- Objects/artefacts
- Instruments
- Environments
- Acknowledgements

Design mechanisms

- Broker
- Boundary crossing activities
- Discontinuity
- Boundary objects
- Framing/alignment (e.g., thematically, contextually)

Systematic approach

Like Kuh (1996) and also as proposed by the aforementioned interviewed experts, the current study builds upon the assumption that a systematic approach is necessary for sustainable change. Led by the research questions, the focus is mainly on the micro-didactical level, however, especially with regard to cross-contextuality, the system that influences micro-didactical situations should be considered as well.

4. The Student Perspective

In the current study, the perspective of the student is central, and more specifically, concerns the problems and supporting measures that students experience in the fostering of their cross-contextual learning. Next to that, the study aims to address the question of how the student perspective is taken up in educational design processes aimed at cross-contextual learning. In this chapter of the study the answers to the following two questions will be reviewed and discussed:

- What is known about students' experiences with cross-contextual learning? and;
- What is known about educational design processes which more or less integrate the student perspective?

The latter includes questions as to what extent student-orientation is desirable and realistic, as well as considering the requirements and consequences of integrating the student perspective.

4.1. Students Experience with Cross-contextual Learning

In both Chapter 2 and Chapter 3, different theories with regards to cross-contextual learning were discussed. Throughout the current study, it is especially the theories that address seamless learning and boundary crossing that ground the study; although it is not always traceable as to how such theories have been developed. This means that it cannot be dismissed that the student perspective was included in the formulation of those theories. However, in most theoretical and empirical studies found in the literature, the student perspective was not explicitly mentioned, and there has been limited research to build upon with regards to the experiences of students in terms of cross-contextual learning scenarios. The research that was found in this regard, is discussed as follows.

Jansen et al. (2012) conducted a case study with two students (cases) aimed at examining their experiences with boundary crossing between middle school and high school. In the first case, the student experienced a difference between the middle and high school practices, because the teachers focused their attention on different areas (e.g., different teaching and assessment approaches with regards to the understanding of autonomy that students have regarding the way they resolve problems). In the other case, the student experienced a different pacing in terms of the course content. In the high school, the teachers drove through the required content much quicker, and independent of students having fully understood the content or not. Also, the content was experienced simply more extensive at the high school level by its very nature. Beyond that,

content was presented more gradually at the middle school level, and more integrated at high school, which would also be the same in terms of the structure of the learning materials employed. The student described how those differences were dealt with personally, without support.

Although no other research was found in the vein of the student experience with non-explicitly supported cross-contextual learning scenarios, some research was noted to offer insight into how students experienced certain interventions. In some studies, the implementation of interventions for cross-contextual learning were evaluated from the student perspective. Brockmann and Loer (2016) asked their students to report on an implemented seamless learning intervention at the higher education setting. They concluded that the students had felt more personally engaged and attentive, and that they experienced greater practical relevance and greater sustainability in their learning experiences.

In the study published by Voon et al. (2020), primary school students expressed that⁶:

Learning outcome

- The seamless learning design not only helped to revise what was learnt in class, but also to learn additional knowledge that helped for application in daily life.
- The seamless learning design helped them to become conscious that different contexts offer different applications of the same content.

Learning activities/methods

- The seamless learning activities (in this case, doing an interview and an outdoor experiment) enabled visualisation of concepts for a better understanding.
- The students were convinced that the best way to learn science was through experimentation in order to discover what happens in real life ('so that I really know what is going on or gain hands-on experience, rather than reading from the textbook', Voon et al. [2020], p. 19).

Learning resources

- The Internet has more resources and facilitates the searching for and sharing of information (e.g., the exchange of new ideas with friends).

⁶ Also in a project by Wong et al. (2010), primary school students were interviewed with regards to their seamless learning experiences: however, the interview results were reported only in combination with other results, which made it difficult to derive what was reported by the students and what was interpreted by the teachers or parents.

- Peer learning was fostered and the students noted that this had a positive influence ('Not only we shared ideas, we had to think of our own idea. We got more ideas from our friends and we may relate to our friends' idea and got to learn more', Voon et al. [2020], p. 19).

It can be summarised that whilst we know something, we still know little in reality about students' actual experiences, and especially non-explicitly supported cross-contextual learning. On the one side, students have been shown to experience discontinuities and problems in non-supported cross-contextual learning scenarios (however, this was not researched at the higher education level). On the other side, supported cross-contextual learning scenarios seem to have a positive influence on students' overall learning experiences (e.g., engagement, understanding, and satisfaction).

Where Section 4.1 was specifically related to RQ1 and RQ2, the next sections move on to focus on RQ3 and RQ4. The two pillars of the study (the student perspective on cross-contextual learning vs. the integration of the student perspective in educational design processes) have not been related yet. The question of how the student perspective is taken up in design processes has increased interest from revealing how little is still known about the student perspective. This raises the question of how this problem is dealt with in educational design practices. However, no content-related relation has yet been identified (e.g., with regard to MSL X, the involvement of the student perspective in educational design is especially necessary), neither in the current study so far nor in the literature.

The next section discusses the relation between the student perspective and other perspectives, and how the student perspective can help with regards to educational design processes for cross-contextual learning. General educational design literature was largely considered as the literature on cross-contextual learning contained very little. Although it has been argued for within seamless learning (Kuh, 1996), collaboration with students has only been addressed in the study of Crafts et al. (2001). However, their focus was on the college-culture level rather than at the micro-didactical and/or curriculum level. Thus, the next section focuses upon the general potential of collaboration with students in educational designs.

4.2. Discussion about Student Orientation

Student-orientation, student-centeredness, student engagement, student voice, and student participation are some of the many constructs that are used in the context of the question of, if and how the perspective of the students is taken up in design processes. The constructs appear to be used interchangeably in the

literature. For example, student engagement has been used historically in the United Kingdom to discuss student participation in educational design. However, in the United States, student engagement has become known for the intensity of interaction of an individual with learning activities. For this reason, in the United Kingdom, student participation and student voice now tend to be used in the same way and for the same meaning as did student engagement previously (Martens et al., 2019; Trowler & Trowler, 2010).

In the current study, all of these different constructs are considered, so long as they focus on how the perspective of students is taken up within design processes (e.g., not student engagement in the United States). The current study is only concerned with the different understandings and conceptions on the way that education (both at the macro and micro level) should be oriented towards the student (i.e., students' perspectives and needs) (see Section 4.2), and how this is implemented within educational design processes (see Section 4.3).

Reinmann and Jenert (2011) discussed four forms of student-orientation within the actual higher education system, and identified two distinguishing dimensions. The first distinguishes between support and participation, whilst the second considers if students are involved supportively or participatively in didactical or organisational situations. The combination of the two axes then led to four forms of approaching student-orientation (each typified with a metaphor):

- Orientation to students as customers is when the student perspective is viewed to be *supportive* in being able to be adaptive to students' needs within *organisational* situations. When higher education institutions view themselves as entrepreneurial institutions, the satisfaction of their customer base (i.e., students) is their point of orientation. With regards to this orientation, the institutions offer for example student services.
- Orientation to students as learners is when the student perspective is viewed to be *supportive* in being able to be adaptive to students' needs within *didactical* situations. When higher education institutions view themselves as responsible for their learners, the learning outcome becomes central for orientation. With regards to this orientation, institutions design and develop learning environments that empower student learning.
- Orientation to students as citizens is when students *participate* in the design of *organisational* situations, the idea being that students' needs and objectives can be considered through political processes of involvement. With regards to this orientation, students (can) participate to design the higher education institution and engage in political and administrative processes.

- Orientation to students as participants is when students *participate* in the design of *didactical* situations. When higher education institutions orient themselves to students as participants, students (can) participate in content-based and methodological-didactical decisions. It builds upon the understanding that students can decide best as to what they learn and in what way (Reinmann & Jenert, 2011).

Figure 8 visualises the axes, the descriptions of the four approaches, and the metaphors. Next to that, the figure shows that each form requires different roles and competencies from the students. The critical issues with the involvement of the student perspective (with regards to the four forms) are as follows.

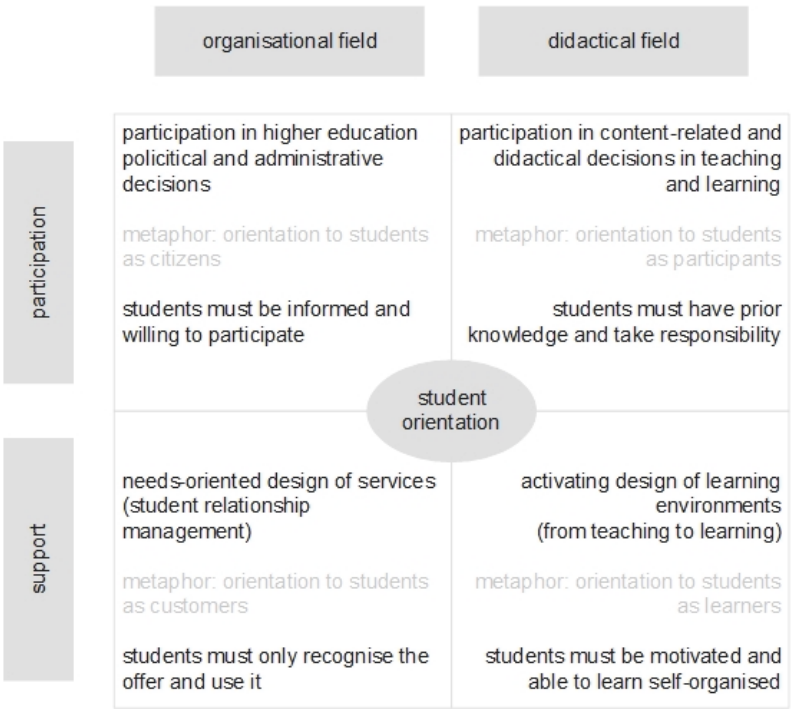


Figure 8: Four Approaches of Students-orientation (Reinmann & Jenert, 2011)

- **Orientation to students as customers:** When students are seen as customers, and higher education institutions develop services which help to satisfy their students, it may be questioned as to whether or not this is the objective of a higher education institution (see also Carey, 2013). The actual objective of higher education institutions in terms of the current

study's focus is education ('Bildung') and research. A strong service-orientation could change that focus too much. Next to that, such services are only ever successful if the students know about them and use them.

- **Orientation to students as learners:** When students are seen as learners, and didactical situations are specifically adapted to their (individual) needs (strong student-centeredness), it is required that students are both willing and able to take responsibility for their own learning processes (self-organised learning). Therefore, they need to have clear objectives and to be self-motivated.
- **Orientation to students as citizens:** When students are seen as citizens who participate and have influence in the political and administrative processes, it is required that students are very well informed. Students also need to be willing to participate in this kind of processes, which only works when the students also possess the right to (co-)decide.
- **Orientation to students as participants:** When students are seen as participants in the design of didactical situations (e.g., objectives, content, methodological decision). It is required that students are able to anticipate what will be important for them in the future. In addition, they need to be able to evaluate which didactical methods are best suited to attain the self-formulated objectives (Reinmann & Jenert, 2011).

The different requirements and issues with student support and participation question to what extent student-orientation is both desirable and realistic. Reinmann and Jenert (2011) concluded that pure student-orientation is neither possible nor desirable. Students do not learn at their best when all their needs and wishes are fulfilled by default, but when they are confronted with expectations that challenge them (Kinzie & Kuh, 2007). Next to that, students often do not recognise or make best use of the possibilities they would have to support or participate; perhaps simply because they do not meet the necessary requirements, such as motivation or competence for participation. Bovill et al. (2009) confirmed that both students and teachers are concerned as to whether or not students possess the required competences for active participation; however, they also argued that these competences can be learnt through training. For meaningful student participation, the requirements need to be developed during the studies, and led by the higher education institution.

Reinmann and Jenert (2011) concluded that rather than focus on pure student-orientation, a constructive dialogue between teachers and students is actually what is needed, because a pure teacher-orientation is neither desirable (as described in the Introduction chapter). This points to the need for collaborative working (as a long-term cultural change more than an individual intervention) between students and teachers in order to reveal differences in perceptions and

expectations (Reinmann & Jenert, 2011, p. 228). This approach is also in line with the vision of Kuh (1996), who argued this specifically in terms of seamless learning. As described in Section 3.4, Kuh (1996) described that collaboration and cross-functional dialogue needs to be fostered. The following section discusses what is known about collaborative design processes between students and teachers. The form (the 'how to') of collaborative design processes is discussed, plus what the involvement of students in participatory processes can mean for them.

4.3. Integration of Student Perspective in Design Processes

For the current study, all possible kinds of collaboration between students and faculty or educational designers are taken into account. Brooman et al. (2015) described the spectrum of possibilities as:

Student participation in curriculum design ranges from limited module satisfaction questionnaires and ranking engagement (Trowler & Trowler, 2010) which are unlikely to elicit change based on dialogue, to shared understanding where students are co-creators actively choosing subject/module content and assessment criteria (Bovill & Bulley, 2011). (Brooman et al., 2015, p. 665)

The range of Brooman et al. (2015) starts out with evaluation or satisfaction questionnaires⁷. Teachers, however, can also introduce more course-specific questionnaires in order to elicit more direct feedback. Next to questionnaires, interviews or focus groups can be employed in order to reveal information about students' experiences (e.g., Seale, 2010). In this case, the students are approached in terms of them being users of the educational design in question (Martens et al., 2019).

Less direct methods to enquire the student perspective or their experiences involve the analysis of student works such as assignments and assessments. These instruments provide insight into students' understanding of learning content, but largely ignore their perspective and experiences with the course (here, the students are essentially testers of the (effectives of) educational designs, Martens et al., 2019). Another indirect method is to examine or follow conversations between students (e.g., Seale, 2010), or to hold informal conversations with the students themselves.

⁷ With most higher education institutions implementing some form of feedback mechanism (e.g., for evaluation and quality development), this leads to the reality that the option for students having 'no role' is no longer really plausible anymore.

When we move to a more participative type of educational design, the use of students as co-creators comes into play (e.g., Bovill et al., 2011; Seale, 2010). Students can become involved as participants in brainstorming processes, in the building of prototypes, for user checks of prototypes, or in full educational design processes. Their roles can range from testers to informants to design partners (Martens et al., 2019). The distinction between these roles correlates with the degree of power or control the students have in such participative constellations.

Power and control

In both Section 4.2 and also in the current section, the question is asked of how much power students should have in order to achieve successful collaboration. In the model of Bovill and Bulley (2011), as shown in Figure 9, an overview is provided of the various levels of ‘power and control’ students may have as a visualisation of participatory activity.

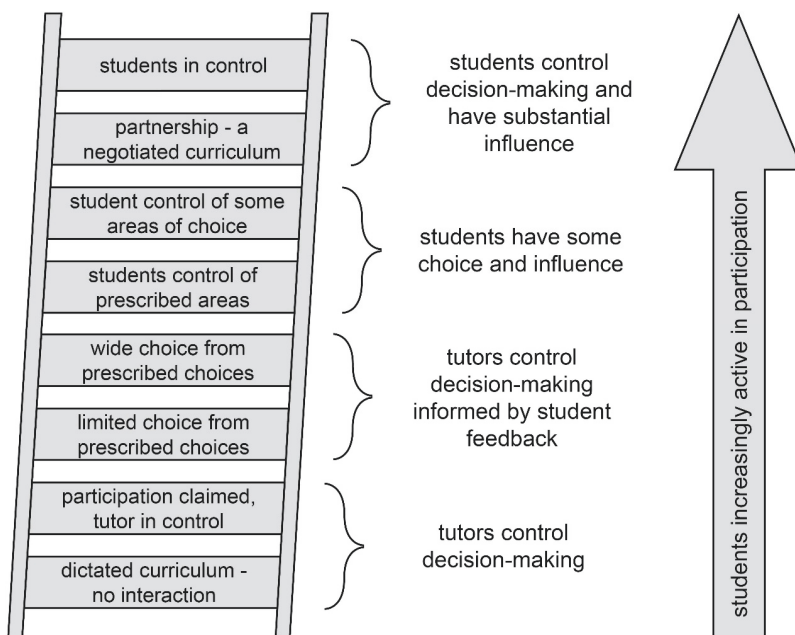


Figure 9: Ladder of Student Participation in Curriculum Design (Bovill & Bulley, 2011)

In previous sections, it was concluded that a certain right to have their say is necessary in order for students to be motivated into taking up a participative role. However, it has also been described how difficult it can be for the students, because their knowledge and competences are often found to be lacking. This leads to the consideration of the kinds of power and control that exist within these middle segments, where the control is shared between teachers and students (co-decide).

Positive consequences of the involvement of students in design processes

In the educational design literature, not only the importance and requirements for the effectiveness of collaborative design with students are described, but also the consequences of such. The collaborative design with students is described as having a positive influence when one wants to translate blueprints (design concepts) into practice, and allows for insight to be gained regarding the effects of designs that teachers and designers implement on students (Könings et al., 2014, p. 5). Next to that, it is argued that participating in educational design processes enhances students' awareness of the learning process (Bovill et al., 2009), because it promotes metacognition and reflection on teaching and learning (Könings et al., 2014). In addition, it can foster responsibility over students' own learning (Bovill et al., 2009). Those arguments are in line with the objective to develop students' competences to make them able to learn cross-contextually.

4.4. Consolidation: Assumptions and Concepts toward Student Orientation in the Study

In this section, the meaning of the literature for the current study is explained. Based on the literature, a summary is provided according to the theories and concepts that will play a specific role in the study's methodology, analysis, results, and their discussion. Although all of the theories and concepts previously described may be deemed relevant to understanding the student perspective with regards to cross-contextual learning and the involvement of their perspective in educational design, the theories and concepts presented in this section are stated as being central to the current study. Along the structure of Chapter 4, the third part of the conceptual framework of the study is presented.

Students' experience with cross-contextual learning

In order to find out about the student perspective towards cross-contextual learning, the literature about what is already known on this topic was described. The (little amount of) problems that the students described were acknowledged to be very compatible with the seamless learning dimensions of Wong and Looi

(2011). The students described problems according to three MSL-dimensions; MSL 3 (learning across time), MSL 5 (learning with different learning materials), and also MSL 10 (learning with different pedagogical approaches). Based on these singular studies, it seems possible to utilise these dimensions for the categorisation of problems that student experience with cross-contextual learning. Therefore, the dimensions for seamless learning will play a central role in the current study with regards to presenting the student perspective.

Students' perspective and educational design

To find out how information regarding the student perspective is involved in design processes of cross-contextual learning, the literature about student-orientation and student participation was reviewed. The most important assumptions for the current study, as well as the concepts that play an important role in the study, are the following:

Involvement of the student perspective: From enquiry to implementation

For the current study, it is important to reveal the understanding of 'the involvement of the student perspective'. Reinmann and Jenert (2011) distinguished between support and participation, a distinction which will also be pursued in the current study. It is important to emphasise that both visions are meant with 'the involvement of the student perspective'.

Support means that the student perspective can be enquired in order to reveal and to learn about the students' experience and their perspective. The information being enquired can then be applied to support the design of supportive measures for cross-contextual learning. As described, different forms and methods are employed to enquire about the student perspective (e.g., questionnaires, interviews, focus groups, etc.).

Participation means that the students can also participate in the design processes, and which can then lead to students having a more direct influence. Whilst it can be discussed if the supportive involvement perspective of the students can also be seen as a kind of participation; for the sakes of clarity, the current study talks of student-orientation or of a range of possible forms of involvement of the student perspective rather than 'student participation'. Intuitively this includes a broader spectrum of methods than just student participation alone.

With regards to the forms, the broadest range is used for analysis. The following list summarises the possible forms as they were derived from the literature:

- (No role)⁸
- Supportive forms: Direct feedback instruments
 - Questionnaires (often provided by higher education institutions and often compulsory)
 - Specifically developed questionnaires (often developed by teachers with context-specific questions)
 - Interviews or focus groups
- Supportive forms: Indirect feedback instruments
 - Assignments and assessments
 - Informal contact and conversations with students
- Participative forms
 - User check
 - Co-design (ranging from brainstorming to participation in the full educational design process)

With regards to the model of Reinmann and Jenert (2011), the focus in the current study is mainly on the didactical elements whereby students' experiences are explored within their micro-didactical contexts, rather than on the organisational elements. However, in order to overcome problems with cross-contextual learning, also services, political, and administrative processes may come into play (e.g., the implementation of interventions and supportive measures).

Students' perspective in collaboration with other perspectives

With regards to the discussion about balance between student and teacher orientation, a normative understanding of collaboration underpins the current study. Both a full student orientation or a full teacher orientation are assumed to be undesirable. Still, with regards to the empirical part of the study, the field was approached with an open attitude. During data collection and analysis, it is possible that forms to come to the fore, which do not fit the normative understanding. All forms were taken into account at the same value. First, in the interpretation phase it will be discussed as to what means of collaboration may be preferable in terms of designing cross-contextual learning.

Openness is not only with regards to the forms, but also for the other themes. The themes as they were discussed based on the literature are used as the categories for analysing the student and teacher perceptions of the student perspective involvement. These themes are:

⁸ As described, this form is barely relevant for practice.

- *Perceived importance of enquiring and integrating the student perspective*
- *Estimated extent to which the student perspective is known*
- *Forms and potential forms for enquiry and participation*
- *Timing of enquiry and participation*
- *Integration and implementation of the student perspective*
- *Conditions and requirements for enquiry, participation, and integration*
- *Power and control between students and teachers*
- *Consequences of the involvement of the student perspective.*

5. Methodology

This part of the dissertation presents the empirical part of the current study. In this chapter, both the research design and the relevant methodological decisions are presented. Although the research design may appear static on paper, it evolved through an iterative process; hence, not only the final research design is presented, but also the relevant discussions that led up to each decision made during that process.

As the research design of the study is framed by the research paradigm, this is addressed first, including brief descriptions of the applied understanding of research. This starting point is key as it influences other elements later on in the design such as in the data collection methods, understanding the interaction with the respondents, the interpretation of the results, and also the quality criteria (Maxwell, 2013). Following on from the research paradigm, the research design itself is then presented, which includes the methods, instruments, and application of the quality criteria, leading on to the analysis strategies employed.

5.1. Research Paradigm

Section 1.3.1 described how the current study aims for a deeper understanding of students' experience of problems and supportive measures in cross-contextual learning scenarios. Consequently, in the study, students' experiences are researched from the student perspective (and the involvement of their perspective within educational design processes). This means that the objective is to reconstruct and understand the everyday meaning of the research subjects (problems and supporting measures) for the research objects (in this case, the students). The aim being to understand and reconstruct their realities appropriately, coherently, reliably, validly, and verifiably (Soeffner & Hitzler, 1994, p. 128).

The fact that knowledge about the subjective perception of the students is understood as contributive for better conceptual understanding, points to the fundamental assumptions of socio-constructivism, whereby the understanding of truth (the world around us) is socially constructed by those involved in it (Reinmann, 2013). It is assumed, therefore, that the students play an active role regarding the construction of the subjective reality. On the other hand, the influence of the socio-cultural environment on their construction is considered. Both the contexts and the students' subjective perception of those contexts influence students' experience of cross-contextual learning. For the current study, this means that it was assumed that the existence of a reality (e.g., the problems and

supporting measures with cross-contextual learning⁹) can only be understood and described intersubjectively¹⁰ (Breuer, 2003; Soeffner & Hitzler, 1994). That, in turn, denies direct access to the phenomena, which has two consequences for the research process: researcher dependence and context-boundedness. Both are explained in the following sections.

Researcher dependence

Just as understanding problems and supportive measures in cross-contextual learning emerges from the interaction between students' construction of reality and the influence of the context, the understanding the researched phenomena is understood to be constructed based upon the interaction between the researcher and the field. The understanding of students' reality depends on the interpretation of the researcher. Beyond that, the researcher makes contact with the field itself, which has a reciprocal influence on the field. The researchers' interactions with the field therefore lead to changes in this field, as well as to adjustments in its individual perception of the field (and thus the understanding of students' reality and the answer to the research questions).

This all means that the study depends upon the researcher, and represents only one possible access to the phenomena (Breuer, 2003; Soeffner & Hitzler, 1994). The understanding of the problems and supportive measures that students experience could also be constructed differently. In order to be able to deal with this subjectivity, a researcher should work with certain criteria for validity, and for this, the researcher is challenged to:

- present the process of gaining knowledge in the sense of intersubjective comprehensibility as transparently as possible (Breuer, 2003).
 - This is attempted through the detailed description of the research design and process in the following sections.
- identify one's own perspective on the object of research and to have a reflexive openness to other approaches to the object of research and possible contradictory positions (e.g., to actively reflect on one's own role as an observer in the research process) (Breuer, 2003; Fichten & Dreier, 2003).

⁹ The same can be applied for RQ4 towards educational design. In this chapter, the theory is exemplary applied related to RQ1 and RQ2. This is to make clear the influence of the understanding of research on the current study.

¹⁰ This also legitimates the research questions: Assuming that the understanding of the learning context practice is socially constructed by those involved in this practice, makes it necessary to involve all perspectives in order to understand this practice.

- This is attempted through utilising several instruments (e.g., reflective diary) and especially through extensive discussion of the methodology and the influence on the results discussion (see Chapter 8).

Context-boundedness (and generalisability)

Due to the assumption that the understanding of the phenomena is a construction that emerges from the interaction between the researcher and the field, significant value is also attributed to the field as well. The socially constructed reality of the students (and the researcher), has, in the case of the current study, arisen according to a unique, specific context. This raises the question, to what extent can the results be generalised to other contexts. It can only be answered by means of reconstructing the same research process within each of those contexts (Lamnek, 2005, p. 291). Therefore, it is important to present the process itself and how the answers to the research questions evolved. Next to that, thick description of the context, where statements or considerations originate from, is necessary in order to be able to derive or estimate generalisability (Lamnek, 2005, p. 181). In Section 5.3 and also in Sections 6.1-6.4, the context is described as detailed as necessary so as to understand the context and background of the study, and which may therefore have influenced the answers reached to the study's research questions.

Next to the description of the research process and the context, also with regards to the research design certain decisions are needed in consideration of researcher-dependence and context-boundedness. Certain strategies are employed in order to define an explicit handling of the challenges of researcher subjectivity and context boundedness (e.g., within single research instruments such as the interaction between a researcher and a study's respondents during interviews). Together, those considerations lead to a reflective and systematic procedure which provides both transparency and traceability (Maxwell, 2013). The entire handling of the quality criteria is summarised in Section 5.4.1

The understanding of the phenomenon within its natural context is –because of the research paradigm– the only option to answer the research question. The socio-constructivist understanding therefore frames how the research needs to be done and 'read'. The challenges faced by researchers should not cause them to not conduct their research of the phenomenon in this way, but do necessitate a certain procedural handling of the challenges. Through consideration of the strategies employed to deal with the aforementioned challenges, the strengths of the (qualitative) research design can be used, which offers minimal degradation to the research quality of the study.

5.2. Case Study

Why a case study?

In order to gain a deep, comprehensive understanding of the student perspective on the phenomena to be studied, a case study design was chosen. Lamnek (2010) described the aim of a case study investigation as being, ‘to capture all significant aspects, dimensions, and facets of an object of investigation with regards to the objective of the investigation’ (p. 273). One of the most important characteristics of case studies, therefore, is their ability to offer a unique closeness to the reality of the phenomena being studied (Lamnek, 2005, p. 311). These descriptions could be said to be apply well to the current study, with the aim being to capture students’ experiences of problems and supportive measures for cross-contextual learning, and the involvement of the student perspective in educational design processes as embedded within their natural contexts.

Why a multiple case study design?

As described previously, there is the challenge of reaching universally valid insights from one or a few cases when results are strongly context-bounded. In advance, it can be stated that with regards to students’ experiences of problems and supportive measures for cross-contextual learning and the involvement of the student perspective in educational design processes, it is expected that the results will also find relevance for other cases and in other contexts, since certain elements are expected to be case- and context-overarching and, therefore, generalisable. In order to be able to research which aspects are general and to foster the generalisability or transferability of the results to other contexts, a multiple case design was selected. The comparison of several cases allows for more comprehensive description and more robust explanations to be developed than if only a single case were to be examined (Yin, 2017, p. 62). In this way, external validity can be tested in striving for analytical generalisability of the study’s findings.

Why a qualitative case study design?

Within a case study, both qualitative and quantitative research methods and instruments can be used. The research problem in the current study requires a detailed understanding of the participants’ experiences, which matches better with the characteristics of qualitative research. Maxwell (2013) described that a qualitative approach is especially appropriate to questions about the meaning of phenomena to those involved, and the influence of the physical and social context on these phenomena. In addition, Maxwell (2013) stated that a process

focus often demands a qualitative rather than a quantitative approach. On this, both descriptions align with the research questions and objectives of the current study.

Passage to the next sections

Yin (2017) described that case studies:

- cope with the technically distinctive situation in which there will be many more variables of interest than data points,...
- rely on multiple sources of evidence, with data needing to converge in a triangulating fashion,...
- benefit from the prior development of theoretical propositions to guide data collection and analysis. (p. 15)

Therefore, in Sections 5.3 and 5.3.1, first the field is described (as distinct). Then Section 5.4 describes the methods and instruments (including triangulation). Both are built upon and related to the theory as described in Chapter 2, Chapter 3, and also Chapter 4.

5.3. Field Description

The current study presents a dissertation affiliated to a research lab wherein different project teams worked on seamless learning problems in the Bodensee (international industrial and collaborative) region on the borders of Switzerland, Germany, Austria, and Liechtenstein. The lab is structured as shown in Figure 10.

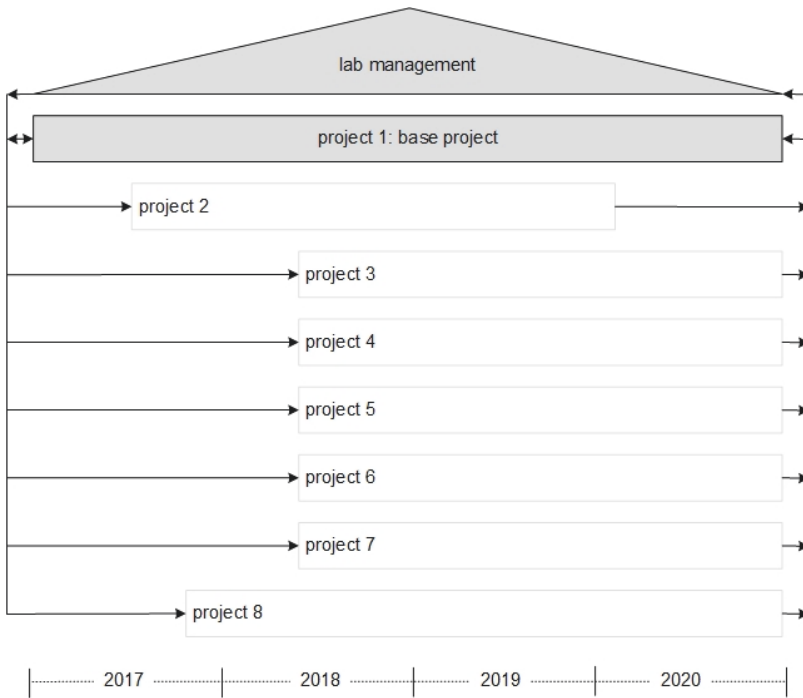


Figure 10: *Structure of the Lab: Management, Base Project, and the Subprojects*

The lab management coordinated the applications of each project and reviewed (continuously) if and how the projects contributed to the project-overarching objectives of the lab. The lab management also organised exchange and networking activities within the lab and beyond (e.g., organisation of meetings, conferences, and publications). The other projects (the base project (Project 1) and Projects 2-8) had a more content-based orientation.

The dissertation project of the current study was implemented from the position of the base project. The base project supported the other projects through their processes (implemented between 2017 and 2020), which aimed to tackle seamless learning issues across different practices. The collaboration between the base project and the subprojects was structured according to design-based research (DBR) processes. A typical design-based research process is presented in Figure 11.

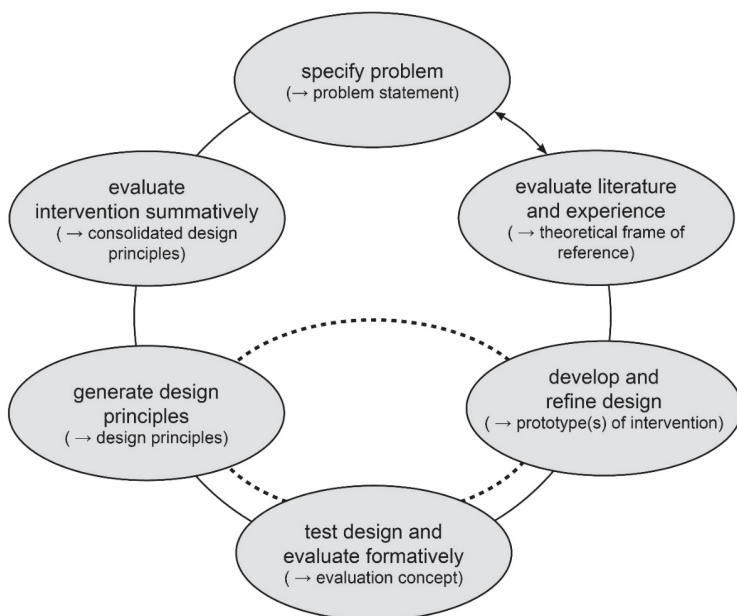


Figure 11: Design-Based Research (Euler, 2014)

The basic process of DBR involves developing solutions (i.e., interventions or supportive measures in the current study) to problems (i.e., seamless learning problems in the current study). The interventions were developed and applied in order to research how well they worked. Through iterations, the interventions could then be adapted and retested for improvement. The purpose of employing this approach is to generate new theories and frameworks for the conceptualisation of learning, instruction, design processes, and educational reforms within a narrow collaboration between research and practice.

The base project offered support through workshops held for each step of the DBR process. Also, the base project provided regular support to each subproject through consultation, feedback, and scientific evaluation.

Following the same processes and sequences across all subprojects enabled the base project to apply common learning across the subprojects, as well as the realisation of cross-project comparisons and research. This organisational format also offered a good fit as a field of research for the current qualitative case study. Beyond that, DBR is considered to be suited to the current study because within DBR, different actors and perspectives are involved during each step of the process, which allows for descriptive research of the involvement of the student perspective in design processes.

In this way, the field enabled access to data within a context where this was already in plan anyway, and the data was therefore collected not only in the context of the current study, but also within the initial processes of the aforementioned lab. In this regard, part of the data occurred within its 'natural (project) context'. In this way, it was hoped that the respondents were better convinced that they would directly benefit from their participation in practice (i.e., a win-win situation) (Lankshear & Knobel, 2004).

The field access and the structure of the projects certainly point to a good fit with the research questions and access to data. However, content-wise, the focus on seamless learning rather than cross-contextual learning in a broader meaning of the construct, could be considered questionable. As seamless learning was defined as one notion of cross-contextual learning, it could be argued that cross-contextual learning scenarios have also been the focus of the seamless learning projects. However, within these projects, only the 'concept' of seamless learning was used, which influenced the interventions and supporting measures developed, and therefore (partly) restricts the possibility of conducting a case study research across a broad array of supportive measures. This problem was addressed by the timing of the data collection as well as through triangulation strategies. The study and the data collection methods were implemented rather exploratively, with the primary focus on the original situation, prior to interventions and measures being implemented, which could therefore have had an influence on the data collected. During the data analysis, a broader view was chosen, thus presenting cross-contextual learning in a more general light as opposed to any specific focus on seamless learning. This means that other theories and concepts were not excluded, but taken up for the purposes of analysing and reflecting upon students' experiences of cross-contextual learning. This will be described concrete with regards to the data analysis presented in Section 5.5.

5.3.1. Case Definition: Sampling Strategies

The sampling of the cases within the defined field was applied purposefully in order to answer the research questions of the current study (Cohen et al., 2007). Four of the projects were defined as cases within this multiple case study. Cases can be chosen either because of their similarities or their differences, and with regards to their comparability as well as a test for generalisability (homogeneity vs. heterogeneity). The current study's aim, to research the student perspective, led to the selection of projects which focused upon cross-contextual learning, and which included students in higher education contexts. Next to that, implementation of the DBR-process (e.g., including following the workshops and support of the base project) influenced the sampling. As such, three of the seven

projects did not implement the process as intended (due to various reasons) or did not offer (fitting) possibilities for data collection. As this may have influenced the comparability of the cross-case analysis, these projects were purposefully excluded from the sample, although the experiences gained through these projects were partly used for learning purposes as pilot projects. This overall process led to a total sample of four cases, which are referred to from hereon as Case A, Case B, Case C, and Case D.

The four cases will be described in depth within the presentation of the study's results in Chapter 6 (instead of here in Chapter 5); a decision taken consciously because the descriptions themselves could be seen as interpretative. As described in Section 5.1, the descriptions of the cases can be understood as interpretations which are researcher dependent. Following this understanding, the descriptions present an interpretation (based on the concepts of the study according to the conceptual framework). For now, an overview of the relevant characteristics of each case is presented in Table 3.

Table 3: Overview of Relevant Case Characteristics

	<i>University type</i>	<i>Disciplinary field</i>	<i>Cross-contextual focus of the intervention in the project</i>	<i>Reference to prior/further education/job</i>	<i>Involvement of the student perspective in the design process</i>
<i>Case A</i>	Applied science university in Switzerland and Germany	Maths / Engineering	Integration of authentic contexts in-class by designing a new context related to a context that students know from their private life	Transition into higher education / transition to future courses	Teachers control decision making informed by student feedback (supportive feedback)
<i>Case B</i>	Applied science university in Switzerland	Physics	Integration of authentic contexts in-class by designing a new context related to a context that students know from their private life	Prior courses; future job	Teachers control decision making informed by student feedback (supportive feedback)
<i>Case C</i>	Applied science university in Germany	Project Management / Informatics	Integration of an authentic context in-class related to students' future work contexts	Transition to future job	Teachers control decision making informed by student feedback (supportive feedback from students in project team)
<i>Case D</i>	Applied science university in Switzerland (however process focus was on the industrial practice)	Technical engineering	Designing a new learning context (which – for some learners – adapts to their authentic work context)	Lifelong learning	Students control decision making and have substantial influence (participative: learners in project team)

The categories are elaborated as follows, with descriptions or categorisations related to the concepts as previously described in the conceptual framework. These relations are expanded upon within each elaboration.

University type

The project leaders of each project and each case are all employed at Swiss or German universities of applied science. The target group (or groups) were determined according to the focus of each project. Subsequently, students formed the target group in each of the cases, presenting a similarity across all cases. In some cases, students were the only target group (at least for the project duration, as in some projects, spill over effects to other target groups were intended through dissemination). In other cases, however, other target groups also formed part of the case (already during the project). Some of the applied science universities have a strong orientation to and a history of collaboration with certain industrial sectors. This is especially pertinent in Case D, where this factor led to a broader focus, due to the project including industry employees as well as students.

Disciplinary field

Within each university of applied science, the project leaders (teachers) each are home in different disciplines (faculties and schools) and thereby teach different (kinds of) courses and competences. In Case A, the focus is on fundamental maths competences for different studies in the field of engineering, whilst Case B addresses advanced physics-based competences regarding the topics of fields and waves. Case C is centred on project management competences within the discipline of engineering and programming, whilst Case D focused on learning content about norms and standards in the field of technical engineering. As can be seen, the cases differ from more fundamental competences (e.g., maths, project management) to more subject-specific competences (e.g., fields and waves in physics, and norms and standards in technical engineering).

Students' progress in the study programme

Positioned between the general aspects and the cross-contextual learning aspect lies the students' progress within their chosen study programme. The students' progress varied by student and thereby also differs between cases. For example, Case A concerns students in their first year of bachelor studies, whilst Case B concerns students in their penultimate year of bachelor studies. Case C concerns master's level students, and in Case D, the focus is on employees as well as stu-

dents. This variation especially influences references to prior and further education, and also future employment, in transitions such as moving from high school to higher education, prior, parallel, and future courses, or the transition from higher education on to starting paid employment or a profession.

Cross-contextual aspects

The cross-contextual focus of the interventions and supporting measures to be developed in the projects are described based on the possibilities for facilitation of cross-contextual learning, being the conscious use of context within educational design processes, involving authentic contexts, using contexts that students move within anyway (in-class and out-of-class), and designing new contexts (see Section 3.5).

Integration of the student perspective in the design process

With regards to RQ4 (the role that the student perspective plays within educational design processes), the cases differ according to the kind of students involved in the process, as well as to the way in which those students are involved (the latter being described in Table 3). The involvement of the student perspective in the design process is described according to the distinction of Reinmann and Jenert (2011) towards supportive versus participatory approaches for student-orientation (see Sections 4.2 and 4.4). Next to that, the model of Bovill and Bulley (2011) is included in order to describe the power and control that students and learners have had in the processes (see Sections 4.3 and 4.4). The type of students involved are described in the following section with regards to the respondents.

5.3.2. Participants

To be able to address the research questions of the current study, both students (notably referred to as ‘learners’ in Case D due to the broader target group) and teachers (notably referred to as ‘project leaders’ in Case D, because they were not in the role of a teacher) in the cases will play a role as respondents in this study. These roles are distinguished according to each research question:

- RQ1: **student respondents** – the objective being to enquire about their perception of, or experience with, problems with cross-contextual learning.
- RQ2: **student respondents** – the objective being to enquire about their perception of, or experience with, supporting measures.
- RQ3: **students and teachers as respondents** – the objective being to compare their perceptions (of RQ1 and RQ2).

- **RQ4: students and teachers as respondents** – the objective being to enquire about their perception of the integration of the student perspective in educational design processes.

This leads to the matrix presented as Table 4.

Table 4: Overview of Research Foci and Respondents

	Student	Teacher
Perspective		
Integration		

In the method section, the inner boxes will be completed with the methods used to collect data toward each different research foci.

Since the four projects all took place within the higher education context, the students and their teachers were each affiliated to different higher education institutions in the Bodensee region. In the case of the teachers, they were automatically defined by their involvement in the subprojects. In order to research the student perspective, with regards to some methods, all students could be included. With regards to other methods, purposeful sampling of a representative group of students was aimed at. In case of the latter, the aim of the purposive sampling was to equally represent students that have different characteristics and backgrounds (Cohen et al., 2007). However, in the recruiting of the students for the study, the dependency on the collaboration with the teacher and the willingness of the students themselves significantly influenced the sampling. Together with the teacher, invitations were distributed via email or through the involved courses. Additionally, the teachers aided the purposeful sampling approach in order to recruit information-rich students as a means to ensuring adequate representation across the groups of students (Krueger & Casey, 2008). In terms of the ‘students’ involved in the projects, they included actual students, former students, and also future students.

Relationship to the respondents

According to the project structure, special focus within the current study is required in order to provide clarification on the researcher’s role, and also their relationship to the respondents, and particularly the teachers. As previously mentioned in the description of the field, this dissertation, as the current study, forms part of the overarching base project, and therefore collaborates with and

supports each of the subprojects in order to provide aid with designing their interventions and measures. This activity increased the chance that the researcher, through different roles, may have influenced the researched object and data. Next to that, there was an increased risk that the researcher may have been influenced through their involvement in the researched practices, and thereby potentially their subjectivity. Both of these issues are considered common within qualitative research processes (Maxwell, 2013). In the following method section, methodological strategies are described which were implemented as a means to avoiding and mitigating these potential validity threats. Also, the strategies are discussed in order to add an increased level of transparency and honesty in the reporting of the current study.

5.4. Methods and Instruments

This section describes how data was collected in the current study. Table 5 provides an overview that helps to clarify the connections between the two research foci, the participants, and the different methods applied before the methods are described in greater detail. Table 5 also shows which data collection method is related to which research question.

Table 5: *Overview of Relations between Research Instruments and RQs*

	Student		Teacher	
Perspective	Focus groups, TAPs	RQ1 RQ2 RQ3	Document analysis, Interviews	RQ3
Integration	Interviews, Questionnaires	RQ4	Interviews	RQ4
Both	Informal data strategies: participative observation			All RQs

Default process

With regards to the field description, a default process was defined. Students were asked about the (cross-contextual) problems and supporting measures they experienced at the beginning of their course. The teachers developed the interventions and supporting measures and tested them with their students both in the middle and repeated at the end of the course. There was flexibility

in the arrangement of this process (e.g., which students, how to involve them), and to do things differently where appropriate (e.g., refrain from applying steps if there was a misfit with the context). However, in general, the process was kept as similar as possible between each of the projects.

In Sections 5.4.2-5.4.8, the different kinds of data collection are elaborated upon. In each section, it will be explained and argued:

- why they are chosen as the most appropriate instrument;
- how they were prepared and applied;
- what circumstances influenced the implementation;
- how the data was prepared for analysis; and,
- what other strategies were implemented with regards to the quality criteria (some may be integrated within the previous points).

The quality criteria are addressed in the following section.

5.4.1. Quality Criteria

As described at the beginning of the chapter, the study aims to reconstruct realities of the participants appropriately, reliably (traceably and coherently), and validly (Soeffner & Hitzler, 1994, p. 128). The aspects are elaborated as follows.

Appropriateness

The appropriateness is expressed in the arguments given towards the research design (e.g., the arguments put forth for a case study approach), the methods and instruments for data collection (see Sections 5.4.2-5.4.8), and the strategies for data analysis (see Section 5.5). In order to appropriately answer the research questions, the research design has to be in line with both the research paradigm and the research objectives.

Reliability

- **Traceability:** As the study described as being research dependent and context-bounded, it is important to make the research process traceable (the steps which influenced how answers to the research questions evolved) (Lamnek, 2005, p. 146; Yin, 2017, p. 46). The steps for both the study's data collection and analysis are disclosed in Sections 5.4.2-5.4.8.
- **Coherence:** Special attention was given to the same conditions for measurement and analysis across different points (e.g., same conditions of measurement for all focus groups). A concept (e.g., an approach and guidelines) was developed prior to starting to collect or analyse the data, including the preliminary understanding of the data collection and analysis methods or strategies (e.g., understanding the role of the interviewer

and the respondents) (Ratner, 2001). The conditions for measurement and analysis as well as the preliminary understanding of the methods are discussed according to each individual instrument (see Sections 5.4.2-5.4.8).

Validity

- **External validity:** This was approached through the choice for a multiple case design (Yin, 2017, p. 62), and previously discussed in Section 5.2.
- **Generalisability:** The topic was previously addressed at the beginning of the chapter. Also, generalisability was considered within the instruments to be used for data collection. The strategies applied are discussed in Sections 5.4.2-5.4.8.
- **Construct validity:** This is approached through both triangulation of different theories (see Chapters 2, 3, and 4) (Lamnek, 2005, p. 159) and the triangulation of different data collection methods (Fichten & Dreier, 2003; Lamnek, 2005, p. 290).
- **Internal validity:** Strategies were implemented for each data collection instrument and especially for the data analysis (see Section 5.5) (Kuckartz, 2018; Yin, 2017, p. 45).

Table 6 provides an overview of the different kinds of validity, and whereabouts strategies for handling them can be found in the current study.

Table 6: Overview of Quality Criteria

<i>Quality criteria</i>	<i>Strategy for implementation (current study)</i>	<i>Presentation / description (current study)</i>
<i>Appropriateness</i>	▪ Research design ▪ Arguments per instrument	▪ Case Study (Section 5.2) ▪ Methods and Instruments (Sections 5.4.2-5.4.8)
<i>Reliability</i>	▪ Thick description of the research process (traceability) ▪ Think description of the analysis (oriented to the research questions)	▪ Methodology (Chapter 5) ▪ Data Analysis (Section 5.5)
<i>External validity (and generalisability)</i>	▪ Multiple case-design including cross-case comparison ▪ Representative sampling of respondents	▪ Case Study (Section 5.2) ▪ Sampling Strategies (Sections 5.3.1-5.3.2) and Methods and Instruments (Sections 5.4.2-5.4.8)
<i>Construct validity</i>	▪ Theory-based research questions ▪ Triangulation of different theories ▪ Triangulation of methods	▪ Research questions (Chapters 1 and 5) ▪ Conceptual framework (Chapters 2-4) ▪ Methodology (Chapter 5) and correlation of different data types (Section 5.4.11)
<i>Internal validity</i>	▪ Standardised / systematic procedures for data analysis ▪ Strategies for validity in the processes of analysis and interpretation	▪ Data Analysis (Section 5.5) ▪ Methods and instruments (Sections 5.4.2-5.4.8) ▪ Data analysis (Section 5.5)

The quality criterion of objectivity has not been taken up in the current study. In line with the described understanding of the research, objectivity is not considered possible to achieve (see Section 5.1) (Breuer, 2003; Soeffner & Hitzler, 1994).

In summary, several ideas and strategies pertaining to quality criteria were addressed, and are described in the relevant places in the dissertation (the current study).

5.4.2. Focus Groups

Objective

Focus groups were held with the students as a method to enquire about their perspective on the problems and supportive measures that they experienced with regards to cross-contextual learning scenarios in order to achieve the learning objectives of their courses. They were asked not only about their experiences, but also their (hypothetical) expectations with supportive measures regarding cross-contextual learning.

Appropriateness

The focus groups were chosen for the purposes of qualitative data collection (see Section 5.2). They were opened as a room for discussion among the students (Krueger & Casey, 2008), and therefore allowed for the collection of data from different students and of different perspectives (Krueger & Casey, 2008). Through the sampling (see Section 5.3.2 and the following section), different perspectives were able to be discussed such as the initial situation (e.g., background), the start of the course (e.g., transition and expectations), and the anchorage of the course within the study programme. This placed singular perspectives within the perspective of an overall timeline. In comparison to interviews, with focus groups, more students could be reached and the degree of heterogeneity between them was able to be made more visible. This was considered important because of the individuality of learning biographies of the students. The organisational load of the focus group was limited to the teacher, who maintained this channel of direct access to their students.

Whilst a questionnaire would perhaps have been even better in terms of being able to reach a greater number of students and maybe even more efficient, the application of a questionnaire would not have provided the qualitative data sought, nor included any room for discussion.

Implementation

Table 7: Overview of Focus Groups

Case	Number of focus groups	Number of students	Interviewer
Case A	3	6+3+4	2x Interview 1, 1x Interviewer 2
Case B	2	3+3	1
Case C	1	5	1
Case D	1	5	1
Total	7	29	

Table 7 provides an overview of the implemented focus groups. Seven focus groups were formed at the beginning of the DBR-processes to develop the interventions and supporting measures. Students who participated in the course were sampled for each focus group (Case A, Case B, and Case C; in Case D, there was no course structure, so other learners were sampled). In the focus groups of Case A and Case C, also students participated, who had participated in the course before (thus, they were participating in the course at the moment from the focus groups). Therefore, at the point that the focus group was conducted, some participant students were further on in their course curriculum, and were able to look back and comment with hindsight. In Case B, no former students were included because of organisational reasons, as was also the situation for former learners in Case D. In Case C and Case D, the students and learners who participated in the focus groups would go on to learn with the intervention in the future.

The researcher discussed with the teacher as to which students were likely to be the most information rich (Krueger & Casey, 2008). Krueger and Casey (2008) explained that this should be thought about; as to who offers the greatest amount of potential insight to share on the topic in question. For instance, in the contexts of a focus on a seam between the actual context and future contexts, it was important to ask students who are already situated in this future context in order that they can look back. It was also aimed to find a representative group of students in order to foster the generalisability (within the study) of the answers of the participating students in terms of the whole student population. Each focus group held lasted for an average of 70 minutes.

The focus groups were implemented by two members of the base project team. However, most were implemented by the researcher of the current study. In order to foster coherence between the focus groups, an interview guide was prepared and applied within each meeting. The interview guide included the following different parts:

- **Introduction:** An introduction of the interviewers, as well as the background to the focus group, and the importance of the student perspective (to foster the motivation to participate).
- **Demographics:** Questions about the background of each of the students.
- **General questions:** Questions such as¹¹:
 - How difficult is the course?
 - What makes learning difficult in the course?
 - What helps you learn in the course?
 - What suggestions do you have for improvements to the course?

There was no specific focus on cross-contextual learning here so as to be able to identify the ratio between problems related to cross-contextuality and other problems. When cross-contextual problems were mentioned by the participants, additional probing questions were also asked.

- **Questions on cross-contextual learning:** Students were asked specifically along the 10 MSL dimensions of Wong (as presented in Section 2.4), with questions such as:
 - Does the subject build upon something already known?
 - What are the main differences between the actual course and your previous education?
- **Questions from the teacher:** Questions posed specific to the cross-contextual learning problems identified by the teachers, and/or concerning the supporting measures they planned to develop.

The standardised interview guide can be found in Appendix A.

The organisation of the focus groups was adapted according to the time schedules of the participant students so as to foster their motivation to actively participate. The organisation happened in collaboration with the teacher, who also emphasised to them the importance of the data collected. This was also designed in order to foster the students' motivation to participate. However, the students participated on a voluntary basis, which is necessary to be considered with regards to the representation of the students, and thus with regards to the potential for generalisability of the study's findings (Krueger & Casey, 2008).

¹¹ The questions are translated. For the questions in the original language see Appendix A.

Preliminary understanding

The students were each understood to be the experts when it comes to reporting their own experiences. The objective of the interviewer, therefore, was to understand the students, their backgrounds, and the contexts in which they moved/operated. Whilst the interview guide served a purpose to structure each focus group, there was some leeway in which to follow the flow of the conversation as it was constructed by the students themselves, and thereby to both permit and encourage them to deepen their perspective (i.e., the application of a semi-structured interviewing technique) (Krueger & Casey, 2008). This approach was applied to all of the focus groups.

Validity

With regards to validity within the focus groups, there are four main topics.

- With the aim to collect data from the student perspective, it was considered important not to influence the students with either a suggestive attitude (of the interviewer) or with suggestive questioning. For this purpose, the sequence of the different parts of the interview guide was deemed to be of significant importance.
- One known disadvantage of focus groups is the potential discussion flow between the students. The students may discuss certain topics extensively, but it is also possible for other topics to lose focus (Krueger & Casey, 2008). Should some areas not be adequately discussed, or not at all, this could negatively influence the validity in terms of the aim of the interviews, which was to capture 'all' problems (according to the students as interviewees) regarding cross-contextual learning, and their experiences and ideas that support cross-contextual learning. This was countered by way of applying the pre-structured interview guide, and through the interviewer moderating the discussions towards the interview guide (Krueger & Casey, 2008).
- As the students mostly have a depended relation to their teachers, (social) honesty could have presented an issue for the students. This risk was mitigated by offering the students a guarantee of anonymity.
- To prevent from social pressure between the students, it was explained that heterogeneity between the students, as interviewees was considered normal.

Data

During the implementation, the focus groups were audio-recorded (with permission taken from the student participants). The audio recordings were then

transcribed verbatim by the researcher, an instructed student from the institute, or through the services an external transcription facility. Intern, the audio recordings were transcribed using the software F4. Some of those recordings needed additional translation from the original Swiss-German dialect to the German language. A transcript guide was developed between the intern transcription authors. The external service transcribed only original German recordings according to their own explicit guidelines. The transcribed audio recordings can be found in MAXQDA (see Appendix F).

Also, field notes were taken by the interviewer (e.g., the atmosphere during the focus group, non-verbal communication). Those were taken up as in memorandum form (memos).

5.4.3. Teaching Analysis Polls

What is a teaching analysis poll?

A Teaching Analysis Poll (TAP) is an explorative strategy applied in order to collect feedback from courses or learning interventions. The TAP method is implemented at around the middle of the course schedule, so that the students may benefit from the feedback they provide during the remainder of their course. During a TAP, students reflect in small groups on the following three questions¹²:

- What most helps you learn in the course?
- What most impedes your learning (in the course)?
- What suggestions do you have for improvement (to the course)?

Afterwards, the TAP supervisor summarises and specifies the points raised with the whole group, paying attention to the points raised with a majority vote (Frank et al., 2011). This method is considered widespread in German-speaking higher education institutions, and a detailed described of the TAP process can be found in the study of Frank et al. (2011).

Objective

Complementary to the first focus groups, the TAPs aimed to collect data to aid understanding the student perspective on their cross-contextual learning scenarios and also the supporting factors in this regard. With the TAPs, it was aimed to enquire if and how the developed interventions and supporting measures met the students' needs (as expressed in the first focus groups and interviews), if their experience of seams in the learning experience changed, and if new problems had emerged. The data was not used as an evaluation of the

¹² The questions are translated. For the questions in the original language see Appendix B.

seamless learning interventions, but to complement the information already gathered regarding the problems and supporting factors that the students experienced.

Appropriateness

With the TAPs qualitative data was collected (see Section 5.2). As previously described, the TAPs provide data with a focus on how the students experienced the interventions and supporting measures with regards to their cross-contextual learning, the fit with the described problems, and the eventual emergence of new problems. The TAP was employed so as to enrich the focus group data gathered from the beginning of the course, because the TAPs took place during the implementation of the developed seamless learning interventions and supportive measures (pilot and implementation). This approach enabled the students to reflect upon concrete experiences within the context (compared to the focus groups, which included a more hypothetical appraisal based upon their expectations). With regards to efficiency, the TAPs were implemented in class, meaning that the whole group could be accessed through this method, which automatically delivered representativeness, and therefore there were no issues with generalisability (within the study) found in this regard.

Implementation

Table 8: *Overview of TAPs*

	<i>Pilot implementation</i>	<i>Final implementation</i>
<i>Case A</i>	√ Applied science university in Switzerland	/
<i>Case B</i>	√	/
<i>Case C</i>	√	√
<i>Case D</i>	/	/

Table 8 provides an overview of the implemented TAPs. All TAPs were implemented as previously described, and the process lasted for about 30 minutes. Next to the inductive default strategy that employed very open questioning techniques, a pre-structured interview guide was used in order to pose specific questions regarding the interventions and supportive measures which were developed by the projects. Those questions were brought in by the teachers.

In total, four TAPs were implemented and used for the current study. As Case D did not follow a standard course design, no TAP took place for Case D. For Case A and Case B, it was decided that TAPs would only be employed for the pilot implementation of the seamless learning intervention and supporting measures. During the research process, the teachers found that the students had been excessively exposed to feedback and evaluation methods, and beyond that, the TAP did not contribute much additional value for them. In the context of adaption and close collaboration with the field, it was decided to no longer implement TAPs during the second implementation phase.

Measurement conditions and preliminary understanding

The TAPs were implemented by two project team members of the base project. In order to foster coherence between the focus groups, the TAPs were implemented in line with the original concept of TAP. A detailed TAP implementation guide was developed (see Appendix B), and an introduction to the method was applied so as to familiarise the second interviewer with the TAP process.

The organisation of the TAPs was adapted to the time schedules of the participant students. This approach was taken in order to foster their motivation to participate. The TAPs took place during lecture (class) time, in order that the students were not required to invest additional time. The organisation was applied in collaboration with the teacher, who also emphasised the importance of the data. This was also meant to foster the students' motivation to participate. Next to that, TAPs are meant to be relevant to the actual students themselves. As already described, the TAPs took place during the teaching semester in order that the feedback received could then be implemented and the students thereby gain benefit from it. This approach was aimed at providing a good source of motivation for the students to actively participate.

Validity

All challenges and strategies listed regarding the validity of the focus group also apply to TAPs (suggestiveness, variety of discussed topics, honesty; see Section 5.4.2).

Data

During a TAP, the participant students wrote down their answers to the questions posed on handouts. The TAP supervisor also took notes about the discussion (e.g., heterogeneity between the participant students). For the teachers, the

handouts of the students as well as the discussion in plenum were then summarised. The collected data from the TAP process, in terms of the current study, was this summarised document.

One potential disadvantage of this type of data is the level of summarisation (aggregation) that may have been applied by the TAP supervisor. The students annotate their outcomes of the small group discussions. In this way, the outcomes are summarised by the students. Afterwards, the TAP supervisor summarises the votes again and documents them for the benefit of the teacher. This double-summarised documentation therefore contains a high level of aggregation. With regards to the current study, the TAPs were implemented by the researcher (or members of the base project), which helped with regards to the interpretation of the collected data. However, consciousness about the applied level of summarisation should be maintained whilst analysing and/or interpreting the summary documents.

5.4.4. Questionnaires

Objective

With regards to RQ4 (the integration of the student perspective in the design processes), a few questions were included in the questionnaires as planned in the projects. Through these questions, the aim was to capture the students' experiences with regards to possibilities that they had or would like to have been involved in the course design.

Appropriateness

A questionnaire was chosen as the method to reach as many students as possible (Cohen et al., 2007), who had played a supportive role with regards to the design processes (they gave insight in their experiences through focus groups, TAPs, and questionnaires). A questionnaire was chosen because it enabled the integration in an existing, planned instrument. This was seen as important in order not to overload the students with feedback and evaluation procedures (Lankshear & Knobel, 2004), which had already been raised as a sensitive issue in the project (see Section 5.4.3). With regards to the length of the applied questionnaire, there was not room for many questions; however, the objective to collect data with regards to RQ4 was applied as appropriately as possible for the given situation. Without limitations of the field (the perceived overload for the students), interviews would have allowed a deeper level of questioning as to the students' experiences with their involvement in the course design (Cohen et al., 2007). Consciousness about the data quantity and quality should be maintained whilst analysing and/or interpreting the data.

Implementation

Table 9: Overview of Questionnaires

	<i>Pilot implementation</i>	<i>Final implementation</i>
<i>Case A</i>	2 classes <i>Applied science university in Switzerland</i>	1 class <i>Applied science university in Germany</i> No response from 1 planned class in Switzerland
<i>Case B</i>	1 class	No response
<i>Case C</i>	√	√
<i>Case D</i>	/	/

The questionnaires were planned to be applied at the end of the course. Both open and closed question types were included¹³:

1. The influence from students on the course design was:
 - Excessive
 - Substantial
 - Little
 - Too little
2. In what way did students have influence on the course design? (open-ended question)
3. How did you like the following methods in terms of their influence over the course design? / How would you like the following methods to have influence over the course design?
 - Appropriate
 - Not appropriate

The third question was adapted to suit each different case. For this question, the possibility was included to comment on each method (as different per case: e.g., focus groups, TAP, questionnaires, informal conversations...)

The questions were formulated in a two-fold way, because some students had experience with some methods that others did not. They could therefore only be asked to reflect on their experiences according to the methods that applied to them. The others were asked to estimate how these methods could work for them hypothetically.

¹³ The questions are translated. For the questions in the original language see Appendix C.

It was not possible to ask these kinds of questions (towards the involvement of the learner perspective in educational design) for Case D as the process had significantly differed¹⁴.

Measurement conditions

In order to foster coherence, the questionnaire was applied the same across the cases (except for Question 3). The teachers were asked to introduce and implement the questionnaire in-class to help increase the response rate. In Case A and Case B, this was only successful with regards to the pilot implementation, whilst in Case C this was seen as being successful for both implementations. As can be seen in Table 9, there was no response to the questionnaires that were only introduced and made available outside the class, thus in the online environment.

Validity

As described with regards to appropriateness, the implementation, and the measurement conditions, it was very difficult to collect valid data to support RQ4. A face-validity test was applied to the questions, which helped to support the assumption that they would provide valid data. However, the method in question was seen to provide limited data, which must therefore be considered and taken into account for the interpretation. In Section 5.4.5, another instrument for data collection towards RQ4 is discussed, whilst Section 5.4.11 looks at the correlation between the data types.

Data

The data was exported from Unipark (the platform used to develop and administer the questionnaires) to Microsoft Excel.

5.4.5. Interviews with students who participated in the design process

Objective

In two of the cases, some of the students had a special role within their respective projects. In Case C, students who participated in the course prior to the start of the project also became project team members. In Case D, learners were involved as important partners in the project. They took part in the focus group, and also participated in the project's workshops. With regards to RQ4, these

¹⁴ Because the learners in Case D would be interviewed about their participation in the project, this data could instead be captured through that method of data collection as an alternative strategy (see Section 5.4.5).

students and learners were interviewed in order to capture their experiences with the potential they had or would like to be involved in the design of the interventions and supportive measures.

Appropriateness

Those students who had the described functions in the projects were each interviewed for the purpose of collecting rich, qualitative data about their experiences (Cohen et al., 2007). In Case C, a focus group with the three involved students took place, whilst for Case D, four short one-to-one interviews took place. The choice between focus group or interview in the individual setting was based purely on organisational reasoning. With regards to the objectives to understand the research question, personal interaction between the researcher and the respondents allowed for further questioning in order to ensure understanding of the students’ experiences. Personal contact is the key argument when it comes to the appropriateness of each instrument, independent of being a focus group or individual interview. The specific advantages of a focus group are described in Section 5.4.2. The individual interviews gave the participants the room to develop their own answers and not to be influenced by others (Krueger & Casey, 2008). However, the differences between the focus group and the interview were mostly countered by the structure of the interview guide (see following sections). This way, both instruments ensured adequate data.

Implementation

Table 10: *Overview of Interviews with Participating Students*

	Focus group / interviews
Case C	1 focus group, 3 students
Case D	4 short 1:1-interviews

Table 10 provides an overview of the implemented interviews. The interviews were planned to take place around the midpoint of each project, where the students and learners had gained a certain level of experience through their involvement in the projects. In Case C, all of the students who played a role in the design projects as project team members were interviewed. In Case D, the aim was to find a representative group of learners in order to foster the generalisability (within the study) of the answers to all involved learners. The focus group with the students in Case C lasted for a duration of 1 hour and 30 minutes, whilst the four short one-to-one interviews in Case D lasted for 30 minutes each.

Measurement conditions

In order to foster coherence between the focus groups and the individual interviews, a standardised interview guide was employed (Cohen et al., 2007). The interview guide included different themes, derived from the literature as presented in Section 4.4 (relevant aspects of the involvement of students in design processes). The interview guide itself can be found in Appendix D. Exemplary questions are as follows¹⁵:

- To what extent do you feel that the teacher/project leader knows the perspective of students (learners for Case D)?
- What role does the perspective of the students (learners for Case D) play for a successful design of interventions and supporting measures from your point of view?

The interview guide was structured in different parts:

- An introduction to the objective of the interview, the background of the study and the role of the researcher, the researchers' understanding of involvement regarding the student perspective, and the openness towards different valuing of forms of involvement.
- General questions, as previously mentioned.
- Specific questions about perspectives and forms to enquire and integrate the student perspective in educational design processes. The students were asked specifically along the forms as they were presented in Section 4.4 (ranging from no involvement of the students through to their participation and power within the design processes. The forms of power and control were derived from the model of Bovill and Bulley (2011).

The organisation of the focus group was adapted to the time schedules of the students and learners so as to foster their increased rate and level of participation. For the interviews of the Case D learners, the implementation was supported by their managers (e.g., the interviews took place during working hours) to help foster their motivation to participate (Cohen et al., 2007).

Preliminary understanding

The students were understood as being the experts when it came to their own experiences and understandings. The objective of the interviewer was to understand the students and their experiences. There was no preconceived evaluation or desired form of student involvement brought in by the interviewer. All possible forms of involvement (as described previously) were brought in neutral in

¹⁵ The questions are translated. For the questions in the original language see Appendix D.

value to be able to discuss possibilities that were not thought of automatically as such by the respondents. This way, their attitudes towards these forms could be discussed as well.

The interview guide structured the focus groups, however, there was also some room permitted in order to follow the flow of the conversation as it was constructed by the respondents, and thereby to deepen their perspective through semi-structured interviewing. In order to foster coherence, this understanding was applied to all of the interviews.

Data

Like the focus groups as described in Section 5.4.2, the interviews and focus group were each audio recorded and the collected audio data subsequently transcribed.

Validity

All of the challenges and strategies listed regarding the validity of focus group interviews (see Section 5.4.2) also apply to the interviews here (suggestiveness, variety of discussed topics (for focus groups), and honesty). With regards to suggestiveness, it was important that the sequence of questions was strictly kept to. As both the actual experiences and hypothetical forms of collaboration with the students (derived from the literature) were questioned to be of value, so that the forms brought in by the researcher did not unnecessarily influence the experience or value of the actual forms.

The challenges and strategies towards honesty differed somewhat. Compared to the focus groups, as discussed in Section 5.4.2, the relationship with the respondents differed. The researcher already knew the students from collaboration in the projects. Next to that, the dependence of the students and learners was not to the teachers, but to their managers (project leaders). On both issues, clarification of the roles (of the researchers and the respondents) and their dependence was provided to both the respondents and their managers. The collected data was only accessible to the researcher, and was anonymised. Beyond that, the managers expressed their openness for critical feedback. The respondents expressed not having felt uncomfortable in their interviews, and it was assumed that their honesty and openness was not considered an issue in terms of validity.

5.4.6. Document Analysis

Objective

Documents were used to analyse the teacher perspective on seams that they perceived their students to experience, and which they perceived relevant to work on. The documents were employed with regards to RQ3 in order to compare the student perspective on seams that they experienced in their learning, with those seams that their teachers perceived/assumed their students would likely experience.

Implementation

The teachers had thought about the seams and supporting measures that they wanted to work on prior to the start of the project. The teachers each proposed their ideas in order to attract funding. Therefore, the proposals represented the teachers' thoughts and arguments about the seams that they considered to be of relevance to work on, and presented a description of the actual 'problem' that they wanted to resolve through the project. After having gained approval, the project proceeded with the workshops. The focus of the first workshop was to analyse the 'problem' as described in the teachers' proposal. What was learnt from the workshops was recorded using templated documents, which will be referred to as 'documentation of Workshop 1'. Both the proposal and the documentation of Workshop 1 could be used in the document analysis.

Appropriateness

As previously mentioned, the documents represented the teachers' thoughts and arguments about the seams and supportive measures that they deemed relevant to work on. They could therefore be used to understand which seams and supportive measures are relevant from their perspectives. Also, the problem analysis took place prior to the explicit project involvement of the students (e.g., focus groups). The 'naturally emerged' data (in the context of the projects) could therefore be utilised in the current study without need for new data to be contrived.

Measurement conditions

Both documents were structured according to predefined templates, which helped to foster coherence between the documents arising from each different case.

Validity

The fact that the documents were produced by the teachers themselves, helped to increase the validity. However, the requirements for a proposal could also influence the way that the seams and supporting measures are then presented (e.g., alignment of an individual project with the targets of those providing the funding). The combination of the two documents, however, was assumed to counter this eventual problem.

Data

The aforementioned documents were available for all cases. As the data had been created already, it was able to be directly utilised in its original form.

5.4.7. Interviews with Teachers

Objective

With regards to RQ4, the project leaders (referred to as teachers in Case A, Case B, and Case C) were each interviewed on a one-to-one basis in order to capture their experiences with the involvement of the student perspective in the educational design processes.

Appropriateness

As the interviews with the teachers/project leaders shared the same objective and implementation as the interviews held with the participating students (or learners for Case D), the appropriateness for the interviews is as already referred to in Section 5.4.5.

Implementation

Table 11 provides an overview of the implemented interviews. The interviews were planned for the midpoint of the projects, as by then it was assumed that the teachers and project leaders would have gained a certain level of experience in terms of having involved the student perspective in their projects. All of the teachers and project leaders were interviewed, which meant that no problems with generalisability (within the study) existed. In total, six interviews took place, with an average duration of 1 hour.

Table 11: *Overview of Interviews with Teachers*

Case A	1 teacher: applied science university in Switzerland 1 teacher: applied science university in Germany (total 2)
Case B	1 teacher
Case C	2 teachers, co-teaching at same location
Case D	1 teacher

Measurement conditions and preliminary understanding

The measurement conditions (standardised interview guide; structure of the interview guide; organisation of the interviews) and the preliminary understanding for the interviews were the same as for the interviews held with the participating students. As referred to in Section 5.4.5, example questions (adapted with regards to the teacher/project leader perspective) are as follows¹⁶:

- How do you enquire your students' perspectives?
 - Which existing sources of information were used to reveal the students' perspectives (e.g., evaluations)?
 - Do you conduct additional concrete activities on your own to find out about the students' perspectives (active questioning within conversations, surveys,...)?
- How do you plan to incorporate the student perspective (the information collected) into the design process?
- Which conditions (could) influence which form of collaboration with the students you choose? (desirability vs. possibility)

Validity

Also with regards to the interviews with the teachers, suggestiveness was the biggest perceived issue regarding validity (see Section 5.4.5). The second potential issue is the relationship of the researcher with the teachers. The researcher already knew the students from collaboration within the projects. Therefore, clarification of the roles (of the researcher and the respondents) was implemented. The collected data was only accessible to the researcher and not shared within the seamless learning lab.

¹⁶ The questions are translated. For the questions in the original language see Appendix D.

Data

Like the focus groups held with the students, the interviews were audio recorded and then transcribed (see Section 5.4.1). In some cases, the interviews also included information about the seams. This data was used crosswise in addressing both RQ1 and RQ2.

5.4.8. Informal Data Strategies: Reflective Diary

Objectives

The objective of the reflective diary was to record and archive informal emerging data throughout the research process. Beyond that, the reflective diary was aimed to help to place (other) data directly within its context, and to reflect on the fit within the research practice (Maxwell, 2013). Due to the context-boundness of the research object, and the objective to enquire the phenomenon within its natural context, aspects of this context and the activities within the contexts were considered very important to capture (Fichten & Dreier, 2003; Maxwell, 2013). Therefore, next to the planned data collection strategies, a researcher diary with observations, perceptions, and memos was also maintained.

Appropriateness

Being part of the base project, there were numerous possibilities to observe and get to know the context well. Some situations that were valuable in the context of the current study, such as (informal) conversations held with the different project partners, were able to be captured the moment they emerged (unplanned). This made the reflective diary a useful instrument through which to capture emergent insights.

Implementation

Field notes were taken in both analogue and digital notebooks during the seamless learning projects, and also in and around the data collection processes of the current study.

Validity

The notes and memos which were developed in the researcher's diary have strong subjective and situated value. What is perceived to be relevant in a certain situation, is an (non-systematic) interpretation formed by the researcher. For this reason, the data held within the researcher diary was not selected for use as stand-alone data (Flick, 2011), but utilised as complementary to the formally collected data. The combined data was then used to improve the validity

of the strategies on a reciprocal basis. The validity of the researcher's diary itself was attempted by way of thick descriptions applied with critical reflection, as well as discussions and validity checks with other project partners (discussions as to whether or not similar perceptions were held).

Data

The field notes were both descriptive and reflective. The descriptive notes explained different aspects of the contexts and activities. The reflective notes described expectations, assumptions (in advance), and reflections (retrospective) of the context and (data collection) activities.

The notes were (partly) digitalised and uploaded as memos into MAXQDA. The memos were then categorised as follows:

- Personal notes which made explicit assumptions and expectations in advance (regarding situations such as workshops and interviews)
- Personal notes about the researcher's own perceptions of observed practices
- Relevant observations for validation of other data (e.g., confirming or contrasting observations)

5.4.9. Naturally Occurring Data and Contrived Contexts of Data Collection

As previously mentioned, some of the data was collected not only within the context of the current study for this dissertation, but also within the initial project structure. For instance, the focus groups and documents were planned in the project (beside the current study). In this regard, this part of the data occurred within its 'natural (project) context'. This way, participants could be better convinced that they would directly benefit from their participation (win-win situations). Lankshear and Knobel (2004) explained that it is more ecological to use data that already exists and is readily available, than to generate new data. This is because such data is not generated for the purpose or the study only, and may also enhance the authenticity of the collected data. Still, ecology was never the only consideration when collecting data for the current study. Especially with regards to RQ4 about the integration of the student perspective in educational design processes, where data needed to be collected separately. Although the questionnaire was also planned in the context of the project, specific questions were developed with regards to this topic. Also, the interviews were planned specifically for the current study.

5.4.10. Included and Excluded Data

This section details the demarcation of data excluded from the current study (Yin, 2017). During the project, there were different possible time points for data collection (see Section 5.3), which allowed for different kinds of data to be analysed in different ways. First, the initial situation could be enquired. However, evaluation data (i.e., taken after the implementation of interventions and supporting measures which were meant to foster cross-contextual learning) could also be used to answer the research question. Nevertheless, evaluation of the interventions and supportive measures are not the objective of the study; therefore, evaluation data was excluded. The intended focus was to enquire on the students' experiences from the initial standpoint. This start point was hence described using data collected at the beginning of the DBR process (within the conception and development phase). As the projects each started at different stages of development, the definition of the initial situation is situated accordingly.

In the context of the current study, TAP-data was collected as the latest point in the DBR process. At the point the TAP was implemented, the participant students had greater experience and richer insights into forming an opinion on the phenomenon of enquiry. The TAPs were analysed with regards to the research objective in order to describe the problems and supporting measures. As described, the data was used to gain insights into potential new emerging seams; therefore, the data was not used to evaluate the interventions and supporting measures themselves.

Missing data

Data was collected until a solid data basis was available to answer the research questions. From this perspective, overall, there were no incidents of missing data to be reported. However, not all data collection instruments could be implemented ideally, or the same across all cases. Some data was therefore not collected where an instrument was unable to be implemented because of circumstances in the field.

Sometimes, data needed to be collected, that was not considered to be the ideal kind of data. This, of course, can influence the quality of the data (also in combination with the response rate). However, the issues described here could be countered or their risks mitigated, for instance by using complementary and/or different data. The correlation between the different data types is addressed in the next section.

In summary, no data pertinent to any of the study's research questions was fully missing; however, the quantity and quality of data may influence the analysis, the cross-case comparison, and the interpretation. This issue is addressed in the discussion of the results and where deemed appropriate.

5.4.11. Correlation of Different Data Types

This section discusses the relation between the different kinds of data (combinations or contrasts) with regards to both the collection of the data and its subsequent analysis.

Focus groups and TAPs (RQ1 and RQ2)

Both the focus groups and the TAPs were utilised with regards to addressing RQ1 and RQ2. The TAPs were especially used as a means of validation for the problems and supporting measures that the students were expected to confront. Notably, some of the students were not situated within the enquired learning context at the point that the focus group took place. Therefore, in order to be able to compare their hypothesis with their real experience, the TAPs were used as *complementary* to the focus groups. The focus groups were, however, the primary instrument as they provide a richer form of data than the TAPs (e.g., more possibilities for deeper questioning; more time for implementation).

Problems and supporting measures from the teacher perspective (RQ3)

To analyse the teachers' perceptions of the problems and supporting measures that their students experience, the primary analyses were conducted by way of document analysis. However, in some of the teachers' interviews (which were actually implemented with regards to RQ4), relevant information with connected to RQ3 also arose. This data was then used as *complementary* to the document analysis, as well as for the purposes of comparison and validation.

Student participation from the student perspective (RQ4)

In Case A, Case B, and Case C, the students who participated in the courses were asked about their perception of their involvement in the course design using a questionnaire. However, this was not applicable for Case D, since no default course structure existed. In both Case C and Case D, students who had an active role as project team members were interviewed with regards to RQ4. In Case A and Case B, there were no students involved as project team members.

The data from the interviews is therefore from a different perspective than that collected from the questionnaires. Whilst the respondents for both instruments

were students, they had different roles; hence, their perspectives differed. Although the data was used with regards to the same research question, it was predominantly analysed *separately*. However, the two data types may have congruence in terms of the case comparison and interpretation.

Informal data strategies

As described in Section 5.4.8, the informal data was mainly used for the purposes of triangulation (as a validity check) and also in the data analysis. This approach helped to place the data within its context, which then aided interpretation of the data. Analysis of the data is addressed in the next section.

Overview

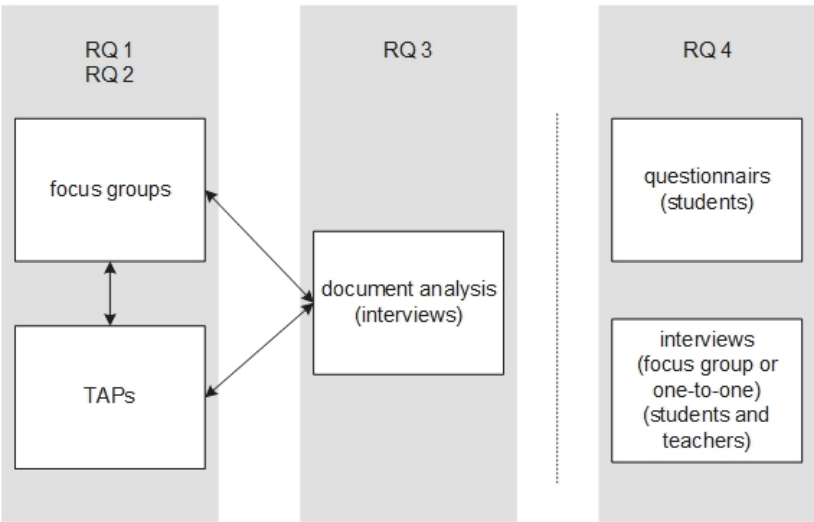


Figure 12: Overview of Overall Correlation of the Data

In summary, the combination of instruments led to a unique set of data in the current study (see Figure 12). The different perspectives from different time points offers a good grounding of the data for the analysis required to answer the research questions.

5.5. Data Analysis

Yin (2017) is renowned for publications that describe the implementation of case studies. Yin’s model of study includes five basic steps:

- Compiling
- Disassembling
- Reassembling
- Interpreting
- Concluding

Compiling, disassembling, reassembling

Compiling regards the determination of the database. It concerns the sorting and arrangement of the data, as well as identifying and assigning the relevant units for analysis. This is addressed in the previous sections (e.g., all data is (or has been transformed to) text data, evaluative data is excluded, etc.).

For disassembling and reassembling of the data, Kuckartz (2018) provided a procedure for qualitative text analysis, upon which the current study was developed. The procedure is visualised in Figure 13.

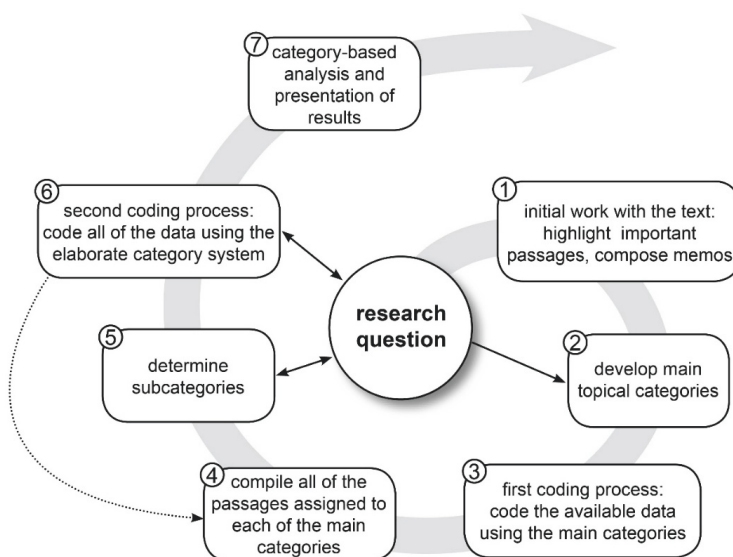


Figure 13: *Thematic Qualitative Text Analysis Process (Kuckartz, 2018)*

With regards to disassembling data (e.g., developing and defining a category system, assigning data to categories), Kuckartz (2018) as well as Schreier (2014) emphasised the importance of category development according to the material (Schreier, 2014). Compared to Mayring –who perceived qualitative content analysis essentially as a theory-based procedure– Kuckartz and Schreier both

accepted a more inductive approach, combined with a theory-based, deductive approach (Schreier, 2014). In the current study, a combination of deductive and inductive procedures (which interact with each other) was employed for coding (disassembling); the process of which is described in detail as follows.

Both the coding as well as the analysis were technology-supported, utilising the MAXQDA analytical software. First, the collected data was imported into the software (see Appendix F). Then, three codebooks were developed. The first codebook was used to categorise problems related to cross-contextual learning, whilst the second was for categorising the supporting measures, and the third codebook was developed to categorise student participation within educational design processes.

Problems with cross-contextual learning

The problems with cross-contextual learning were first coded deductively, along the MSL-dimensions of Wong and Looi (2011) (see Section 2.4). However, those dimensions were unable to cover all the data; leaving an often-used new (remaining) category that emerged. Next to that, the dimensions were not sufficiently detailed; hence, new dimensions were developed, and existing dimensions elaborated through use of subcategories. This revised approach made it possible to not only focus on seamlessness, but also on cross-contextuality in the broader sense.

The ‘remaining’ category was first coded according to the codebook of Hawelka (2016), which was originally developed as a system to analyse TAP data. The codebook focuses on hindering and supporting factors in learning processes, with hindering factors associated to problems and supporting factors used to code supporting measures (see next section). With regards to problems encountered with (cross-contextual) learning, Hawelka’s (2016) codebook first helped to categorise the large amount of codes that were left in the emergent ‘remaining’ category. However, Hawelka’s codebook did not include any specific focus on cross-contextual learning; therefore, the codebook was adapted in order to be able to distinguish between cross-contextual and non-cross-contextual problems. Based on the definition of cross-contextuality (see Section 2.4), the Hawelka categories were assigned as being either cross-contextual or non-cross-contextual. In a third round, the residual codes left in the remaining category were coded inductively if they concerned problems for cross-contextual learning. The most important changes are described in the following. Elaborations on the model of Wong and Looi (2011) are described in the theoretical reflection in Section 8.2.

As described, the most important change is that problems were described towards cross-contextual learning in general, rather than specifically regarding seamlessness. First, problems were also coded when students described a certain context as missing (e.g., an informal context, a social context, an application context). Added to the model of Wong and Looi (2011), who especially focussed on encompassing contexts and experiences (relatedness and integration), categories were developed so as to code students' having described missing context (aspects) that hindered their learning. Second, the different outcomes or consequences of the described problems were each coded. It was especially distinguished between problems with regards to continuity (as being the objective of seamlessness), understanding, and motivation. Third, requirements for cross-contextual learning were also coded. Students described, for example, lacking time or certain competences (e.g., self-discipline) to learn within certain or different contexts. Summarised, the codebook included the following:

- Problems with requirements for cross-contextual learning;
- Problems in the elaborated dimensions of Wong and Looi's (2011) model;
- Problems with missing contexts for learning; and,
- The influence of problems regarding continuity, understanding, and motivation.

A full list of the codes can be found in Appendix F. However, the full codebook (including descriptions of the categories, examples, descriptions of what is not coded in the category) can be found in MAXQDA (see Appendix F).

The codes were given only to statements with a clear expression of a problem or negative perception. This means that it was the students who determined what was a problem for them (i.e., it was their perception). 'Problems' which were proven to have a negative influence on learning processes or outcomes according to empirical evidence found in the literature, but which were not perceived as problematic (in the researched context) by the students of the current study, were not coded.

Supporting measures for cross-contextual learning

Initially, the supporting measures were also coded along the dimensions of Wong and Looi's (2011) model. However, because of the specific focus on cross-contextuality, an excessive amount of data would have been left uncoded from such an approach: Although, the current study had no focus on single-context problems, this is different with regards to the supporting measures, because they could be implemented in one context, and still have a positive influence on a cross-contextual problem (also supporting measures in a single context, can be supportive with regards to cross-contextual learning – see boundary objects,

persons, and activities in Section 3.5). That is why, as a second round, the codebook of Hawelka (2016) was used instead. This codebook allowed for a combination of both supporting measures ‘across contexts’, as well ‘within contexts’¹⁷.

The student perspective in educational design processes

The experiences of the students and the teachers toward the involvement of the student perspective within educational design processes was coded according to the developed interview guide. The interview guide was based upon the current literature (e.g., different ways and instruments to gain insight to the student perspective, different kinds of power) (see Section 4.4). Consequently, the codebook was also substantiated with theoretical perception.

Based on the understanding of disassembling and assembling data, according to Kuckartz (2018) and Schreier (2014), an iterative coding process was implemented that combined a deductive approach with a more inductive approach. With regards to the codebook, only a few small changes were applied¹⁸.

All codebooks

For all codebooks and for all categories, memos were written in order to explain what was coded (including explanations about what was not coded, plus example codes for each category). For all of the generated documentation (e.g., focus groups and TAPs to analyse cross-contextual learning problems; interviews to analyse the student perspective involvement within educational design processes), several rounds of coding and recoding took place (e.g., testing a codebook with pilot documents, followed by going back and forth until the codebook was considered to be of adequate stability prior to coding the documents). In the end, a crosscheck was performed on the code-level (i.e., a check of all codes within one category).

Interpreting and concluding

With regards to the analysis, Kuckartz (2018) proposed a model with six forms for analysis.

¹⁷ A full list of the codes can be found in Appendix F. However, the full codebook (including descriptions of the categories, examples, descriptions of what is not coded in the category) can be found in MAXQDA (see also Appendix F).

¹⁸ A full list of the codes can be found in Appendix F. However, the full codebook (including descriptions of the categories, examples, descriptions of what is not coded in the category) can be found in MAXQDA (see also Appendix F).

1. Category-based analysis of the main categories
2. Correlations of subcategories within a main category
3. Correlations between main categories
4. Cross-tables – qualitative and quantitative
5. Configurations of categories
6. Visualisations of correlations

In the current study, the main categories were analysed, the correlations between the subcategories as well as the main categories were considered, and the configurations of the categories were reflected upon. The analysis were described more detailed in the following sections.

Problems with and supporting measures for cross-contextual learning (RQ1 and RQ2)

First, it was considered if the main categories of each research question were present in each case. Using the coded material, each case was then examined using the support of visual tools (see Appendix F), which helped to provide an overview of the problems and supporting measures for each case; both for the student and the teacher perspective.

This approach enabled the identification of which problems and supportive measures plus how many codes were in each case. However, in the current study, the quantity of codes per category was not used to reflect the importance of the problems or supporting measures in terms of the cross-contextual learning scenarios. The assumption was that the extent of discussion about a certain problem (or supportive measure) did not automatically dictate that the problem (or supportive measure) was actually more important to the students. The importance was construed by the researcher through interpretation of the meaning that the students and teachers each expressed (e.g., based on the summaries provided at the end of each focus group and interview). This process was also supported through written memos.

After describing the problems and supporting measures within each of the cases, the categories (and therefore, the different problems and supporting measures) were deeply analysed on the case level. As a crosscheck that all relevant aspects were analysed, document portraits were employed (see Appendix F). Next to that, the problems were related with the supporting measures through interpretation of the relations that the students and teachers explicitly gave.

Comparison of the student and teacher perspective (RQ3)

The problems and supporting measures were categorised and coded the same way for both the student and the teacher perspective. This made it possible to perform data comparison using the MAXQDA software (see Appendix F). Comparisons were made as to which problems and supporting measures were shared, and which differed between the participant groups. Also, the relations between the problems and the supporting measures (as seen by the respondents) were compared to see if they saw the same type of supporting measures for the same problem.

As a side note with regards to the problems that the students and teachers described: In the proposal used for the database of the teachers' perspective, the teachers focused on certain problems instead of considering a full overview of the problems (compared to the student focus groups, where the objective was to capture all problems that the students experienced). Therefore, the documentation of Workshop 1 (problem analysis) deepened and broadened the researcher's view of the problems. Overall, these differences in the data must be considered when comparing the student and teacher perspectives. The broadness of the problems that the teachers identified might be explained according to the type of data. However, it was supposed that this does not state anything about the importance of the problems, because of the assumption that the teachers focused on the most relevant problems for their particular learning practices.

A second side note concerns the interpretation and overview; in that the numerous categories for supporting measures, according to Hawelka (2016), were aggregated to distinguish between boundary objects, persons, and activities. In the results, the supporting measures are presented in detail, and the most significant also included in the cross-case analysis. For further interpretation, however, the different types of supporting measures were often found to be more important than the singular supportive measures. In this case, the aggregated supporting measures were used.

The student perspective in educational design processes (RQ4)

The analysis approach with regards to RQ4 was the same as for both RQ1 and RQ2. First, it was considered what categories were present in each of the cases (through the support of visual tools), and both for the student perspective and the teacher perspective. After deep analysis of the categories (including the different aspects regarding the involvement of the student perspective in educational design processes), a crosscheck was applied to ensure that all relevant aspects were analysed by way of document portraits.

Cross-case analysis

After the analysis on a per-case basis, cross-case analysis was performed. With regards to the problems and supporting measures, comparisons identified which problems and supporting measures were present in more than one case (and thus not did not seem (only) context-bounded). These problems and supporting measures were then re-examined separately. With regards to the comparison of the student and teacher perspectives, it was analysed as to what extent the types of problems and supporting measures differed (compared across all cases). Next to that, it was analysed how the perspectives differed. With regards to the involvement of the student perspective in educational design processes, the experiences reported across the different cases were then compared. Here, the focus was both on the similarities and differences between the cases; comparing the evaluations that the different students and teachers had attributed to their experiences with the involvement (e.g., how was the student perspective involved in the design process and what can be learnt from positive (or negative) experiences in one or more cases compared to the experiences reported in other cases?).

Quality criteria for the data analysis

The analysis (e.g., the implementation of the codebooks) was not tested with other researchers (i.e., no interreliability tests took place). The data was coded by the same person within a short time period, which reduced the chances for variance in the interpretation and application of the codebook (on top of the thick description of the codebooks and categories themselves). Within the study, it was therefore assumed that coherence in the application of the codebooks was achieved¹⁹.

Next to that, the objective was not to analyse the data quantitatively, but only in qualitative form. From this perspective, it was decided that communicative validation (e.g., to attribute a certain saying to a certain category) with the respondents themselves was a more meaningful way to test how the codebooks (analysis) worked. However, with the students, communicative validation was difficult, as interpretation of the (students') perspective could only be tested by way of summarising and paraphrasing during the focus groups, interviews, and TAPs. However, with the teachers and projects leaders, an exchange based on the interpretations took place. Texts which described the interpretations, based on the categories, were shared, feedback provided, and then corrected where appropriate. This approach helped to increase the validity of the current study.

¹⁹ The overall research dependence forms part of the research understanding, as discussed in Section 5.1.

6. Results

In this chapter, the results of the current study are presented. For each case, the context is described. Then, the problems, supporting measures, and the ideas put forward for the involvement of the student perspective within educational design processes –as experienced by both teachers and students– are presented, complete with thick descriptions. For each case, the following aspects are described:

- Context description;
- The teachers' perspectives on problems and supporting measures for cross-contextual learning;
 - Based on the theory (see Sections 2.4, 3.4, 4.4) and the derived codebooks (see Section 5.5), with dimensions shown as *italicised* text.
- The students' perspectives on problems and supporting measures for cross-contextual learning;
 - Based on the theory (see Sections 2.4, 3.4, 4.4) and the derived codebooks (see Section 5.5), with dimensions shows as *italicised* text.
- Relations between problems and supporting measures are presented in tabular format at the end of the sections.
- Comparison and interpretation of both perspectives (students' and teachers');
- The students' perspective on the involvement of their perspective within educational design processes;
 - Based on the theory (see Section 4.4) and the derived codebook (see Section 5.5).
- The teachers' perspective on the involvement of the student perspective within educational design processes;
 - Based on the theory (see Section 4.4) and the derived codebook (see Section 5.5).

The presentation of results starts with the teachers' perspective (although the study' focus is the student perspective) because the case description, which is the project context as mainly defined by the teachers, relates closely to the problems and supporting measures that they themselves proposed. Thus, after a description of the context, the teachers' perceptions of problems experienced by their students (due to cross-contextual learning) are described. Next, the teachers' perception of recommended interventions and supportive measures is elaborated upon. The results in terms of the students' perspective are then reported in the same way. Afterwards, both sets of experiences according to the involve-

ment of the student perspective within educational design processes is described, and structured based on the following categories (as derived from the literature; see Section 4.4):

- Perception of the extent to which teachers know their students' perspective;
- Perception of the importance for teachers to know the student perspective;
- Forms and potential forms to gain insight about the student perspective;
- Actual and ideal timing of enquiring about the student perspective;
- Perception regarding implementing the student perspective within course designs;
- Conditions which influence the enquiry and implementation of the student perspective;
- The perception towards power and control to make decisions within educational design processes (students vs. teachers vs. shared);
 - Dimensions are shown as *italicised* text.
 - Side note: If a category is not mentioned within the descriptions, this dictates that no data exists for that category, for that case.

With regards to some of the descriptions, direct (albeit translated) quotes of the respondents are presented for the purpose of illustrating the descriptions. Mostly, these quotes were chosen because they offer a more concrete explanation of a situation or context, which thereby aids more in-depth understanding. In a few cases, the quotes add a degree of information that had not come to the fore after disassembling and reassembling the data, but was found during the subsequent crosschecking. Where relevant, these quotes are used as complementary example findings. In case of the quotes having been identified from the crosscheck, this is specifically mentioned.

In Section 6.5, the case comparison is presented. The results are presented according to the research questions:

- Students' perception of problems with cross-contextual learning
- Students' perception of supporting measures for cross-contextual learning
- Students' perception compared with teachers' perception
- The involvement of the student perspective in educational design processes

The discussion of the results (e.g., mirroring with the literature and rival explanations) is presented in Chapter 7. The implications are presented in Chapter 8.

6.1. Case A

Contextual information

Case A is a project that was led by a teacher from a university of applied sciences in Switzerland. The project includes two fields of implementation. The first field is the applied science university in Switzerland where the project leader is based. The teacher works at the School of Engineering and teaches mathematics to engineering students through a mathematics course which was also the subject of further development under the project. The second field of implementation is a university of applied science in Germany. The teacher is a professor at the Faculty of Informatics, and is the main project partner. The professor teaches mathematics to informatics' students. Together, the two teachers developed an intervention, complete with supporting measures, with the aim to improve cross-contextual learning in their respective mathematics courses.

At both locations, the mathematics courses are delivered to first-year undergraduate students, and include both lectures and exercises. Also, at both locations, maths is perceived to be a key competence area, since mathematics knowledge is fundamental to the other courses within the study programs on offer under the technology and informatics disciplines. Thus, the mathematics course is an obligatory requirement with regards to the more discipline-specific courses.

Cross-contextual matters

The contextual characteristics previously described point to the cross-contextual matters of each course. Being a first-year course, relations with the prior educational context needed to be considered. Some students had a background coming from vocational education (in German: BMS), whilst other students were on a high school (in German: Gymnasium). For some students their prior education was some time ago, whilst for others there was no discernible time between the two educational contexts. Some of the students had prior work experience too, whilst others did not. For some of the students, their transition into higher education felt discontinuous or disjointed.

Within the higher education institution setup, the main cross-contextual matters were noted as follows.

As described, mathematics is a course which develops key competences that are required also for other courses. Relations to those other courses therefore also have to be taken into consideration. In Case A, both parallel and future courses have a relationship to the mathematics course. However, most other courses

take place after the maths course, as maths knowledge is considered fundamental prior knowledge with regards to most other courses. This leads to a fragmentation of the learning context and the contexts where the key competences are going to be needed and applied (among others, the discipline-specific courses of the study programme). For students, this meant that the (experienceable) relevance is often hidden within other contexts that happen later on (time-lag). The teachers described that the students miss application-oriented examples, making some students question why they are studying maths with regards to the more discipline-specific study programme they have chosen. This obscured visibility of the relevance can negatively influence students' motivation. Also, it influences the tangibility of the learning content. Thus, students in their first year of study often lack application-oriented examples that support them in the transfer process of the analytical competences that they need to learn.

Cross-contextual objectives

In the context of the project, the teachers aimed to develop an intervention that enhanced the relatedness between mathematics courses and other relevant contexts. Through the developed intervention, they aimed to align these contexts with each other. By using the same learning object in different contexts (e.g., BMS, Gymnasium, other courses), these contexts might appear more similar to each other, which supports transitions between the contexts. For instance, this can happen because recognition and recall of prior knowledge becomes easier.

The intervention was aimed to be a boundary object that could connect to other contexts which show relevance at the moment that is not currently automatically experienceable for the student. This is why the intervention takes up a topic which is part of a (possible) future course, as well as from daily student life.

Cross-contextual intervention and supporting measures

In Case A, the intervention to be developed was a learning app in combination with (to the respective context adapted) tutorials (boundary objects). In the app, students can edit pictures: however, behind the process of editing pictures are certain mathematical principles, which the students need to learn through their mathematics course. The app allows students first insight into potential fields of application. Therewith, the app forms a bridge or connection to future courses, as well as a connection to some daily life topic. This then begins to add relevance for the students. Editing pictures can only be understood through an understanding of the mathematical principles upon which the editing is grounded. In this way, editing pictures makes the learning content become

more tangible, in effect. Next to that, a potential field of application can become more clearly visible; leading to increased motivation to learn the required principles.

Development of the intervention

The development of the app and the tutorials took place within the project. The 'default' process, as described in the methodology (see Section 5.3) was followed.

6.1.1. Teacher Perspective on Cross-contextual Learning

Problems

In Case A, the problems from the student perspective partly require distinguishing between the two locations, Switzerland and Germany. First, the problems which are similar to both locations are described. Where appropriate, the location-specific problems are also mentioned, with a note added where a problem was only described by students from one of the locations.

The teachers described two problems related to *cross-contextual learning across time* (MSL 3). In chronological order, the first problem emerges because of the gap between the prior educational context and the current educational context; in this case, the mathematics courses (MSL 3: *prior educational contexts/degrees*). The students previously attended various different types of educational institutions, and each therefore have a different mathematics background. The teachers each described that the transition to higher education can be more difficult or less difficult depending on the students' backgrounds. The teachers described, also, that for some students, this can be an emotional issue. Some students who are conscious about the gap between their prior educational context and the current course requirements, can be faced with fear and/or low self-efficacy. According to the teachers, fear can also be related to the image that the mathematics courses may have within the student community; namely, that mathematics is a course where first-year students get selected.

For some students, the transition to higher education as a context is also effectively a difficult one. The teaching and learning approach in the mathematics courses may well differ significantly from the approach taken at the students' former school (MSL 10: *multiple pedagogical or learning activity models and approaches*). For most students, the learning content is more theoretical and abstract (at the higher education level) when compared to the content they have familiarity with from their former schooling experience (MSL 9: *prior vs. new knowledge; theoretical vs. practical knowledge*).

Related to learning over time, the teachers also described gaps between their courses and future courses (*MSL 3: future courses/work*). The teachers at both locations described that most students do not manage to transfer what they have previously learnt (competences) to a new context. This was a problem that the teachers had understood from colleagues who taught courses situated later on in the course curriculum, and which build upon the key competences that should have been gained during the first-year mathematics course. The teachers heard that the retention of knowledge is considered to be low, and that students are unable to use the tools that they should have learnt previously (e.g., formulae and principles) in the latter discipline-specific courses. They seem not to be able to make the connection between the courses, and do not see which learning content they should be using in order to solve problems in the new context, although the contexts in fact are often very much related (*MSL 9: prior vs. new knowledge*).

Another problem regards cross-contextual learning with tasks at different complexity levels (*MSL 8: multiple learning tasks*). In the mathematics courses, the students are faced with the objective to understand the learning content introduced within the course (including deriving mathematical formulae and principles). Second, they need to be able to then apply this learning content. Third, they need to be able to evaluate which content relates to which mathematical problem (e.g., to evaluate which principle they need to apply in which exercise). In the case of the latter, they need to be able to analyse a problem, formulate the problem in a certain mathematical way, and then evaluate which principle they should apply in order to solve the problem. In the following quote, the teachers described the problem of students having to switch between educational levels and tasks:

The second seam manifests itself in the discipline-specific courses: students do not recognise a mathematical problem as such (for example: a linear system of equations, a differential equation or an eigenvalue problem). This means that there is obviously a lack of contextualisation: in mathematics [the maths course], there was too little emphasis on the context, but only on the solution of the problem. Therefore, the student is not able to apply the gained methodological competences in the new context. (Teachers, Case A; Documentation from Workshop 1, p. 10)

The teacher from the university of applied science in Germany mentioned noting a problem with the students' mathematical language skills. Mathematical language is required prior knowledge, but which is often not available at the moment when the students actually need it (*MSL 9: prior vs. new knowledge*).

The described problem become visible in (among others) a gap noted between the learning and assessment contexts (*MSL 10: learning vs. assessment contexts*). The teacher at the university of applied science in Switzerland described that it is possible for students to pass their exam without having established a deep understanding of the learning content. The teacher at the university in Germany described that it is difficult to align the learning and assessment contexts, explaining that in the exam, students especially need to be able to apply certain mathematical principles. However, in order to really understand such principles, the students need to fundamentally understand how such principles are constructed, and how to derive them. This is something that the teacher in the German university practiced with students in the mathematics course, even though it does not form part of the course exam. According to the teachers, this can have a problematic influence on the students' motivation, both for the maths course, and also on their level of general understanding.

The teachers described that some students find maths as a subject to be somewhat boring, and that the learning content is perceived as being 'dry'. The teachers described that students are not always motivated to work hard on the course, although that is the only conceivable way to digest the learning content to a deeper level (through exercising and automatisisation). As described in the case description (see Section 6.1), prior exposure to application-oriented examples (or even an authentic application context) is missing for many of the students. The teachers described the fragmentation seen between the students' learning and (potential) application contexts as a problem (*MSL 1: formal and informal learning*). Students do not automatically relate the learning content to phenomena in daily life, which could help to make learning the required course content more concrete. They are also unable to relate the theory back to authentic real-world problems, as they will largely be taught in future courses (*MSL 3: future courses/work*), making it significantly difficult for students to experience relevance and meaning at the time of receiving the course (*outcome: motivation*).

Supporting measures

The teachers see the app and the tutorials as a solution for the combination of problems previously described. The app is meant to be implemented in different educational contexts, so that the app stimulates continuity between the different educational contexts, based on the recognition of learning content across contexts. This process is meant to stimulate transfer and retention, and was put forward as a suggested supporting measure to the problems with prior and future learning contexts (*MSL 3: learning across time*).

In the app, students can edit pictures; providing, that is, they understand the mathematical principles behind the editing process. It is these principles that the students need to learn from their maths courses. The aim being here that, through the app, practical relevance becomes clearer to the students as users. The topic of the app relates the mathematical principles to action-related phenomena used in daily life (*MSL 1: formal and informal learning*), to a possible future course interest, and a potential professional field of application (*MSL 3: future courses/work*). This offers a solution to both the relation between the actual, prior, and future learning contexts (*MSL 3: learning across time*), and also the missing experience of relevance for the student (*outcome: motivation*).

Also, the app functions as a comprehensible and attractive presentation of the learning content that fosters both understanding and motivation. From the perspective of the teaching and learning approach, the app may foster more experimental and interactive learning (doing), which has been described as one of the problems experienced (work hard, exercise, automatisisation) (*MSL 10: multiple pedagogical or learning activity models and approaches*). Next to that, peer learning was described as an argument for the app; an argument not directly related to problems specific to the course, although it could be a positive effect of the app, which takes its potential beyond the identified problems.

6.1.2. Student Perspective on Cross-contextual Learning

Problems

Central to both locations was the difficulty to move from a theoretical understanding of the learning content to application of the learning content (in exercises, but also in future courses, where maths is the key competence) (*MSL 8: learning tasks; MSL 3: future courses/work*). Students described a gap between instruction-based contexts and the contexts where they started applying and undertaking exercises using mathematical formulae (*MSL 10: multiple pedagogical or learning activity models and approaches*).

I find it difficult too, to do an exercise/solve a problem for the first time (after the instruction). However, I actually only learn this way, by applying. (Student, Case A; Switzerland; Focus Group 2; Line 80; #00:16:00-2#)

Students stated it not being easy to start applying and exercising with formulae for the first time. They described a situation whereby the teacher had finished their instruction (e.g., demonstrating using a blackboard, collectively (teacher and students) solving an exercise), and then said that the students should undertake an exercise individually next. They described this moment as challenging, especially when there is a time-lag between receiving specific instruction

and the possibility to undertake such a follow-up exercise (*MSL 3: learning across time*). However, the students know well that exercises are the only way to gain real understanding. This was especially true at the university of applied science located in Germany, where students emphasised that undertaking a significant amount of exercises and practice was the only way to go.

The students in Germany described that it was a barrier, if they did not manage to complete the exercises during the courses and need to take them home to be completed (*MSL 4: learning across locations*). It is perceived as a hurdle to restart the exercise once they are back home, due to the level of required self-discipline (*requirement: competences*).

One student (at the university in Switzerland) described needing more time to write down the steps before starting the exercises. Overall, most students described that having time for in-depth digestion of a topic is often lacking (*requirement: time*). Both in the lectures (e.g., following steps that the teacher demonstrates on how to derive a formula) as in self-study situations. However, for some students, this was not considered to be a problem, arguing that time constraints would be a fact of life in the professional field as well; perceiving time-based challenges as good preparation for the future.

When the students overcame the first hurdle in attempting the first exercise, they described experiencing problems with application and synthesising (*MSL 8: multiple learning tasks*). They described that they did not always understand which formula they should use in which situation; and for which mathematical problem. Especially, when a number of formulae need to be integrated, this was seen as a hurdle, and described as difficult to find a point at which to start.

At the applied science university located in Switzerland, the students experienced a gap between the learning context and the assessment context (*MSL 10: learning vs. assessment contexts*). In the learning context, the theory was first presented and explained, and then afterwards the exercises took place. The lectures and exercises were adapted to each other. This was considered positive, because it helped the students to apply exactly what had been explained to them. As described, applying was their way to reach a certain level of understanding; however, with this method, the students do not need to evaluate the fit between the exercise and the theory it was based upon. In the exams, however, this was one of the main struggles that the students experienced. They described it being difficult to formulate mathematical problems and not knowing which formulae to use in order to solve a problem. They described the exercises as being perceived to be easier when compared to the exam, which makes it difficult to estimate if they were adequately prepared for their exams.

Well, I find that in the exams, there are, umm, a few formulae linked together in an exercise. That is more difficult. You have to recognise exactly where you have to use what, and how. That is partly more difficult than in the exercises, because in the exercises you have one topic and you just do that one only. (Student, Case A; Switzerland; Focus Group 1; Line 167; #00:38:43-4)

One student in the focus groups, who was already further on in their study programme and could therefore evaluate the course retrospectively, recognised this problem as well. Beyond that, this student described having forgotten the exact means of application by the time those same competences were needed in future courses (*MSL 3: future courses/work*). The student described that after the exam, having forgotten the learning content again (and also having wanted to forget!). Afterwards, even the slightest variations on what was learnt can make any relation to new learning content unrecognisable (*MSL 9: prior vs. new knowledge*).

A few of the students described that they sometimes questioned why they needed such in-depth mathematics theory (*outcome: motivation*). However, most of the students were intrinsically interested in the subject of mathematics.

At the applied science university located in Germany, the students emphasised that mathematics was a course that was effectively given in service of other, future courses. This was why they sometimes questioned the balance between the depth and breadth of the treatment of the learning content. They described that they had not chosen the study programme in order to become experts in maths (*outcome: motivation*).

The student who was more advanced in their studies described the problem of students –at the time of taking the course– not realising how important and relevant the learning content would be with regards to their future courses (*MSL 3: future courses/work*). The student also explained that such an understanding could increase their motivation and significantly help their study strategies (*outcome: motivation*). In the focus group, the student described having had the feeling: ‘if only I had known’.

Solutions and supporting factors

With regards to the seam between understanding and application (*MSL 8: multiple learning tasks; MSL 10: multiple pedagogical or learning activity models and approaches*), the students described that applying and exercising is helpful in order to attain the prescribed learning objectives. As a supporting factor within this process, the students described having pre-planned hours for undertaking academic exercises within their time schedule, because during these hours, a

teacher was available to answer their questions (at the applied science university located in Switzerland, they emphasised that one could ask literally anything –even the most basic questions– without any feeling of being ashamed). Next to that, the practice supported problem solving with self-discipline (*required: competences; MSL 4: learning across locations*). The students of the applied science university in Switzerland described that the learning materials helped them to overcome this (potential) gap. They described that the actual way of presenting the solution within an exercise was considered as being good, because they were able to show in detail how their solution was derived. Next to that, practical examples helped to make the learning content both more tangible and understandable.

Although the students did not describe their lack of relevant experience as a significant problem, they articulated that other measures helped to make visible this notion of relevance (*outcome: motivation*). The students described that they cognitively knew that they would need the knowledge and competences in their future courses. They trusted the teacher in this regard. Also, for the students who were studying in Switzerland, intrinsic motivation was seen as the reason that this issue was not perceived as having been problematic. Thus, especially at the applied science university in Switzerland, the students considered maths itself to be interesting, which compensated for the missing practical relevance of the course they experienced at that moment. The teachers' good examples also supported this. At the applied science university in Germany, practical examples were seen as the most valuable contribution of the instruction-based learning setting.

Some of the students described that the solid preparation from their prior educational institution had supported their transition into higher education. The more that they had learnt at their former school, the easier their entry to university had been. This influenced how difficult the learning content in their new (actual mathematics) course was perceived (*MSL 3: prior educational contexts/degrees; MSL 9: prior vs. new knowledge*). Those students who had not been in the situation of having received good preparation from BMS or Gymnasium significantly appreciated when the teacher provided a refresher of all the learning content required to understand the upcoming learning content. This also had the effect of allaying some of their fears and low self-efficacy. The students attending the applied science university in Germany described that the refresher course would have been helpful if delivered at the right time. This was not the case at that time. Overall, the students described that good explanations from their teachers helped them to catch up and to tackle many mathematical problems.

With regard to the differences between the learning and the assessment context (*MSL 10: learning vs. assessment contexts*), the practice of having taken mock exams was described as a good learning strategy. The students described that they did not want the exams to be easier, but have better practice in the learning context.

Independent of the described problems, at the applied science university in Germany, peer learning was described as a supporting factor.

The app itself seemed to be an idea welcomed by the students, assuming that it was appropriately implemented. The students emphasised that the focus needed to be on problem solving, and also the traceability of solutions. The students desired more practices and exercises, and the app could present a solution in this regard.

Overview

Table 12: *Overview and Relationships between Problems and Supporting Measures from the Student Perspective in Case A*

<i>Problems (student perspective)</i>	<i>Supporting measures (student perspective)</i>
MSL 10: multiple pedagogical or learning activity models and approaches MSL 8: multiple learning tasks (transition between contexts and tasks: understanding (instruction) vs. applying (exercising) vs. evaluation) MSL 3: learning across time (just-in-time exercising)	- (Scheduled time for) application and exercises - Teacher availability - Learning resources: detailed description of the approach to solve a problem - (The idea of the app could be working, required that the focus and implementation are on problem solving and traceability of solutions)
MSL 4: learning across location Requirement: competences (lack of self-discipline for self-study at home)	- (Scheduled time for) application and exercising
Requirement: time (lack of time for deep learning)	- More exercises
MSL 10: learning vs. assessment contexts (differences between requirements in exercises for learning and assessment; more difficult exams)	- Adaption of learning context to assessment context (not changing the assessment setting) - Examining mock exams (applied science university in Germany)

MSL 3: future courses/work (low retention of competences to future courses) MSL 9: prior vs. new knowledge (lack of prior knowledge retention hinders learning in other courses)	/
Outcome: motivation: Missing visibility of relevance for future (discipline-specific professional fields and future courses) abstract knowledge (low problem experience)	- Practical examples (for understanding and tangibility) - Knowledge that learning content will become important and relevant (meta-communication) - Intrinsic motivation for maths (applied science university in Switzerland)
MSL 3: prior educational contexts/degrees - Different learning approaches - Prior knowledge - Fears and low self-efficacy (low problem experience: problem introduced by the teacher)	- Solid preparation from prior educational institution - Refreshing learning content required to understand upcoming learning content (teacher departing from the start, so that no prior knowledge is required)
	<i>Other supporting measures (not related to specific problems)</i> - Good explanations of learning content - Peer learning (applied science university in Germany)

Table 13: *Overview and Relationships between Problems and Supporting Measures from the Teacher Perspective in Case A*

<i>Problems (teacher perspective)</i>	<i>Intervention and supporting measures (teacher perspective)</i>
	<i>App & Tutorials</i> <i>Learning approach (experimental, interactive)</i>
MSL 3: prior educational context/degrees (difficult transition to actual context) - Fear and low self-efficacy caused by expected or experienced gap between prior educational context and actual context - Different pedagogical approaches in both contexts (MSL 10: multiple pedagogical or learning activity models and approaches) MSL 9: prior vs. new knowledge	Continuity because of the use of app and tutorials across different learning contexts (at different levels)

MSL 9: theoretical vs. practical knowledge (different kinds of (fragments of) knowledge)	
MSL 3: future courses/work (gaps between actual course and other courses) - Retention of knowledge and competences MSL 9: prior vs. new knowledge (missing retention of prior knowledge hinders learning in other courses)	- Continuity because of the use of app and tutorials across different learning contexts (at different levels) - Comprehensible and stimulating presentation of learning content through the app
MSL 8: multiple learning tasks (gaps between tasks on different levels such as understanding, applying, and evaluating) MSL 9: prior vs. new knowledge (missing prior knowledge: mathematical language skills)	- Making visible relations between mathematical principles and their application through the app and tutorials
MSL 10: learning vs. assessment contexts (missing alignment between learning context and assessment context which influences both understanding and motivation) MSL 9: theoretical knowledge (understanding and derivation) vs. practical knowledge (application)	/
Motivation - Invisibility of relevance due to fragmentation of learning context and authentic contexts (e.g., missing access or connections with contexts for application in daily life or the future (courses or professional field)) - Lack of willingness to work hard, exercise	- Making visible relations between mathematical principles and action-related phenomena used in daily life, to a possible future course interest, and a potential professional field of application (through the app) - Comprehensible and stimulating presentation of learning content through app - Learning approach (experimental and interactive)
	<i>Other supporting measures (not related to specific problems)</i> (Increasing) peer learning

6.1.3. Comparison and Interpretation of the Student and Teacher Perspectives

When comparing the student and teacher perspectives, the most remarkable finding is that the teachers assumed there to be more problems than the students

actually reported having experienced (*problems in more dimensions than perceived by the students*). In essence, the teachers work to resolve the problems, so that their students may not perceive them as being problems.

This might be explained by the actual measures taken by the teachers to help students to catch up, and thereby mitigate potential problems in the course. From the teachers' perspective, the most important problem was the missing connection between contexts that provide visible relevance for the students (in terms of motivation). The students, however, talked about intrinsic motivation. Next to that, the teachers helped their students by providing concrete examples as well as references to courses and situations where the students will later need to apply the theory being learnt. Thus, although the students may not be able to directly experience the relevance, they were cognitively able to appreciate that mathematics was a requirement in order to be able to understand other learning—more discipline-specific—content, then or in the future.

This does not mean that it is not necessary to work on the topic as proposed by the teachers. One former student described that it would have been motivating to have been (even) more conscious about how important the learning content would be in the future. Next to that, the teachers might be better in estimating how the visibility of relevance can make learning content more tangible for their students; not for the reason of student motivation, but with regards to their understanding and application of the learning content, which was a problem described by the students. However, this would mean that the objectives with the intervention and supporting measures would need to be changed.

The second problem perceived differently by the teachers and students was the transition from prior educational institution to higher education. The students recognised the difficulties which were noted by the teachers (heterogeneity between students); however, they did not perceive their experience as having been negative. The students attending the applied science university in Germany described that the refresher course would have been helpful if delivered at the right time. At the applied science university located in Switzerland, the students did not describe problems regarding this transition. Whilst they did not say that it was easy, they had felt supported during the transition. The teachers' strategy to refresh everything that was deemed necessary, and at the right time, made the transition workable for all concerned, and no negative connotations were expressed in this regard.

With regards to the seam between understanding, application, and evaluation, there was no discrepancy found between the students' and teachers' perspectives. However, the importance of the problem was described somewhat differently; especially with regards to the perception of supporting measures (*different*

valuing of problem-dimensions and supporting measures). The teachers focused on the visibility of relevance as the means to countering this problem (with the app), whilst the students focus was on exercises and learning resources (e.g., good documentation on how to approach a mathematical problem). For the students, this problem was seen as their highest priority, whilst for the teachers it was one of the problems that could be supported by the application. The tutorials that support the app were less of a focus for the teachers, although the students would emphasise their importance (if one transfers the supporting measures they experience to the intervention).

The app itself seemed to be an idea welcomed by the students, assuming that it was appropriately implemented. However, they also discussed solutions other than the app, such as mock exams. This was perceived as a means to help with regards to the constructive alignment of the learning setting and the assessment setting, which was described by the students as being problematic.

It was interpreted that the teachers partly focused on and valued the significance of problems and supporting measures differently from their students. They recognised the need for more supporting measures than implemented at that time, and were inclined to further build upon them. Newly developed supporting measures could be adapted more with regards to the problems that the students prioritised. Whilst the teachers had not ignored the problems, because of the integrative character of the intervention, their focus had been on different problems that may have shifted the focus away from the key problems, as they were perceived and described by the students.

6.1.4. Involvement of the Student Perspective in Educational Design Processes

The student perspective

For Case A, the database with regards to RQ4 consists of the complementary questions that the students answered from the post-course questionnaire. Not all of the subcategories were answered to the same depth, and there was no data for the question on how important students perceived their influence on the course design, how their feedback was taken up in the course design, and which factors determined this involvement; neither in the actual situation, nor in a desired situation.

Students' perception of involvement

Due to the limited data connected to this research question, the importance for the involvement in or influence on course design could only be derived from

the question regarding the extent to which students could influence the course design. Half of the students from the applied science university in Switzerland perceived that they had some significant influence, whilst the other half perceived their influence as being 'little'. Notably, none of the students stated 'excessive' or 'too little'.

At the applied science university in Germany, the greater majority of the students evaluated their influences as 'little', whilst only two students stated 'substantial', and two students perceived having had 'too little' influence.

Form and potential forms

At the applied science university in Switzerland, the students recognised different opportunities to influence the course design. In their answers regarding in what form students had influence on the course design, the students especially described ad hoc, in-class possibilities. For instance, they described having had the room and freedom to ask questions to the teachers. Next to that, they described the situation where the teacher introduced the next steps, asked if the students agreed with the procedure, and if they were ready to move on to the next steps.

One student also described that the students could have an influence by helping each other. Another singular answer given was regarding the questionnaires which were implemented during the course.

To the closed question on how students experienced or would like certain forms of involvement, the students answered with a clear preference for direct conversations to be held with the teacher. The students evaluated the other forms (questionnaires applied pre-post and TAPs) as heterogeneous. Approximately half of the students evaluated these forms as being appropriate, whilst the other half disagreed. Notably, the option of oral interview using an external moderator was rated as appropriate by the least number of students. Questionnaires applied post-course were found to be rated higher than questionnaires applied before the course start.

At the applied science university located in Germany, the option of a questionnaire applied before the course was also rated negatively by the students. However, when compared to those studying in Switzerland, the students from Germany rated the application of a questionnaire at the end of the course to be the most appropriate form. They ranked informal conversations, pre-test, and focus group (held before the start of a course) as being less appropriate (in that order).

The students at the university in Germany recognised the questionnaires as being the most practicable and feasible way that they could influence the course

design. Additionally, some of the students mentioned time slots, which they could design/arrange themselves, whereby they could work individually or collaboratively on the learning content. Additionally, a few of the students explicitly stated having not seen any possibilities to influence the course design.

Timing

One of the students argued that a pre-test would be too early, believing that they did not have adequate experience and did not know what to expect. As previously described, the students appeared to prefer forms that are more continuously applied. At the applied science university in Germany, the options to influence a course in advance were also rated negatively by the students.

Teacher perspective

Prior to questioning the teachers about their experiences towards the involvement of the student perspective, the teachers were asked to what extent they believed that they understood the students' perspective. In Case A, the teachers estimated that they knew the perception of their students well. They recognised small discrepancies, and no fundamental differences between their perception and that of their students. However, one of the teachers described sometimes being surprised by their students, hence continual checking was considered to be important in order reduce discrepancies.

Importance

Especially the teacher who worked at the applied science university in Switzerland described it being very important to know what is in the heads of the students. The teacher liked to consider what was in the students' minds and saw this as a requirement for gut/adaptive/appropriate teaching. For the teacher from the applied science university in Germany, the same question was not explicitly discussed. However, during the process of communicative validation, the teacher from the university in Germany confirmed sharing the same vision.

Forms and potential forms

Both of the teachers described that they learnt the most from observations undertaken during their actual teaching hours. Second, they described informal conversations held with their students as a source of information about their students' perceptions. For instance, talking with the students during the class breaks. The teacher from the German university described working together with the tutors as a third method, as the tutors ensure that a certain bottom-up flow of information occurs. Last, the teacher from the university in Switzerland

stated sometimes implementing smaller feedback methods such as minute papers in order to gain insight into the students' perspective.

The teachers also discussed alternative existing forms which are not currently implemented, or others that could potentially be applied to enquire about the student perspective. One of the questions asked concerned what the teachers thought about student cooperation in the workshops, or as project team members. The teacher from the applied science university in Switzerland explained being open to try, but had not (at that time) been convinced by the idea. The same teacher questioned if students would want this with regards to time and motivation. Next to that, the teacher questioned what the return on investment could potentially be, considering the belief that they already actually had knowledge of and were able to represent the student perspective themselves.

Timing

Both of the teachers were convinced that continuous interaction with their students was important so as to understand them as well as possible. They also mentioned that most sporadically applied methods such as questionnaires were no longer implemented, because it did not provide them with any additional insight into what they gained from continuous interaction with their students.

Integration and implementation

On the question as to what the teachers did with the information they gained about their students' perceptions, the teachers said that they mostly tried to continually adapt their teaching. When they found information about how their students learnt and what materials they use, then as teachers they considered this (learning strategies) within the conception of their teaching plans. Both of the teachers also described sometimes consciously not taking up their students' wishes and/or preferences. For instance, when they argued that another way was didactically more reasonable with regards to the prescribed learning outcomes. However, the teacher from the applied science university in Germany added that this would be the case only rarely.

Conditions

The condition that influenced mostly to what extent the teachers enquired about the student perspective was the group size. The higher the number of students, the more difficult it was to gain insight for (all) their students' perceptions, and then to be able to consider what they raised.

Power and control

Related to the option to involve students within the project, the students' power and control in terms of the educational designs was discussed. Both of the teachers shared the opinion that the teacher should remain the person in charge and responsible for making decisions. Some students would be too much led by the fact that they do not want to give too much effort. They could also be very tactical in this regard, which would generally not be good for the achievement of the specified learning outcomes.

Next to that, the teacher from the university in Switzerland described higher education institutions having a certain responsibility which they needed to fulfil. More than one group of interests needs to be considered in the educational designing of a course.

The teacher from the applied science university in Germany also pointed out the self-responsibility of all students in order for them to make the most out of their educational studies.

Complementary vignette

Well, they [the higher education institution] underestimate what they [students] really think; they are much more reflective than one may have thought. So, I usually get really good feedback from students who say exactly what they think, who have exact ideas. When they have finished, when they finished, or when I meet them again after a year: At the end of the semester, always a special week, then you get to meet your former students. That's also a time when you get to receive feedback, and to talk with the students. It is then that I hear that they have really concrete ideas, about how this and that should be different. That it would then be even better; that the study programme would be even better. Or some might even say, "I wouldn't study that anymore of course. I would study this and that differently", or something like that. Yes, and I believe this is all a bit underestimated; there is far too little, even now in the new planning, known about the students; the student's perception really is not considered adequately enough. I don't mean to say that... it is the lecturer and the study programme developer should decide what is done, but just that the student perception is not being taken into account enough. (Teacher, Case A; Switzerland; Interview; Line 163; 00:59:08-8#)

6.1.5. Interpretation of the Involvement of Student Perspective

As described in Section 5.5, the interpretation of the student perspective as to the involvement of the student perspective in educational design processes has

to be interpreted carefully, because the data captured was limited (low response rate, no possibility to ask further questions and motives). Based on the actual data collected, the students do not actually demand greater influence on the design of the course. They appreciate the actual ad hoc conversations held with their teachers as a form of their having a degree of influence. At the applied science university in Germany, the students also found questionnaires applied at the end of a course to be a good way for them to influence the course design.

The teachers believe that they already know the perspective of the student well, and describe this to be important to them. They attribute this to the continuous and personal interaction that they maintain with their students (in-class observations and informal conversations). The teachers therefore then adapt their teaching to the student perspective on a continuous basis. However, they reportedly found it important to reflect upon the students' perspective first.

Overall, the actual forms of collaboration between the students and their teachers seems to be positively experienced by both the students (although somewhat heterogeneously) and the teachers. There does not seem to be significant demand to change the (kind of) involvement of the student perspective, other than that which already actually takes place, although students had heterogeneous preferences for the forms and potential forms for enquiry of their perspective.

6.2. Case B

Contextual information

Case B is a project led by a professor at an applied sciences university located in Switzerland. The professor is employed at the School of Engineering, lectures in physics, and is involved in academic research projects. One of the physics courses taught was selected to be further developed in the project. Together with several project partners, the teacher developed an intervention aimed at improving cross-contextual learning through the course. The focus of the course is about 'fields and waves', and is an advanced physics topic that takes place later on in the study programme. The course includes both lectures and exercises.

Cross-contextual matters

The advanced physics topic of the course is considered both difficult to teach and to learn. The learning content is abstract, and therefore a high capability for abstraction is required from the course students in order to understand the theory. It is difficult to make the theory on this type of course either concrete or tangible. According to the teacher, problems in the learning processes emerge because students have difficulties connecting the concepts to the contexts in which such theory can be applied and is therefore visible. The students are mostly unable to relate the concepts to relevant daily life or their (mostly limited) professional experience.

An instruction-based approach to teaching the course topic requires a considerable level of prior knowledge. It is also the reason why the subject is placed later on in the study programme (in the second year of a 3-year study programme). The topic is considered to be very new and different at the point at which the students initially start the course. This led to a seam forming between the prior physics (and mathematics) courses and the actual physics course included in the current study.

Being an advanced-level course, relations with the future professional field (of application), as well as with prior educational contexts (e.g., other courses at the applied science university which teach the necessary prior knowledge) have to be considered.

Cross-contextual objectives

The intervention aims to connect experiential learning methods with instruction-based methods. The intervention aims to transfer daily life phenomena as

well as fields of application from the future professional context into the classroom. This approach uses contexts wherein the learning content is used in a more concrete way within the classroom context, with the aim being that the relevance of the abstract theory becomes more visible. In doing this, it is expected to help increase students' motivation on the one side, and as a strategy to make the theory more concrete from the other.

In the context of the project, the teacher aimed to develop an intervention that made the topic accessible in a more experiential, experimental, and playful way. The teacher thereby aimed to make the topic more accessible earlier in the study programme (without prior knowledge), and to reach more potential contexts. Beyond that, the aim was to connect the contexts over time. By using the same learning object within different contexts, it was hoped that the contexts may start to appear more similar to each other over time, which supports recognition and the relating of the contexts.

Cross-contextual intervention and supporting measures

In Case B, the intervention to be developed involved the integration of software that could simulate phenomena from daily life, examples, and tasks from professional contexts (boundary object). Both within classes and in future jobs, it is not always possible to create a fully authentic learning context, or to conduct real experiments (e.g., to test fields and waves). Simulations are therefore used as a way to make calculations and their outcomes more visible and tangible under restricted circumstances. Using the software, students can play and experiment. The simulations are aimed to connect abstract learning content (calculations) with authentic tasks (e.g., experiments), which are not otherwise implementable within a classroom context.

In addition, simulation is the preferred means of working within professional contexts. Thus, it is an example of an application of the theory as it may likely be in the students' future professional contexts as well. Therefore, this supports the students' transition into the professional field.

Development of the intervention

The development of the software and its integration within the course took place within the project. The 'default' process followed was as described in Section 5.3.

6.2.1. Teacher Perspective on Cross-contextual Learning

Problems

The teacher described the key problem faced in the physics course as being the link missing between the classroom-based learning and the students' everyday life. The teacher went on to explain that the learning content would become more tangible for the students, if they could make connections between the formal learning context (in-class) and phenomena which builds upon the theories and concepts observable in daily life (informal learning). The teacher described the gap as being between formal and informal learning (*MSL 1: formal and informal learning*). According to the teacher, students are unable to see the relevance of the learning content, and this negatively influences their motivation (*outcome: motivation*) as well as comprehensiveness. The teacher described that the integration of theoretical and practical knowledge is the missing element, and which is problematic for students trying to gain the required deeper level of understanding (*MSL 9: theoretical vs. practical knowledge*).

As previously described, the teacher found it problematic that the topic of 'fields and waves' only takes place later on in the study programme, and described it as an opportunity missed as the topic is assumed to be very relevant for future professional contexts (*MSL 3: prior educational contexts/degrees*). The absence of the topic in prior educational contexts compared to future contexts the students will later move on to, points to problematic continuity between the contexts (*MSL 3: learning across time*). Overall, the teacher described how students spend too little time exploring the topic, even though the topic is of significant relevance to their intended professional field (*requirement: time*).

Last, the teacher described the potential for the application of digital tools, and noted finding it problematic that such potential was not yet applied within the actual curriculum (*MSL 6: physical and digital learning*).

Solutions and supporting factors

From the teacher perspective, a number of suggestions for improvement could be taken up together to solve the described problems. The teacher especially saw another learning approach with alternative didactical concepts and media as an integrative solution. As described, the teacher argued that the integration of simulations would allow for more playful and experiential learning. With regards to the identified motivational problems (*outcome: motivation*), the predicted positive side effects of simulation integration would be higher learner self-efficacy and increased peer learning.

Beyond motivational improvements, simulation would also allow for a more comprehensible means of presenting learning content, including the use of the senses of sight, hearing, and touch (through haptic technologies). Simulation would allow for more examples and present relevance to the professional fields where the application of theory and concepts becomes concrete (*MSL 9: theoretical vs. practical knowledge*). This makes the learning content more tangible and understandable. As a didactical method, simulations help to integrate the worlds of digital and analogue learning (*MSL 6: physical and digital learning*).

Using simulation as in the future professional field allows for continuity between the educational and professional contexts (*MSL 3: learning across time*). Next to that, the suggested learning approach allows for implementation within a prior learning context, which also would positively influence continuity between prior courses and the actual physics course (*MSL 3: prior educational contexts/degrees*).

6.2.2. Student Perspective on Cross-contextual Learning

Problems

The first and main problem, according to the students, was that they found the learning content to be highly complex. With regards to cross-contextual matters, they considered it to be more complex compared to the content of their prior courses, which they described as being more tangible and concrete (*MSL 9: theoretical vs. practical knowledge*). This was perceived by the students to have made it hard for them to build upon their prior knowledge, and to link their new knowledge back to their prior knowledge. The learning content was not seen to fit, as if from two different worlds (*MSL 9: prior vs. new knowledge; MSL 3: prior educational contexts/degrees*). Two of the students discussed this problem as follows:

What I find difficult in this subject is the intangibility. If there are any electrons, probabilities where they appear, they could be there in the room, but you only know when you look where they really are, but then they could be somewhere else as well. I still find the intangibility of the learning content difficult to understand what it means at all. (Student 1, Case B; Focus Group 1; Line 70; #00:23:44-0#)

The level of abstraction you mean? (Interviewer, Case B; Focus Group 1; Line 71; #00:23:46-6#)

Exactly. In other subjects it is mostly like, if you have an applied voltage, then you can measure; so it is either there or it is not. But here it is like this: when you start to measure here, in theory, it means you change the

picture again and then it is something completely different; and then, after that, it is something completely different again. I find that difficult, for me, to imagine what is happening. (Student 1, Case B; Focus Group 1; Line 72; #00:24:07-4#)

Yes, especially at that point, it is difficult; mostly you learn when you link something new with something you already know. And, if you now try to combine physics with classical physics, then you may reach your limit. That is exactly what he [student 1] says, when you try to observe and analyse the process. (Student 2, Case B; Focus Group 1; Line 73; #00:24:59-9#)

Related to this problem, the students described the problem that some form of learning method is missing which makes the learning content more visible (*MSL 10: multiple pedagogical or learning activity models and approaches*). They considered it negative that there were what they perceived as too few experiments, simulations, and examples in the course, and described that reading text is just different from visual aids with pictures, explanations, and examples.

Some of the students went on to elaborate further with regards to the stated problem. It was not that there were no experiments or simulations in the course, as they were deemed to be helpful, but that there was simply a need for much more. However, some of the students also described problems with the implementation of simulations. They described students being allowed to use the simulation software and to explore, but that they did not understand what was expected of them and felt somewhat overwhelmed. As a consequence, their self-efficacy level decreased. They described having needed more instruction and support (including the setting of clear expectations) in order to be able to learn using the simulation software as a learning method (*MSL 10: multiple pedagogical or learning activity models and approaches*). Next to that, the students mentioned their preference for real experiments over simulations.

Also related to the simulations, the students described that the simulations demonstrated by the teacher were considered helpful. However, afterwards, in self-study situations, the students felt unable to reproduce the same solution. The teacher had shown the students certain documents, yet they were unavailable to the students at the time they attempted to repeat the learning content. This caused a gap between the in-class learning situation and the self-study context (*MSL 3: learning across time; MSL 5: access to learning resources*). Learning resources located on the Internet are often well-explained; however, the students described that those they had seen would not link well to their physics course.

Another issue that the students described is related to the assessment context. The students felt insecure about the alignment of the learning setting and the

assessment setting (*MSL 10: learning vs. assessment contexts*). They described not really knowing what to expect regarding the exam, which made it difficult to estimate whether or not they had invested or had enough time to study for the course exam. Whilst the students did not describe this as a very significant problem by itself (they could live with the uncertainty), any gap would, however, be considered problematic for them.

Solutions and supporting factors

The students described a number of supporting factors, which each helped them in the actual context to reach the required learning objectives. They described good explanations having been provided by the teacher as helpful. The teacher, for example, had explained that the topic area would (likely) be new to them, and that it may prove difficult to relate back to their prior knowledge (*MSL 9: prior vs. new knowledge; MSL 3: prior educational contexts/degrees*). This helped to manage their expectations.

Also, the teacher's availability in case of their experiencing problems was evaluated positively by the students. The teacher allowed the students the opportunity to ask questions and repeated learning content where needed (adaptiveness). This was also reported as the reason that the students would find learning videos to be helpful: as they could pause and repeat as often as they felt necessary. In the actual context, the need was not that great as the teacher compensated for this.

The students explained that the group size for the exercises could be an issue in terms of the teacher's availability; although the actual group size was considered to be ideal. Also, because the students had gotten to know each other very well and had learnt who was good at which topic, this helped to foster peer learning.

The students found the structure of the course to be helpful, and that the adaptation of exercises to the lectures was very positive in the actual course. Next to that, they found it helpful that the learning materials used followed the structure of the course, and served to function as an overview and summary.

In terms of experiments and simulations in the course, the students mentioned wanting more, because this would have made the learning content more tangible and concrete (*MSL 9: theoretical vs. practical knowledge*). They described that 'touching something yourself' helped to increase their success in reaching the learning outcome. However, the implementation and supporting learning materials needed to be improved (*MSL 10: multiple pedagogical or learning activity models and approaches; MSL 5: access to learning resources*).

The students described that their own interest in the new topic was also helpful. They described that the advanced topic was both something new to them and interesting, which they had not encountered before (*MSL 9: prior vs. new knowledge; MSL 3: prior educational contexts/degrees*). The theory was different too. It went one step further, which matched to their own wishes, because in the eyes of the students, it was more akin to the level of physics 'out there' in the real world. Physics is not considered to be easy, and the students wanted to appear competent in this regard.

Also mentioned was that the students considered that it would be more supportive if they had better insight with regards to the course exam (*MSL 10: learning vs. assessment contexts*). They expressed wanting to know more about what to expect. Application of mock exams was mentioned as potentially helpful. More helpful still would have been a mock exam applied under strict assessment conditions in order that they could experience what it would be like in the actual exam (e.g., time pressure).

Overview

Table 14: Overview and Relationships between Problems and Supporting Measures from the Student Perspective in Case B

<i>Problems (student perspective)</i>	<i>Supporting measures (student perspective)</i>
MSL 9: theoretical vs. practical knowledge (complexity of abstract learning content, intangibility) MSL 9: prior vs. new knowledge (gap in context complexity level between prior knowledge and upcoming knowledge) MSL 3: prior educational contexts/degrees (gap in context complexity level between prior educational contexts and actual context)	- Good explanations of learning content - Expectation management with regards to expected gaps - Teacher availability (possibility to ask questions and to ask for repetition) - Interest in the topic - Willingness to go one step further in physics (meeting the complexity level of the professional field)
MSL 10: multiple pedagogical or learning activity models and approaches - Experiments and simulations missed, which would make learning content visible and foster tangibility) - Missing practical examples	- More experiments - More simulations
MSL 10: multiple pedagogical or learning activity models and approaches (hindering implementation of the simulation approach: unclear expectations and feelings of overwhelming and decreasing self-efficacy)	- More instruction and support (including setting clear expectations)
MSL 3: learning across time MSL 5: access to learning resources (resources missing or incomplete when students want to repeat simulations in self-study contexts)	- Learning resources (documented simulations) - Possibility to repeat learning content for self-study (potentially learning videos)
MSL 10: learning vs. assessment contexts (uncertainty about the exam)	- Applying a mock-exam under examination conditions
	<i>Other supporting measures (not related to specific problems)</i> - Small group size (fosters teacher availability and peer learning) - Coordination and alignment of lectures and exercises - Learning resources functioning as overviews and summaries

Table 15: Overview and Relationships between Problems and Supporting Measures from the Teacher Perspective in Case B

<i>Problems (teacher perspective)</i>	<i>Intervention and supporting measures (teacher perspective)</i>
	<i>Simulations</i> <i>Learning approach</i> <i>(playful, experience-based, and peer learning)</i>
MSL 1: formal and informal learning (gap between formal learning context and concrete phenomena in students' everyday life)	- Relevance for private life and future job
Outcome: motivation: Students do not see relevance	- Comprehensible and stimulating presentation of learning content, including different senses (seeing, hearing, haptic) - Relevance for private life and future job - Enabling the experience of competency - Combination of learning resources (digital and analogue) - Peer learning
MSL 9: theoretical vs. practical knowledge (missing access to (contexts for) practical knowledge, although integration is required for comprehensiveness)	- Tangibility of learning content (concrete knowledge)
MSL 3: learning across time Requirement: time Lack of time (to learn about the topic) - Topic too late in study programme - Students do not have time	- Continuity because of use of simulations and learning approach across different learning contexts (at different levels, prior and future)
MSL 6: physical and digital learning (potential for students to learn more with digital tools is not used)	- Comprehensible and stimulating presentation of the learning content, including different senses (seeing, hearing, haptic) - Combination of learning resources (digital and analogue)

6.2.3. Comparison and Interpretation of the Student and Teacher Perspectives

Comparing the perception of the students with the perception of the teacher in Case B, both similarities and differences could be identified. Although described using different words, both the students and the teacher considered the

key problem to be the lack of concrete visibility of the learning content. The derived consequence, differed between the two perspectives. The teacher linked the concrete visibility of the learning content with both relevance and motivation, as well as understanding. However, the students only mentioned linking it to the tangibility of the learning content (thus, understanding). Here, the differences stemmed from the reality that the teacher worked on a problem that the students did not experience.

When looking at the suggested solutions and supportive measures, the students' and teacher's discussion were on different levels. The (actual and desired) supporting measures that the students described were not found to be explicitly linked to the problems they had described. The most plausible interpretation, however, was that they managed to deal with the difficulty of the learning context because of these supporting measures.

Where students especially wanted more of what they considered already worked well for them, the teacher thought in broader terms and across different and new contexts (cross-contextual solutions and arguments). The students were able to join the ideas they had learnt to the simulations, and gained a certain level of experience in doing so, because they had the opportunity to try. However, they described some 'hygiene factors' in the implementation (e.g., simulations could only be seen as supportive, when they were adequately supported) designed to offer security and trust in the implementation. A move away from an instructive learning approach towards an experimental learning approach was not what the students wanted; and since they acquired this additional experience, this led to their feeling of being overwhelmed. This confirmed the importance with regards to the implementation of the intervention, which did not seem to be the teacher's focus.

6.2.4. Involvement of the Student Perspective in Educational Design Processes

Student perspective

In Case B, data was provided according to the complementary questions in the post-questionnaire that the students completed. However, not all of the subcategories could be enquired. There are no answers given to the question as to how importantly students perceive their influence was over the course design, how their feedback was taken up in terms of the course design, and which factors determined this situation. This was the same for both the actual situation and the desired situation.

Students' perception of involvement

In Case B, half of the students who completed the questionnaire evaluated their influence on the course design as 'substantial'. The other half perceived their influence as 'little', but none of the students chose the options of either 'excessive' or 'too little'.

Forms and potential forms

All of the respondents described informal conversations held with their teacher as the most appropriate way to influence the course design. However, with regards to the other methods (questionnaires and TAP), the students were not of the same opinion. Especially with the questionnaires, as half of the respondents found them to be an appropriate form to influence the course design, whereas the other half disagreed. TAP was evaluated as inappropriate by most of the respondents. One student described preferring to talk with their teacher directly (TAP is moderated by an external TAP team member so as to guarantee anonymity, independence, and trust).

Timing

One respondent described that both oral and written surveys before the start or at the beginning of the semester were not as appropriate (as applied at the end), because students do not have adequate knowledge or experience of their course at that point.

Teacher perspective

Prior to questioning the teacher about their attitude towards the integration of the student perspective, the teacher was asked to what extent they believed that they knew the student perspective. In Case B, the teacher described having been in continuous exchange with the students, and that in their experience, the students were open and honest. This led to the teacher having expressed that they knew/understood the student perspective. The teacher only identified small discrepancies between the student and the teacher perspective every now and again.

The teacher also described that it was not an easy matter to estimate. The teacher stated that the number of students with whom they had gotten in contact with was not that great yet. From the other side, he had contact with well-performing and lower-performing students.

The teacher described that sometimes it was difficult to estimate to what degree of understanding the students had reached, and said that the students sometimes also had problems estimating their own abilities and understanding. The

students would tend to overestimate their understanding of topics, believing that they had understood the theory, but at the same time were unable to solve the set exercises.

Importance

As to the question, why knowing the student perspective was important to teachers (for what purpose), the teacher described that everything was about the student, that 'the students are central' and 'if one is able to adapt one's teaching to the students' needs and the world within which they live, this would increase the students perception of relevance'. Also, according to the teacher, it helped to guide the students' attention.

Next to that, the teacher described the option to establish sustainable relationships with some students, and to build upon them. The teacher stated that in knowing the students better, as teachers they can select students with higher potential to write their theses at the institute. Or they could add them to the network of the institute.

Forms and potential forms

The teacher described informal exchanges with students as one of the main sources of information with regards to the students' perceptions, and described the relationship with the students as being close. The teacher described that especially following the demonstration of experiments, students would congregate at the front of the class in order to take a closer look. At these such moments, conversations would emerge, which afforded the teacher insight into the students' perceptions.

Next to that, the teacher described in-class observations as an important method:

Yes, and in our case, the students do the exercises and I'm there for any questions they may have, and that's extremely interesting. That's almost the most important feedback instrument, number one in fact. In this way, I can see during the exercises who is facing what challenges and how fast they are for example. (Teacher, Case B; Interview; Line 99; #00:56:10-8#)

Another form that the teacher described was the traffic-light method. In this case, the teacher would ask the students to what extent they understood the learning content that had just been introduced to them in the class. The students could then answer according to a three-option scale, like that of a traffic light.

Other existing or potential forms to enquire about the student perspective, and which were not actually implemented at the university in question but derived

from the literature, were also discussed. The teacher described the most interesting potential form to be a questionnaire that he would develop. The teacher argued the importance of being able to ask specific and deeper questions to the students, as the more general questions were seen as inadequate in terms of the information richness of the answers they mostly received. It was for this reason that the teacher described not having implemented the questionnaire introduced by the higher education institution during the previous semesters. Another option mentioned by the teacher was for more individual and direct questioning of their students.

As to the question regarding what the teachers thought about student cooperation within the workshops, or as project team members (students as co-designers), the teacher in Case B described being generally open to the idea. However, the teacher was not overly convinced, and questioned if students would actually want this (regarding the impact on their time and motivation). The teacher professed to seeing potential with regards to the development of specific materials, but still saw several hurdles with regards to the implementation of such collaborative works. For instance, with regards to topic-dependence:

Then I would simply teach the topic in a classical way in the lecture, and then we would have a workshop with a group of students where the topic would be taken up again, and where I would provide additional material. We could then ask, 'How would you instruct this to your fellow students?', or 'How should I teach this to the next generation next year?' Alternatively one could ask, 'What are you interested in?', 'What bores you?', 'What is considered amazing to you?', 'What is seen as somehow attractive?' However, I think these all depends very much on the topic, though. (Teacher, Case B; Interview; Line 109; #01:00:40-4#)

Time factor

The teacher described preferring continuous methods in order to gain insight into the students' perception; preferring to also adapt the course to the students' needs in this way (see the following section).

Where the teacher meets up with the students a little later on, this allows them to reflect with the student with regards to the study programme and courses from a little more distance.

Integration and implementation

The teacher described that the students' feedback is continuously sought, and that the teaching was continuously adapted according to the information fed back from the students. The teacher takes up the feedback when planning the

next weeks class, and also reacted to observations in real time as things happened.

From the other side, the teacher also discussed not wanting to accept everything that the students may have wished for. One related statement was that 'edutainment' cannot be the only objective in adapting courses to the students' needs or desires.

Conditions

The main factor that influenced if and how teachers took up what the students would like to see changed, was based on the majority will (of the students). The teacher described it being important that the feedback received and acted upon did not just stem from only a few students.

The second factor that the teacher described was the conditions of the higher education institution. For instance, if the students wanted more experimentation, this may not always be possible due to limited resource availability, for example. The resources provided would become rather worse. Next to that, the institution sometimes demands innovation from the teachers; to rethink courses. Whilst this can help to boost innovation, it also increases the workload of the teachers. Beyond that, the teacher described the degrees of freedom that they had within innovation projects:

Yes, it depends. I wouldn't say entertaining in the sense of a show, but what I do notice is that it is very important that I am authentic, and that I bring my examples from my, well, my professional career, from my experience, or from the institute. It is very important that the lecturer is allowed to bring in their own experiences. There are times where this has no place, and also, tendencies such as, now with study reforms, that everyone should use the same content, the same slides, and that the same exams should be applied. Whilst you may be forced to comply, I resist strongly; but it is the trend, a trend towards standardisation. (Teacher, Case B; Interview; Line 89; #00:52:52-9#)

The topic of power and control between teachers and students was not discussed during the interview.

6.2.5. Interpretation of the Involvement of the Student Perspective

As described in Section 5.5, the interpretation of the student perspective on their involvement in educational design processes had to be interpreted carefully, because the data was limited (low response rate, no possibility to ask further questions and motives). Based on the actual collected data, the students do not actu-

ally demand having more influence on the course design. They mostly appreciated the ad hoc conversations held with their teachers as a means to having some influence.

The teacher felt that the perspective of the students was already known, and described this to be of significant importance. The teacher mainly attributed this insight to the continuous and personal contact had with the students (observations in class and informal conversations), and adapted their teaching to the student perspective on a continual basis. Sometimes, the higher education institution would foster or sometimes limit ideas for further development.

Overall, the actual forms of collaboration that existed between the students and teachers seemed to be experienced positively by both the students (although somewhat heterogeneously) and the teachers. There did not seem to be any demand to instigate any significant change of the (kind of) involvement of the student perspective beyond what was already being done, although students had heterogeneous preferences for the forms and potential forms for enquiry of their perspective.

6.3. Case C

Contextual information

Case C is a project led by two different teachers (both professors) at an applied sciences university located in Germany. They each worked at the Faculty of Informatics. The course which was selected to be further developed within the project concerns programming and communication. The teachers both co-teach the course, with their roles split based on their areas of expertise. The project is about agile project management and the course design was also planned to be agile itself. The course took place during the final year of the study programme.

Cross-contextual matters

Being a final-year course, relations with the future professional field of application have to be taken into consideration. Employers of former students from the applied science university in question reported that the graduating students' project management competences were deemed to be unsatisfactory.

Next to that, a seam was identified between the context where the theoretical content is learnt and practical contexts where experience can be gained, or where the learning content can be applied. In Case C, a practical context was defined as missing in the case of most students, which led to fragmented learning experience in both context types.

Cross-contextual objectives

In the context of the project, the teachers developed an intervention with supportive measures that aimed to bridge the gap between the higher education and future professional application contexts. Ultimately, the aim here was to align the two contexts through the interventions. The teachers integrated elements of the professional context into the learning context in order to facilitate the transition of graduating students into the professional field. By implementing the intervention, the teachers aimed to resolve the problem of the missing experience and also the missing application context.

Cross-contextual intervention and supporting measures

In Case C, the intervention developed was an educational design which integrated authentic, practical elements in the course (boundary objects and brokers). In the course, the students programmed an app according to the principles of agile project management. In this way, the students were able to apply the theory of agile project management and also gain authentic experience in the process. Within the course design, different actors and roles were simulated

(boundary activity) for the course as they exist in industrial practices. Also, the tasks were designed close to what is considered to be professional reality.

According to the principles of agile project management, the course design has to be agile. The students work is project-based, and the course design should therefore be adapted to the needs emerging from the development of the projects (process and product). During the course, technical tools were implemented in order to support the implementation of this adaptive course design.

Development of the intervention

The development of the learning object took place within the project, and the 'default' process was followed. The key differential in Case C is that former students of the course were employed in the project. They already knew the course from the student perspective and were able to bring in this perspective to their role as project team members.

6.3.1. Teacher Perspective on Cross-contextual Learning

Problems

The main problem that the teachers described was that the students often have inadequate experience or are unable to access practical (agile) project management situations prior to, or parallel to, attending the course. Therefore, because they lack experience or access to practical contexts, the students cannot involve practical knowledge and (informal) learning experiences (*MSL 1: formal and informal learning*). The teachers argued that practical knowledge is required in order to be able to internalise theoretical knowledge (deep understanding). The lack of experience or access to practical contexts leads to a seam between theoretical knowledge and practical knowledge, although the integration of both theoretical and practical knowledge is clearly necessary (*MSL 9: theoretical vs. practical knowledge*). In order to be prepared for the professional field (see case description), this problem needs to be addressed and resolved within the learning context. Consequently, transition from the higher education context to the professional field will be easier and smoother (*MSL 3: future courses/work*).

Due to the lacking of experience or access to practical contexts, the students would also have reported experiencing problems seeing the relevance of the learning content for their future employment. This would influence the students' motivation (*outcome: motivation*).

Solutions and supporting factors

The teachers saw another learning approach as the main solution to the problems described here. They wanted to integrate experiential and project-based learning through designing an authentic learning task that aimed to simulate an authentic learning setting as compensation for the lack of experience (*MSL 1: formal and informal learning; MSL 9: theoretical vs. practical knowledge*). Next to that, the experience embodies the relevance of the topic.

As the topic is 'agile project management', the students should implement a project according to agile principles. Through implementation of the project, students can gain practical knowledge and experience, which thereby fosters integration of their theory and practical knowledge (*MSL 9: theoretical vs. practical knowledge*).

The involvement of a real partner from the industry makes tasks appear as realistic as possible (*MSL 3: future courses/work*). The closeness to reality is not only a challenge for the students, but also for the teachers, because students need to be supported by the teachers (scaffolding), and this is effortful for the teachers. Through direct feedback, the teachers can support their students. Feedback can help to navigate the students. To support the implementation of the concept, the teachers aimed to use software to track and automate feedback for their students. Although feedback was not a topic in the context of the problem description, the teachers considered it as a supporting factor regarding the competence development of the students. Another positive side effect of the intervention implementation was that the learning process would become more interactive.

In summary, the full intervention with its supporting measures is an answer to:

- students' lack of experience;
- the lack of visibility of relevance for students;
- the seam between theoretical and practical knowledge; and,
- the seam between higher education and professional contexts.

6.3.2. Student Perspective on Cross-contextual Learning

Problems

Chronologically, at the start of the course, the students experienced a seam between their prior knowledge and the requirements of the course (*MSL 3: prior educational contexts/degrees*). They described project management as not having been a topic in any of their previous courses, let alone agile project management. For some of the students, also programming was new. As the course required the students to start applying directly, they felt that they had been 'thrown in at

the deep end', and causing low self-efficacy. The students described that an introduction (e.g., to some of the concepts and tools which were meant to be used) was missing from the initial week/s of the course (*MSL 9: prior vs. new knowledge*).

Those students who had some experience with agile project management in the professional field described noting a seam between the theory and the practice or practical experience, which made them feel as though they were somewhere in-between. The students reportedly found it difficult to integrate these fragments of their knowledge (*MSL 9: theoretical vs. practical knowledge; MSL 3: future courses/work*).

The students described a problematic alignment that existed between the learning objectives, the learning methods, and the assessment criteria (*MSL 10: learning vs. assessment contexts*). Although the learning objectives and course description have a twofold focus (programming and communication, with agile project management as the bridging topic), the students felt that the assessment criteria prioritised the products that they had to create (the programmed app) as part of the course over and above the actual process itself (implementing agile principles and communication). The students described that, within the context of the evaluation, it did not matter if or how the students applied agile project management, and that the route they took to produce the app would not actually be considered or assessed. Through the eyes of the students, the only objective was to program an app as well as possible.

The students described that this fostered a learning climate that was ultimately competitive. All of the groups wanted to be seen to have created the better app; one that was better than that of the other groups, which then led to the students putting in excessive effort in producing the app. In doing so, no agile principles were being applied, and all efforts were performed just prior to the deadline (which does not correspond with an agile approach).

The problem was mainly that it turned into a competition, and you knew that the more you did, the cooler and the better the teachers would find it. And then you kept doing more and more and slept less and less, and exceeded your workload maybe. (Student, Case C; Focus Group; Line 379; #01:06:35-4#)

The students needed to program an app, which demanded significant effort on their part. Knowing that the app was only meant to prove the programming competences, independent from any meaning of the app, influenced the students' motivation (*outcome: motivation*). The students described that they programmed a number of apps during the study programme which were not used

afterwards. They were evaluated by the teacher(s), but there was no more meaning beyond the task completion. Knowing that all their efforts led to the product being rendered 'useless' afterwards was considered a problem for the students.

Last, for the implementation of agile principles, feedback and availability of the teachers is important. The students described that the teachers were unavailable at the time that the students would have needed their feedback (*MSL 3: learning across time*).

Solutions and supporting factors

Due to the discrepancy between learning objectives and assessment criteria (*MSL 10: learning vs. assessment contexts*), the students saw the main solution to the described problem more as a representative focus to both the learning objectives. The students were very conscious about the relevance of the topic in terms of their future professional field, and were willing and motivated to learn about agile project management. They found it important to be able to apply the theory, and wanted to try it out, experiment with it, and practice it. They saw a project-based learning approach as a good solution, and wanted to learn by doing.

The students considered it important that the process itself would also be evaluated. The students intensively discussed that another learning climate would be required in order for them to be able to learn, and in that it needed to be possible to make mistakes, without it being consequential to the evaluation. Reflection was felt to be more important than the perfect agile implementation. To do otherwise, the students would not feel free to make mistakes, where –according to agile principles– they could and should be free to adapt and learn. This approach would foster their self-efficacy and could also help to compensate for their fears with regards to gaps between their prior and new knowledge (*MSL 9: prior vs. new knowledge*).

...if you have a problem, that you know then, ah, now take it easy, let's have a look at what could be the mistake. And I think that is the ability, you have to trigger the people, the students somehow, so that they don't panic, oh god, oh god, we have to get this project done, but really know, ah no, there can be problems, why is it a problem, now we will have a look, we are doing Scrum (agile), what could be the problem here? What could be running not optimally? (Student, Case C; Focus Group; Line 435; #01:15:17-2#)

Related to the topic reflection, one of the students described that it would support their learning (as well as transition to the professional field) if agile project management would be reflected critically. When does it make sense? When

does it not make sense? What are the hindering factors during implementation? Within the environment of the project, or elsewhere? This would help students to bridge the gap between theory and practice (*MSL 9: theoretical vs. practical knowledge; MSL 3: future courses/work*).

In summary, the students saw the idea put forwards by the teachers as an authentic learning context, and a good way to foster learning. They also agreed that the involvement of a partner from the industry would make the setting more realistic and useful.

Related to the described problems with the actual task (*outcome: motivation*), the students considered such an authentic task as a solution as well. They mentioned there being many associations, churches, and start-ups who may also like to have an app. The students wanted to be able to program an app which they knew would go on to be used following completion of the course.

With regards to the implementation of the suggested approach, the students found it very important to have both introduction (*MSL 3: prior educational contexts/degrees; MSL 9: prior vs. new knowledge*) and clear expectations set out up front. Also, they considered feedback as helpful in order to be able to prove to what extent they had reached the set expectations (*MSL 10: learning vs. assessment contexts*).

Overview

Table 16: Overview and Relationships between Problems and Supporting Measures from the Student Perspective in Case C

<i>Problems (student perspective)</i>	<i>Supporting measures (student perspective)</i>
MSL 3: prior educational contexts/degrees MSL 9: prior vs. new knowledge - Missing prior knowledge because knowledge was not taught (neither earlier in study programme, or in the course)	- Introduction - Experimentation: learning by doing (lowering expectations, more focus on learning than performing)
MSL 9: theoretical vs. practical knowledge MSL 3: future courses/work (difficulty to integrate theory with practical experience)	- Being conscious about topic relevance in the future professional field - Willingness to experiment - Experiential, project-based learning approach (learning by doing) - Reflection on differences between theory and practice
MSL 10: learning vs. assessment contexts - Problematic alignment between learning objectives, methods, and assessment - Missing relevance of agile project management in assessment criteria - Competitive learning climate (concurrency between students) - Low self-efficacy (also caused by the gap between prior and new knowledge: MSL 9)	- Representative focus on learning objectives in assessment (lowering expectations towards topics other than agile project management) - Better learning climate (which allows mistakes whilst it does not influence the evaluation. E.g., focus on reflection on learning activities rather than performance) - Clear expectations regarding assessment - Feedback that helps to monitor own competence development / extent to which students have reached learning objectives
Outcome: motivation (missing relevance for 'the world outside')	- Authentic learning context and meaningful tasks (for 'the world outside') - Involvement of an industry partner
MSL 3: learning across time (missing just-in-time feedback and teacher availability)	- Feedback

Table 17: Overview and Relationships between Problems and Supporting Measures from the Teacher Perspective in Case C

<i>Problems (teacher perspective)</i>	<i>Intervention and supporting measures (teacher perspective)</i>
	<i>Learning approach (experience-based, project-based)</i> <i>Authentic learning task (simulation)</i> <i>Direct feedback (adaptive, agile design)</i>
MSL 1: formal and informal learning MSL 9: theoretical vs. practical knowledge (students do not possess but need practical experience to understand theory (which teachers relate to informal learning contexts))	- Allowing students to gain experience in authentic learning contexts (project-based simulation) - Integration of theory and practice - Feedback (and monitoring of competence development, evt. automated)
MSL 3: future courses/work (employers of former students reported students' project management competences as unsatisfactory)	- Continuity due to use of design elements from job context in learning context (integrating authentic tasks and simulating contexts) - Scaffolding (navigating students) - Feedback (and monitoring of competence development, evt. automated)
Outcome: motivation (students not seeing relevance)	- Allowing students to experience relevance within authentic learning contexts - Including a practice partner in the course
	<i>Other supporting measures (not related to specific problems)</i> - Interactive learning

6.3.3. Comparison and Interpretation of the Student and Teacher Perspectives

When comparing the student and teacher perspectives, the biggest discrepancy found between the student and the teacher perspective, is that teachers considered that the students lack the initial experience for them to build upon. This does not seem to be fully accurate. Some students do possess experience and also have access to knowledge about experience (e.g., from and about the professional field), and can even recognise gaps between theory and practice. Also, the students appeared conscious about the importance and relevance of the topic with regards to their future jobs. However, the teachers questioned if the

students were able to recognise this relevance. This means that the teachers foresaw more problems (or a higher intensity of problems) than the students reportedly experienced (problems in more dimensions than perceived by the students).

Although (some) students had experience with agile project management, or had access to knowledge about such experience, the students still wanted to gain further experience in a theory-led educational field, which they considered as a safe learning environment. This also matched with the ideas of the teachers. Both the students and the teachers agreed that the theory must be applied in order to gain and develop competence. Thus, both the students and the teachers questioned how to make the existing course more practice-based. The solutions and supporting measures that were suggested also matched: they both considered that a nearly authentic learning setting, involving a practice partner and an authentic task, was a good solution to the described problems.

The students complementarily described critical requirements regarding the implementation. They experienced that missing constructive alignment hinders them to reach the learning objectives. They based the success of an approach as dependent on its implementation. Everything needs to be aligned, else 'it doesn't work'. As long as the assessment criteria is focused on the wrong things, any new concept will not (be seen to) work. Thus, teachers may head in the right direction, but they need to go further with regards to the realisation.

6.3.4. Involvement of the Student Perspective in Educational Design Processes

Student perspective

In Case C, it is necessary to make a distinction between two kind of students. First, as in both Case A and Case B, the actual students attending the course (at the time of the project) completed the questionnaire in terms of their experience with student influence on the course design. Second, in Case C, former students were employed as project team members, and their vision was therefore enquired separately.

Students' perception of involvement

In Case C, two points of measurement took place with a 1-year period of separation. In the first year, the respondents perceived their possibility of influencing the course design as 'little' (nine students) or 'too little' (six students). In the second year, after bigger changes to the concept were implemented, the stu-

dents perceived their influence as 'little' (four students), 'substantial' (two students), or 'excessive' (one student). In the second year, the students described that they could make their influence through the team project and through the tasks that they needed to resolve.

The students who were project team members described their influence over the course design especially in the first workshop of the DBR-process. There, they were able to bring in their experience with the course, and to specify the problems that the project team may want to work on during the project. This problem analysis formed the basis for the new course design.

Because the lecturers, they are on a different level, if you would generalise. They can't understand what the effort for programming means or how stressed the students are. And we were able to provide a lot of input, I would say. Three quarters of the canvas [a product that was developed in the workshop] was based on our experiences, as well as input from the lecturers, what they would like to do better, what they had already noticed. And of course there were also some overlaps, which they had noticed....It was my feeling, you could bring in a lot of points, or rather, this was the medium where we could bring in everything we had personally perceived. Of course, you shouldn't put too much emphasis on your own experience. However, it remains a question, how will it be taken up in the end, and whether or not it was or will be processed. (Student Project Team Members, Case C; Lines 143 and 157; #00:18:04-3# and #00:21:26-0#)

Importance

The student project team members described their perception of discrepancies between the teachers and students. They found it important to involve the student perspective with regards to the design of an intervention. The students compared it with a certain customer orientation. Students are customers and they learn more when the intervention is adapted to their needs. Also, they described it being difficult for teachers to estimate how much effort students needed to perform in solving a task.

Forms and potential forms

In Case C, oral forms to enquire about the student perspective were evaluated as the most suitable method, according to the students. The questionnaires were less positively rated. Overall, there were voices for and against all of the implemented and proposed forms (focus groups, questionnaires, and TAPs), and the answers appeared to be heterogeneous.

Looking at the differences between the first and second year, it was notable that the students from the second implementation (the ones who were more positive about their influence over the course design) were also more positive about the (same) forms (focus groups, questionnaires, and TAPs). Although there were also critical voices raised, the overall tendency was positive. One of the students described that the learn effect of the course was high, and that any additional influence of the students would not have improved anything further. Another of the students described that there were already adequate opportunities for students to influence the course.

The student project team members especially argued for focus group to be organised by a third party and held at the beginning of the course. They emphasised the importance of participant anonymity. Next to that, they evaluated it positively that future students were also included within the focus group, because they were considered to lack any undue pre-existing bias.

The student project team members especially argued against the use of questionnaires from the higher education institution (these are questionnaires other than that developed by the project, which were specifically adapted to the course). The students especially described the feeling that the teachers would not actually do anything with or act upon the feedback students gave in such questionnaires.

According to the student project team members, a potential form that could be employed to enquire about the student perspective would be the use of a digital tool such as Mentimeter. This would allow for the collection of information across a number of students, without unrealistic effort required from the teachers.

Timing

In the questionnaires, one student explained that especially at the beginning of a course, students do not know enough to be able to answer questions regarding the course design. However, another of the students described that it was considered meaningful in order to sharpen the vision and objective of the course prior to or at the beginning of a course, which was also confirmed by the student project team members. Overall, the answers given to this topic were very heterogeneous.

The student project team members described positive experiences with mid-term feedback and evaluations, which prompted feelings in the students that the teacher was truly interested, and that they would profit from the eventual improvements implemented based on their feedback as the course proceeded.

Integration and implementation

In the focus group, limited data was collected about how the students felt that the teachers received and acted upon their input. The discussion was more about the feeling that, in the end, the teachers would decide what the intervention would look like, not the students. This topic is described in the following two subcategories.

In general, the student project team members described that the project form (proposal, pre-structured DBR-process, collaboration with different teams) would stimulate the involvement of the student perspective. It would be more difficult, to not do anything with it, because of the image reflected towards the base project team members.

With regards to the influence that the students had over the course design, the student project team members described one extraordinary experience. They had attended a course where they collaboratively developed the course along with the teacher as part of the course. However, they described that this had been a one-off experience with an extraordinary and highly motivated teacher.

Conditions

The most discussed topic with regards to the involvement of the student perspective in the course design was the topic 'relationship of dependence'. The student project team members discussed that it would be difficult for students to be honest, as long as a relationship of dependence existed. Thus, as long as teachers grade their students' work, this would continue to have a significant influence on any collaborative working relationship in terms of the course design. Independent of the enquiry form and the integration of the student perspective, the student project team members argued that students would always do what they thought the teacher wanted to see.

On a more general note, the student project team members described that for all forms, it was a requirement that the students know what the teachers will actually do with any feedback they provide. According to the students, the feeling that the teacher would take any feedback seriously was a key requirement for students to be motivated to participate and to provide feedback. Also, they described an influence of the students' estimation of to what extent a teacher was able to handle critical feedback. At the same time, the student project team members recognised that it was very difficult for teachers to adapt to a heterogeneous group of students.

Power and control

As previously described, the student project team members had strong concerns that, in the end, it was the teachers who were in charge, meaning that their input would be less/not valued. They described the teachers as the ones who would decide what would happen during any intervention. This topic came up more than once. In relation to questions about the desirability and reality of the students' participation, and to the question, 'What do teachers do about the effort that students put in when participating by way of providing feedback?'.

Consequences of the participation

The student project team members found it rewarding to help improve the course design. However, overall, there was not much discussion held about the meaning of being a project team member for them.

Teacher perspective

Both of the teachers in Case C described that they believed that they knew the students' perspective for the most part. They realised that it was impossible to fully know the student perspective, but were convinced that they knew it fairly well already.

Importance

The teachers described that they also wanted to know about the student perspective. They described a certain customer orientation to their reasoning. Also, they described that knowing the student perspective was one way to ensure that a learning design or intervention would more likely succeed. If one was able to adapt to the students, this would positively influence the students' motivation.

Forms and potential forms

On the question of how teachers enquire about information regarding the students' perception, the teachers explained that the course concept allowed for close contact with the students. The concept includes a team project in which the students take on certain team roles. The teachers coach the students within the team constellation, as well as individually. This leads to a significant amount of exchange taking place. The contact with students becomes closer and (some) students even feel sufficiently free and relaxed in order to provide feedback.

Next to that, the teachers can observe the students' behaviour and communication (with each other) through various online systems, and also in the tools that

they use within the course. This can be a rich source of information for the teachers to enquire about any problems that the students may experience.

The teachers opted not to use the questionnaires issued by their higher education institution; stating that they already had enough feedback instruments. The teachers described that these questionnaires usually provided less rich information about the students' experiences when compared to the instruments that they already used. This was seen as especially valid because the students would likely not complete the open-ended questions contained within the institution's questionnaire.

Having former students as project team members was also considered as a means to enquiring about (and implementing) the student perspective. These student project team members can also be used to enquire about the opinion of other students as part of their role of assisting throughout the course.

Also, it was discussed with the teachers from Case C if a more participative design with the students could be an option (e.g., by inviting students along to the design workshops). Both of the teachers questioned the return on investment of such a design method, and evaluated it as not an ideal form of student participation for the purposes of course design. On this, one of the teachers in Case C provided the following response:

I'm only hesitating because the student hasn't participated like this before. So, after we have discussed this. I actually wonder why not? Why, because we collected so much feedback already, and I don't think there is any need to include someone else now. And maybe I also doubt if there is someone who wants to do it. If you have been asking for feedback all the time before –concretely at the course level, content-wise and on the meta-level– then you are now bringing in a student who has participated in this course to another course where it is more or less about meta, maybe meta-meta, I think at this point maybe I am overstrained. I do not know. But I can't think of a student who springs to mind. We did it in that sense, if you like, with the student project team members. They were then exactly in that position. (Teacher, Case C; Interview; Line 52; #00:56:39-5#)

Timing

Due to the actual course concept, enquiry into the students' perspective happened on a continual basis. Whether or not this was the preferred rhythm and timing in terms of the teachers was not evaluated, nor was it discussed during the interviews.

Integration and implementation

As to the question of how teachers act upon the information they receive about the student perspective, the teachers also referred to the course concept itself. As previously described, the course was about agile project management, and because of that, the course design was also structured along agile principles. This means that the course design was continuously adapted to the actual situation and to the progress of the students' projects. In this way, the students' needs and their feedback was able to be integrated within each step of the course design.

One of the teachers discussed that the continuous and partly ad hoc integration of the student perspective can also lead to uncertainty and unpredictability. When there are too many changes, this can be uncomfortable, both for the teachers and for the students. It can make things unnecessarily complex. This was raised as an important issue that should be corrected, balanced.

Conditions

With regards to the implementation of interventions and supporting measures that the students wished for, the teachers described their dependency according to the rules, requirements, and resources of the higher education institution. According to them, this was the most influential factor with regards to the implementation of the students' ideas and feedback.

Power and control

One of the teachers described that the student project team members had equal rights with the teachers. However, it was also described that this role was not considered easy for the students. The other teacher described that the student project team members could not always abstract from their own experience. The teacher described an example whereby the student project team members thought that an introduction to a certain theme was unnecessary, even though the actual course students had requested such an introduction. Here, the perspectives of the student project team members and the actual students were not seen to be congruent.

With regards to the discourse about who controls the course design, both teachers were of the opinion that the teachers should be in charge, and that they should lead the decisions taken (in line with the rules and regulations of the higher education institution). This was their job and responsibility; just as it was also their job and responsibility to react to their students' needs.

We want to know what they are thinking about it, but we don't say at this point that everything that comes from the students as input will become, how should I say, the credo for us. So, it will be then, I think, reflected by us. It must perhaps also come from a substantial quantity [of students] and perhaps also over a longer period of time, so that one, how should I say, that it attains a certain credibility, the feedback. And then there is still the question, does that make sense from our point of view of the conception of this teaching module, so to speak, that it fits. (Teacher, Case C; Interview; Line 40; #00:29:07-7#)

The teachers also prove the feedback they receive from the student perspective with regards to the adaption or implementation of improvements. They reflect on the feedback first, and then compare it with their didactical and learning objectives. They also described that they do and cannot change bigger things at one time, preferring instead a gradual adaption through which they try to consider the student perspective.

Summarising quote

Well, I could of course come up with a number and I would say, I think I know the student perspective maybe 75-80%, because you will never achieve 100% transparency. That's simply because, in the end, I'm still the one who awards the grades and therefore don't have the full openness [of the students]. But I have been doing such projects with the students for a very long time, and very intensively too as this has always been my area of interest. Over the years, I have gained a lot of experience in trying to teach people how to communicate; in other words, how to convey that they can talk quite openly, and I guarantee that it does not influence the student's grade. Of course, they don't believe that 100%, but I think we're actually quite fair in this respect. And the fact that I can observe the students virtually every day, every lesson, in everything that they communicate (as almost everything they communicate I get to see), and I can go through it with them, provide and receive feedback, and do this with relative openness, I think we have a high degree, a pretty high degree, to be honest. Much more than usual, I think. It's hard to estimate it more precisely, I think. (Teacher, Case C; Interview; Line 14; #00:14:18-3#)

6.3.5. Interpretation of the Involvement of the Student Perspective

As described in Section 5.5, the interpretation of the student perspective on the involvement of the student perspective in educational design processes has to be interpreted carefully, because the data collected was limited (low response

rate, no possibility to ask further questions and motives). Based on the data obtained in Case C, it is interesting to have a look at students' evaluation of the influence on the course design in relation with the evaluation of the course itself. The data showed that students' desire to have more influence on the course design decreased when the course concept became more agile and student-oriented. Here it would be interesting to deepen the correlation between the positive evaluation of the course, the positive evaluation of students' influence on the course design, and the evaluation of specific forms that could be used to influence the course design. Although the actual data did not allow for this, the tendency seems to be that the students have the desire to influence the course design, but that this decreases when the students are satisfied with the current course design. The form of enquiry for the student perspective did not seem to play a significant role, so long as the students were satisfied with the overall course design (the evaluation of all forms were mostly positive).

Comparison of students in the course and the student project team members

Due to the limited breadth of the questionnaire items (next to the limited significance of the answers given), it was difficult to compare the two student perspectives. However, a few tendencies did raise certain questions that may be considered interesting for the current study:

- Timing: The students who completed the questionnaires voted for all time points (before, during, and after) as appropriate to enquire about the student perspective. The student project team members preferred enquiry (or participation) at the beginning or during the course, because this would help to foster motivation for increased student participation (chance for benefiting yourself).
- With the student project team members, more different forms could be discussed. It was interesting that the student project team members came up with 'new' forms to enquire about the student perspective. It seems that the positive experiences that the students had increased both their recognition and a positive attitude for the collaborative course design.

Teachers

The teachers reportedly had the feeling that they already knew the perspective of the students, and even described this to be important to them. They mainly attributed their insight to the continuous and personal contact they had with the students due to the specific, agile course design (observations in class and coaching). The teachers adapted their teaching and coaching to the student perspective on a continual basis. Also, this was stimulated by the overall adaptive

course design. Both of the teachers described that sometimes the higher education institution fosters or limits ideas for further development (e.g., resources for extensive mentoring in the course).

Overall, the actual forms of collaboration between students (in-course) and teachers seems to have been experienced positively by both students and teachers. There did not seem to be any desire to change the (kind of) involvement of the student perspective, other than what has already actually been done (although students had heterogeneous preferences for the forms and potential forms for enquiry of their perspective). The student project team members had some mixed feelings towards the collaboration. They more often brought up conditions that would be required for meaningful collaboration (e.g., feeling that teachers take up their perspective (for motivation), the distribution of power and control, and the relationship of dependence between teachers and students).

6.4. Case D

Contextual information

Case D is a project led by a project leader from an applied science university located in Switzerland. The main project partners were based in the industrial practice and work in the field of technical engineering; meaning that in their work, norms and standards have significant influence. These are important topics, which every student or employee in the field has to deal with. Beyond that, norms and standards are fast developing, which by their very nature requires a lifelong learning approach.

In comparison to the other three projects, Project D is not one where the target is a specific course about norms and standards in the field. Instead, the project aimed to develop a new learning concept. Different (combinations of) formats were therefore possible, with not only students from the higher education context targeted. Learners at all educational levels and within different contexts (e.g., the workplace) are meant to be able to learn with the concept.

Cross-contextual matters

The high number of norms and standards in the field is a topic that concerns different educational and professional contexts and learners. Learners encounter the topic more than once in their learning biography. Compared to the other projects, Project D was not developed from the perspective of the individual learner, but from the objective to develop a platform that serves all with courses and learning paths that can be adapted to an individual's needs. This wide approach therefore leads to numerous cross-contextual matters, because learners need to be able to use the concept within different contexts (e.g., different schools, different educational levels, different workplaces) and at different times (sequentially, for different levels of learning objectives). From the perspective of the learner, learning will be especially cross-contextual over time, as they progress through different stages (in different contexts) of the learning process. Up until now, the learning contexts across the various different stages have not been related.

Cross-contextual objectives

As described, the cross-contextual objective requires the development of a learning concept that serves different kinds of contexts and a wide target group of learners. In doing so, both the different contexts and target groups are aimed to be interconnected. The idea here being that if all contexts use the same learn-

ing concept, less seams will emerge between the various contexts (thereby ensuring continuity). Integration of the same knowledgebase across different contexts would lead to more shared understanding and a (peer) learning network, which aims to make working with norms and standards easier.

Next to that, the project targeted a learning concept that would allow learners to keep up with the rapid changes regarding the learning content, which empowers lifelong learning.

Cross-contextual intervention and supporting measures

In Case D, the learning concept is a learning platform, which will need to serve a heterogeneous group of learners; meaning that possibilities for individualisation must be integrated. What the platform will look like exactly very much depends on the needs of the individual learners, and would be put into concrete terms first during the project.

Development of the intervention

The development of the platform took place within the project, and the 'default' process was followed. What was special in Case D was that the project partners from the industry were all significantly involved throughout the development process. This involved not only project leaders, but also potential users of the platform (i.e., the learners). For the project team members themselves, this may seem natural; however, compared to the other cases, Case D was unique in that no other case included such a level of learner involvement during the project process itself. Although also in this case, only learners from the industry were involved in the analysis and development phase, students from different educational institutions were targeted as well. Like in the other cases, the students were involved in the testing phase.

6.4.1. Project Leaders Perspective on Cross-contextual Learning

Problems

The main problem that the project leaders described, was the rapid changes seen in learning content, especially in recent years (*MSL 3: learning across time*). The learning content has become very extensive. Beyond that, old norms and standards have been replaced by either new or other norms and standards. These widespread change in practices have led to many people no longer having the same significant overview they perhaps once had (*MSL 9: prior vs. new knowledge*). This is especially relevant for employees who are required to work with norms, as it has become increasingly difficult to find one's own way through the jungle of today's norms (*outcome: motivation*) and to stay up to date.

Next to that, the field of application is also very broad. Employees work with the learning content (standards) in many different ways. Along the development process of a product, people from all levels and disciplines along the development chain are required to work on or with the required standards. Some need to be able to apply them, whilst others need to be able to understand them, and some need to be able to evaluate and measure them. This means that the relevance for the individual learner can differ considerably. The way that learning content should be prepared for today's heterogeneous group of learners needs to be adapted to the way that the knowledge will in reality be applied. This means that (the same) knowledge needs to be prepared according to a needs-oriented and practice-based ethos (what is not always the case yet).

Next to that, the project leaders described that the didactical way of instruction is now no longer current, has become outdated, and therefore the sustainable learning outcome can be improved upon through the application of more innovative learning concepts (*MSL 10: multiple pedagogical or learning activity models and approaches*).

As lifelong learning is widely considered necessary in order to stay up to date, learners are required to maintain contact with topics across different educational settings. This starts off in vocational education, or at an applied science university, and continues on through various further educational settings and learning within the workplace, which of course can include numerous settings and contexts. However, continuity of the overall learning process is problematic at best (*MSL 3: learning across time*). The project leaders described gaps between prior and new knowledge, as the different educational settings are not largely aligned to one another (e.g., level of difficulty, repetition) (*MSL 9: prior vs. new knowledge*).

Solutions and supporting factors

The project leaders suggested one new learning concept as the solution in order to provide up-to-date learning content, which addresses all target groups across different educational levels. From the project leaders' perspective, this was the main requirement for an effective learning concept (*MSL 3: learning across time*).

A one-size-fits-all type of solution aims to foster continuity across the learning process. Also, it aims to counter coordination problems between the different target groups, which are meant to become an integrated network with an enhanced shared understanding (compared to the actual situation).

Due to the significant need for individualisation, many different teaching and learning methods have relevance. The main characteristic of the concept is adaptiveness to the learners' situation, with regards to both the learning content

and the learning methods employed (*MSL 10: multiple pedagogical or learning activity models and approaches*). In order to be able to realise such an adaptive concept, the project leaders noted there being a clear need for a modular organisation of the learning content. Next to that, a combination of different modern approaches and didactical methods (with a focus on application, discussion, and examples) would help to realise the required level of flexibility, thus allowing learners to become self-organised learners (*MSL 10: multiple pedagogical or learning activity models and approaches*). Both self-organised learning and flexibility aim to foster the required motivation to work with today's complex and extensive learning content (*outcome: motivation*).

6.4.2. Learner Perspective on Cross-contextual Learning

Problems

The first problem that the learners described was that learning content was often extensive and overly complex. It is therefore difficult to achieve an overview (*MSL 9: knowledge synthesis*). Second, it can be difficult to find answers to a problem as resources are difficult to find (*MSL 5: access to learning resources*). Next to that, one cannot always be sure that the resources are trustworthy or even actually valid (*MSL 5: form of the learning resources*).

Beyond that, resources are not always adapted to the needs of the individual learner. Mostly, learners are required to learn about a norm just in time it is required, and thus at the moment of implementation. The learners described that there is sometimes too extended information. In some situations, the learners only lose time and become demotivated or even frustrated until they find what they need, but in other cases, the relevant information may simply not be available to the learner. The information available can simply be too short or too concise; hence, more information is needed just to be able to find an answer to the question or problem (*MSL 5: form of the learning resources; MSL 5: access to learning resources*). Facing all these kinds of issues can be very time consuming, which presents unnecessary difficulties within the everyday workplace (*MSL 3: learning across time; outcome: motivation*).

A third problem, that was also intensively discussed, was that different learners can interpret the same learning content in different ways. Naturally, this hinders working with standards and can result in coordination problems as well as mistakes in the workplace (*MSL 2: individual and social learning*). The following discussion about a workplace situation emphasises this problem (and also presents some potential solutions):

But that is exactly the point. That the idea or the function of the surface, this table's surface, comes from the designer, from the person who creates it and who says "I want that". And now somebody has to produce this table. And this person must be able to say "okay, that's how the table has to be", because that's now it is written on the document. And he will also measure it. (Learner 4, Case D; Focus Group; Line 63; #00:10:48-8#)

And if he doesn't know, then he can use the same knowledgebase, where it is described how to produce it or what it should be. How he finally does it, I can leave it to him, but he has to know, "ah this is what the constructor means". (Learner 1, Case D; Focus Group; Line 64; #00:11:00-8#)

But we also know... (Learner 2, Case D; Focus Group; Line 65; #00:11:02-9)

...that it works "perfectly" [sarcastic, everybody laughs] (Learner 3, Case D; Focus Group; Line 66; #00:11:06-2#)

...that a producer thinks slightly differently than a constructor. That a constructor in tool-making works very very detailed....And that a machine builder with 10 metre steel girders, has a quite different, quite a different umm, how do you say, has a different understanding of the details... (Learner 2, Case D; Focus Group; Line 67; #00:11:50-4#)

It is okay, if the constructor has this view, he will put it like that on the drawing. But in the end he also wants that. If this doesn't work, doesn't fulfil the function, yes well, then he has drawn it wrong....So the input must already be correct... (Learner 4, Case D; Focus Group; Line 69; #00:12:15-4#)

But then there is also the question of how the producer understands what is written on the drawing, because you can interpret it differently. (Learner 5, Case D; Focus Group; Line 70; #00:12:21-8#)

In summary, learners experience problems in keeping up with current standards, because they are difficult to find as well as difficult to interpret and to work with. This is especially true where norms and standards need to be disseminated to many different learners, who each have their own way of comprehending them.

Solutions and supporting factors

In the given conversational excerpt, a tentative solution was suggested: The learners wish for one learning concept, with access for all (*MSL 9: knowledge synthesis; MSL 5: access to learning resources*). In this concept, learning content needs

to be kept fully up to date, proven, and reliable (*MSL 5: form of the learning resources*). This is meant to lead to one language for all, which presents all known problems and their interpretations (*MSL 2: individual and social learning*). All of the learners agreed that such a network is important. The more that is known about how someone's colleagues work with the standards, the better they can align their work to that of their colleague.

With regards to the didactical form of the concept, the learners listed a number of important factors. First, learning content should be explained well. However, when enquired further, the learners' definition of 'explained well' was somewhat ambiguous. The learners agreed that learning content needed to be structured with different levels of detail (*MSL 5: form of the learning resources*). This would resolve the problem of having to read more or less than actually needed when trying to solve a problem. With regards to time, the learners mainly discussed just-in-time concepts (*MSL 3: learning across time*).

As to the level of detail, the learners discussed that this level needed to be adapted according to the relevance of the problem. This means that learning content needs to be provided in a well-organised and modular way. The idea here being that a learner can then decide for themselves to what extent they want to elaborate upon or to seek out further information with regards to any given topic (*MSL 5: form of the learning resources*).

Next to that, the modular structure of learning content should make it more accessible in general (*MSL 5: access to learning resources*).

Last, some of the learners articulated their preference for learning with concrete examples, whilst others preferred the use of templates, and some expressed a preference to learn and work using learning videos (however, the learners mostly did not see this as being realistic).

Overview

Table 18: Overview and Relationships between Problems and Supporting Measures from the Learner Perspective in Case D

<i>Problems (learner perspective)</i>	<i>Supporting measures (learner perspective)</i>
MSL 9: knowledge synthesis (encompassing different fragments of knowledge: learning content is extensive and complex)	- Learning content in one learning concept - Learning content organised in different levels of detail
MSL 5: access to learning resources MSL 5: form of the learning resources (learning resources untrustworthy and invalid)	- One learning concept with access for all - Modular structure to make learning content accessible (findable) - Fully up-to-date, proven, and reliable learning content
MSL 5: form of the learning resources MSL 3: learning across time Outcome: motivation (learning material does not fit to (just in time) learners' needs (too extensive or too concise))	- Learning content organised in different levels of detail (to be able to find learning content adapted to one's needs) - Well explained / presented learning content
MSL 2: individual and social learning (different interpretations of same learning content makes it difficult to learn and work with the content collaboratively (e.g., coordination needed))	- One learning concept with access for all, allowing for building shared understanding and network (same base of knowledge, same language)
Requirement: time - Lack of time	- Learning content organised in different levels of detail (to be able to find learning content quickly and adapted to one's needs)
	<i>Other supporting measures (not related to specific problems)</i> Different ways of presenting learning content (e.g., practical examples, templates, learning videos)

Table 19: Overview and Relationships between Problems and Supporting Measures from the Perspective of the Project Leaders in Case D

<i>Problems (project leader perspective)</i>	<i>Intervention and supporting measures (project leader perspective)</i>
	<i>Learning concept / platform that allowing individualised learning</i>
MSL 3: learning across time MSL 9: prior vs. new knowledge - Rapid changing learning content (difficulty staying up-to-date) - Increasingly extensive learning content (missing overview, influencing motivation)	- (Only) Up-to-date learning content - Fully accessible - Self-organised learning and flexibility aim to foster motivation to work with today's complex and extensive learning content
Different ways of application of the same knowledge base by different learners	- A one-size-fits-all overall solution that includes different teaching and learning methods (which enable individualisation, adaptiveness, and flexibility) - Modular organisation in order to foster self-organised learning - Shared understanding across different groups of learners
MSL 10: multiple pedagogical or learning activity models and approaches (outdated didactical concepts)	- Innovative learning concepts (focus on application, discussion, and examples)
MSL 3: learning across time MSL 9: prior vs. new knowledge (educational settings aimed at teaching norms and standards not aligned)	- A one-size-fits-all solution to foster continuity in a lifelong learning process across different educational contexts

6.4.3. Comparison and Interpretation of the Learner and Project Leaders Perspectives

When the descriptions of problems and supportive measures from the project leaders' perspective were compared with those from the learners' perspective, many similarities were actually found (e.g., extensiveness of the learning content, actuality and access of the learning resources, and the need for individualisation).

The differences in the description of certain problems can often be traced back to different perspectives. Project leaders tend to look at problems and supporting measures from a design point of view (e.g., heterogeneous learners), whilst

learners look at problems from their own individual perspective (how the structure or level of detail in learning content fits to their needs). Both parties described elements of empathising with the other's perspective, but overall they each mainly described the problem from their own perspective. Content-wise, the same problems were articulated; however, they were sometimes described slightly differently.

With regards to the supporting measures, the learners described what their requirements for the success of a new learning concept were. For example, they went deeper in terms of the levels to be included within a modular structure (elaboration level of content, problem-oriented relevance). The project leaders thought and reasoned what the solutions could look like from a didactical perspective (self-organised learning, modern didactical methods). Overall, both perspectives seemed to complement each other, rather than to contradict.

The similarities of the perspectives can be explained through the collaboration of the project leaders with the learners during the problem analysis phase. The collaboration of these two parties is described in the following section.

6.4.4. Involvement of the Learner Perspective in Educational Design Processes

Case D is the most difficult in terms of defining the roles of the different project team members. The main project leader works at a higher education institution, and works together with two companies from the industry. Both these companies also have one or two of their own project leaders. From the project perspective, they are considered as the customers of the product developed within the project. However, within the wider project, each company also has a number of employees that are involved as 'future learners'. From the perspective of the project leaders, these employees are the users of the learning concept developed within the project. Thus, there is a kind of middle project management level, that has both knowledge as future learners and also as project leaders. In the interviews conducted with learners, they responded according to their role of a future learner.

Learner perspective

The learners described that, because of their close collaboration, the project leaders (by then) knew the perspective of the learners well, and described there being only some small discrepancies. They also described how information comprehended by the project leaders would have been less had they not involved the learners in the way that they did.

Importance

The learners described it being important to enquire information about the different types of learners, because each perspective can differ significantly. In order to be able to develop a learning concept that best fits to the customer, it is important to know and understand the perspective of the customer. The learners described this being important in using the learners' expertise on content as well as to collect information about the way in which they best learn.

The learners described that a top-down developed and implemented concept for learning would not work in actuality. They saw the involvement of learners as a fundamental requirement for any successful learning concept.

Forms and potential forms

As previously described, the learners were also (partly) perceived as project team members. During the DBR-process, they each took part in a focus group where they were able to share their perspective. Beyond that, they also joined a workshop to design and construct a prototype of the learning concept.

The students were satisfied with the way they had been involved at the point of the current study. However, for the future process, it may become important that the perspective of a broader group of learners will be sought. In this regard, the participating learners also considered working with questionnaires. The learners discussed that it is important to fit the method of enquiry to the person, as some preferred to talk on a 1:1 basis, others in group situations, whilst some preferred written correspondence.

Timing

The learners described that the involvement of the learners was important from the beginning, and mentioned that it should start 'as early as possible'. At the beginning they found it important to have a representative group of learners involved, but later in the process, they mentioned involving even more learners so as to gain a broader base of feedback on the developed learning concept.

Integration and implementation

In Case D, it was difficult to distinct the methods for enquiry of the learner perspective from the methods to integrate the learner perspective in the design process. The perspective of the learners was initially used to define the objectives of the project. Also, their ideas were used with regards to the development of the learning concept. As described above, the learners were considered as being

full-valued members of the project group during the development of the prototype.

The learners described that they found this to be a good means of involvement. However, they also noticed how difficult it is to integrate all the different visions from all (different kinds of) members. They recognised that it is not possible to meet all the needs and wishes of the different learner groups.

Conditions

For productive learner participation, the learners described it being important that the relevance for the learners was made very clear. In terms of their motivation to participate, they expressed having needed to see what would be better for them through their participation (return on investment).

Power and control

The topic of power and control was not seen as a significant deal in terms of the interviews, which might be explained by the learners having been involved as project team members (also having been granted the time to participate by their managers). The students described that the project leaders were responsible for the further proceeding of the process; however, they also wanted to be kept up to date and still have some involvement. They were reportedly convinced that the success of the project was partly due to their involvement as project team members.

Consequences of the participation

In Case D, the learners described that they learnt a lot by participating in the project, including having learnt about the perspectives of other learners (for instance, from the employees of other departments).

Perspective of the project leader

The interviewed project leader in Case D described believing that he mostly already knew about the learner perspective. During the DBR-process, the project leader only noted a few small discrepancies; however, the project leader was also very conscious that a full understanding of any heterogeneous group of learners would never be realistic.

Importance

The project leader considered it important to involve the learners, as through that way, different perspectives could be contemplated and understood. The

project leader argued for customer orientation, and said that the learning concept would not work where there was no adaption to, or support from, the learners. According to the project leader, a top-down implementation without the involvement of (a representative group of) learners simply would not work.

Well, I think that's personal, but I also think it can have a big impact. Maybe the opinions towards that are a little bit different. But in the sense of how to involve their perspective: they need to be part of it, and to feel part of the whole thing. So, you don't just have an idea... I think it finally supports motivation. If somebody comes to you and says that's the coolest thing, then I think that's a different motivation compared to when they have to learn something. When they can actively participate and say what they think is cool. Umm, I think that's for sure. So I think it has a big influence on how it is accepted afterwards. Yes. I think it will be used better if they have participated from the beginning. (Project Leader, Case D; Interview; Line 97; #00:29:32-0#)

Forms and potential forms

The project leader described that the focus group, (informal) conversation, and a project intern workshop were the methods used to enquire about the learners' perception and needs. This can be referred to as the problem specification phase. Afterwards, during the development phase, the learners took part under the role of developer as well. They formed part of the team tasked with constructing the prototype. The project leader described that this was an important step, because the learners were challenged to concretise both their needs and wishes.

The project leader described that the project team worked more independently from the learners during the development phase (when prototypes had been collaboratively developed), but that the learners would be involved again during the both the pilot and evaluation phases. With regards to the implementation, the project leader expected to implement a questionnaire in order to obtain insight into the perspective of a broader public (compared to the selected group with whom the team collaborated during the design phase).

Timing

The project leader described that the means of involvement partly emerged because of the shared assumption that 'that is the way it works'. Due to the self-evident understanding of customer- or learner-involvement, the project team decided from time to time to involve future learners. With regards to the time points, the project leader described finding it important that the moments of involvement were consciously chosen. The time points should be continuously

reassessed throughout the project, because involvement is important across different stages of the project proceeding; however, it also needs to be consciously decided when involvement would be actually meaningful. In the current project, the project leader described that the involvement at the very beginning was low. Although after the collaboration was good, by the next phase it had subsided a bit.

Integration and implementation

In Case D, the previously described collaborative form of involving the learner (perspective), led to the integration and implementation of information gained about the learning perspective, which happened automatically as the learners brought in their own perspective when they collaboratively developed the prototype with the team.

Conditions

Conditions which played a role in the organisation of the learner involvement included the need for a representative and motivated group of learners. With regards to their motivation, the involved learners needed to secure time available for their engagement in the project (from their managers), as their involvement could not include voluntary work in their own time. Next to that, their motivation depended on the trust that their contribution would be considered worthwhile, and would benefit from the outcome of the project in the long term.

In addition, organisational factors also played a role. It was more difficult to involve learners from the higher education institution due to organisational issues, although they were also one of the target groups of the project. This led to them not taking part as project team members during the development phase (joining later on during the testing phase for the first time). Therefore, due to this, the project leader stated that it was important to consider heterogeneity across the different target groups, and to be conscious about the sample of learners, which did not include students.

Power and control

In Case D there was an understanding of shared responsibility. The project leaders were responsible for the scheduled continuance of the project; however, with regards to the content, the value of the contributions was deemed to be split equally between the project leaders and the learners. The project leaders however were responsible to reflect upon the contributions of the different perspectives, and to consider the extent of representation prior to implementation.

6.4.5. Interpretation of the Involvement of the Learner Perspective

The learner perspective

The learners had the feeling that the project leaders knew the perspective of the students, and described this as being important to them. They mainly attributed their insight as due to the continuous collaboration with regards to the development of the learning concept (from the initial problem analysis through to the prototype development). The learners argued that such collaboration was necessary in order to implement the learner concept, and that this required the support of the learners, and could only happen where the learning concept was developed according to a bottom-up approach. The learners described that a representative group of motivated participating learners was important in order to be able to enquire about and to implement the perspective of the learner within the developed learning concept. The learners described having learnt a lot from their participation.

The perspective of the project leader

The perspective of the project leader was very similar to that of the learner. Also the project leader thought that, due to the collaborative working, enough was already known about the learners' perspective, and considered that this was important. Also with regards to the forms for enquiry, implementation, and the conditions that influenced enquiry and implementation, the project leader argued the same as the learners. In terms of the timing, the project leader added that conscious decisions about when and who to involve was important. The project leader also added feeling responsible to keep the project moving forwards and to integrate (and reflect upon) the different perspectives.

Overall, the actual form of collaboration between the project leader and the (future) learners seemed to be experienced positively by both parties. There did not seem to be a demand to change the (kind of) involvement of the student perspective other than what had already actually taken place. Although the comparison of the perspectives on the involvement of the student perspective was not central to the current study, it was notable that the perspectives of the project leaders and the (future) learners were in fact very close to each other.

6.5. Case Comparison

In this section of the chapter, the results of the individual cases are compared with each other. Similarities and differences are examined in order to learn how the context-boundedness of the results may be interpreted. This section only

presents a view of the results of the comparison; whereas the discussion, interpretation, and implications can be found in Chapter 7 and Chapter 8.

With regards to the case comparison, several points regarding teacher perspective should be made upfront. A comparison of the teacher perspective across the different cases was not planned within this study, primarily as the student perspective is central to the overall study (RQ1 and RQ2). With regards to the teacher perspective (RQ3), only the comparison of discrepancies between the student and the teacher perspective was analysed across the cases.

Still, a remarkable similarity between the teacher perspective across the cases was found in the topic of relevance. In all of the cases, the teachers aimed to enhance cross-contextual learning in order to improve the visibility or experience of the learning content relevance. Therefore, they planned to build bridges to existing contexts or to involve new contexts. From the perspective of the teachers, this was mainly aimed towards fostering student motivation.

Next to that, in all cases it was aimed to foster continuity across different educational levels (e.g., prior educational contexts/degrees and future courses) or for the transition to the professional field. Whilst this may have been expected because of the objectives of the seamless learning lab, however, in most cases, it was not implemented and measured during the lifecycle of the project. Except for Case D, only one context was taken into account during the project. Both points will be taken up in the research agenda (see Section 8.3).

With regards to the student perspective case comparison, one point regarding the different contexts should be made upfront, as it helps to explain some of the case comparison results. In terms the development stage of the projects, for Case A and Case D, data was collected during the early development state of the project. The students had no experience with the intended intervention and supporting measures at the time the data was collected. In Case B and Case C, the teachers had already implemented the first aspects of the intervention, and established the project based on their initial experiences. This might help to explain why the students talked about problems and requirements regarding the implementation of the intervention next to ideas for the conception of the intervention. In Case A and Case D, potential problems and requirements regarding the implementation were discussed in a hypothetical way. Of course, in those cases, the students could only rely upon their experiences from other situations and transfer them to the actual problems. At the time where the TAP-data was collected, the students in all cases could rely upon first experiences.

6.5.1. Students' Perception of Problems with Cross-contextual Learning²⁰

In this section, the problems and dimensions discussed in two or more cases, are presented. This exercise heightened the view of how similar the issues faced were between the cases, as well as how they can to be differentiated.

Problem Dimension 1: When the access or connection to contexts –which makes visible and experienceable relevance of the learning content– is missing, problems with the tangibility of abstract learning content emerge.

This problem came to the fore especially in the cases that mainly targeted course at applied science universities for implementation (i.e., Case A, Case B, and Case C). In those cases, the students perceived the access or connection to practical contexts being absent. In the different cases, the access or connection to different kinds of practical contexts is described. First, there are future educational contexts (*MSL 3: future contexts/work*). These are contexts in which abstract learning content is taught, and the knowledge and competences are taught as prior knowledge for those contexts. Second, there is the future professional context (*MSL 3: future contexts/work*). Third, there are daily life contexts, which make visible what abstract knowledge looks like in practice (*MSL 1: formal and informal learning*). The three contexts would visualise how the abstract knowledge is applied and how it can be applied in practice. In each context, students would be enabled to recognise or apply what they had learnt within some contextualised form. This would make abstract (decontextualised) learning content more tangible and concrete, and therefore more understandable (*MSL 9: theoretical vs. practical knowledge*).

Students in the three cases described this as one of the biggest problems in reaching the assigned learning objectives. In Case A and Case B, the students described it as being necessary for the tangibility of the learning content, whilst in Case C, it was a deeper understanding of the theory. In Case A and Case B, the students described that tangibility would foster understanding. In Case C, the students described that knowledge of project management theory alone was insufficient when it came to working with it. They argued that experiencing the theory within a practical context was a clear requirement for their competence development.

In Case D, the problem was described the other way around. The learners had access to contexts which make visible and experienceable learning content in a

²⁰ In the subtitle (and in the upcoming subtitles) the word 'student/s' rather than 'learner/s' is used, because it best fits the current study's context of higher education. Learners -as used for Case D- is included and equally valued, although not explicitly mentioned each time. The same counts for 'teacher' (including project leader/s).

tangible way. However, they experienced a misfit with the presentation of the theory in the formal learning context (e.g., learning resources). In this case, the learners experienced the theory not being understandable, applicable, or useful in the way it had been presented. Thus, in Case D, access to the practical context was provided; however, connection between the two contexts was seen as being problematic, which also relates to Problem Dimension 2.

Problem Dimension 2: When there is an instruction-based context as well as a context to apply the learning content (e.g., in class), problems emerge when the theory and practice are not bridged.

Related to Problem Dimension 1, Problem Dimension 2 deepens the relation between instruction-based contexts and contexts where the learning content is applied (mostly in-class). The students described experiencing the contextual transition as problematic or challenging, especially with regards to the application (compared to the focus on understanding in Problem Dimension 1) (*MSL 8: multiple learning tasks; MSL 10: multiple pedagogical or learning activity models and approaches*).

The problem is located in the connection or bridge between the contexts. Students described it as problematic when they did not feel adequately prepared to manage the transition (*MSL 9: prior and new knowledge; MSL 9: theoretical vs. practical knowledge*). This can be the case when the instruction or support was missing or not just-in-time (e.g., Case B, Case C, and Case D). For instance, in Case B and Case C, students described that an explorative (or experiential) setting to apply learning content did not make sense, as long as the fundamental knowledge was absent. This was why they evaluated learning approaches which centralised exploring or learning by doing as hindering to both applying and understanding where the gap was too significant. In this case they mainly described it as a waste of time.

Consequently, timing seemed to be very important. The students described the availability of fundamental knowledge and expectation management as being of significant importance. When this was not the case, they described negative feelings such as overload, overstraining, and low self-efficacy.

In Case B, Case C, and Case D, just-in-time availability of learning resources (materials or personal resources) was one additional point of discussion with regard to the problematic relation between the two contexts.

In Case A it was described that the first time of applying learning content was challenging, although they described a good timing and fit of the instruction and context where learning content was applied.

Problem Dimension 3: When there is a cross-contextual learning arrangement (approach, tasks), students experience it problematic when the cross-contextuality is not mirrored in the assessment setting.

In Case A, Case B, and Case C, this was an intensively discussed problem area. All of the students described that the use of different contexts and learning experiences in different contexts (e.g., different contexts over time, instruction-based vs. contexts for application) did not make sense, when the weighting of the different learning experiences and the integration was not subsequently considered in the assessment (*MSL 10: learning and assessment contexts*). This can concern different kinds and fragments of knowledge (*MSL 9: theoretical vs. practical knowledge*), and can also concern different tasks (*MSL 8: multiple learning tasks*).

In Case A, the students described assessment as being more difficult than exercises within the learning setting, because the integration of different fragments of knowledge had not been central to the learning context, but was required within the assessment context. In Case B, students described uncertainty of the assessment context, which hindered the development of appropriate learning strategies as preparation for the assessment context in the learning context. In Case C, the students described that students were supposed to apply agile principles in the learning context. However, this was not found to be relevant for the assessment. In these cases, the missing relations between the learning and the assessment context led to an ineffective learning context with regards to the objective of learning.

In Case D, the respondents in the focus groups were not confronted with formal assessments (at that time). This, however, does not mean that Problem Dimension 3 will not become a problem at some future point in time when assessments might come into play as well.

Students' perspective on problems that were perceived by the teachers

In this section, two themes are addressed, which were found to be important to both the teachers and project leaders. The student perspective on these problems was enquired with questioned about those themes (see Sections 5.4.2-5.4.3). Therefore, the problem perception might have been suggestively triggered; however, the themes still appeared to have relevance or potential in the cross-case comparison.

Problem Dimension 4: When access or connection to contexts –which make visible and experienceable relevance– are missing, problems with student motivation emerge.

All of the students and learners shared the teacher perception that motivation is higher when the relevance of learning content becomes visible or even experienceable. The teachers evaluated the lack of visible and experiential relevance because of a fragmentation of the learning and authentic contexts as problematic to student motivation (*MSL 1: formal and informal learning; MSL 3: future courses/work; outcome: motivation*). However, the students described still having a certain form of motivation. In Case A and Case B, the students described being generally interested in the topic. In Case A, Case B, and Case C, the students described that knowing that the learning content was important in terms of their future courses or to their future professional field was sufficient to prevent from a lack of motivation. Even when they only knew this on a metacognitive level and could not explicitly explain how the learning content was of likely relevance to those fields, they still did not suggest that motivation was likely to be problematic. Still, the students in all three cases agreed that access and connections to learning contexts which led to visible and experienceable relevance would foster motivation. The students confirmed that learning content would appear even more meaningful, and thereby their motivation would increase.

In Project D, the learners described the essential connection between the learning context and the context that it is being learnt for. When the connection between theory and practice is not provided or obscured, they described experiencing decreasing motivation (until amotivation). Thus, the learners in Case D described the connection as an absolute requirement for the effectiveness of the learning concept that was aimed to be developed.

Problem Dimension 5: When a gap between the prior educational context and the actual educational context exists, this is problematic with regards to learning new knowledge and competences.

All of the students and learners shared the same perception as the teachers, in that reaching the learning objectives would become more or less difficult depending on prior knowledge levels (*MSL 3: prior educational contexts/degrees; MSL 9: prior vs. new knowledge*). The students in Case A described that they recognised the teachers' descriptions of problems regarding transitioning from prior educational contexts to a new context. Retrospectively, some described that the transition from the BMS or Gymnasium educational context was a challenge. In Case B and Case C, the students described a gap with regards to the complexity of certain new learning content. The level of complexity was not found to linearly increase with regards to the level of complexity experienced

within the prior educational context (e.g., how to learn agile project management when normal project management had not been sufficiently understood first).

The students explained that the intensity of the problem-experience was limited somewhat, because teachers integrated supporting measures in order to be able to catch up. Also, they found ways to deal with this challenge such as self-study and peer learning. Whilst the students welcomed support with regards to transitions, they also saw this as being very difficult for teachers due to high levels of heterogeneity between students. Although supporting measures could help foster cross-contextual learning, the students did not categorise this as a high-priority problem.

The learners in Case D described the heterogeneity between different learners as one of the more significant challenges with regards to the development of an intervention. For them, it was considered important that the presentation of learning content was adapted to their prior knowledge, because they needed to be able to apply the standards as just-in-time due to limited time availability to repeat learning content or to self-study between the prior and current contexts.

In summary, these were the problem dimensions that were found to have relevance in two or more of the cases. Overall, it became clear which problems were relevant at the applied science universities with similarities across the two locations, courses, countries, and discipline areas. The problems were also found to be present in Case D too; however, the learners often looked at them from a different angle and explained the meaning in different ways. The interpretation and discussion of the problem dimensions finds place in Section 7.1.

6.5.2. Students' Perception of Supporting Measures

The cross-contextual learning scenario potential, as well as the supporting measures were then compared across the cases, with supporting measures that were discussed in two or more cases also presented. Similarities were examined in greater depth between the cases, as well as how they need to be differentiated. In advance, it is important to note here that the supporting measures often differed by case with regards to a singular problem. For instance, for problems related to learning across time, the students described different supporting measures in each case. In Case B, the students considered it sufficient to be (meta-cognitively) prepared by the teachers. Being conscious about the gap prevented further problems from emerging. In Case C, the students described their need for instruction. In Case D, the students asked for just-in-time learning resources. The relation between a supporting measure and a problem dimension needs to be considered where the supportive measures are described differently

within two or more of the cases. A summary of the problems and supportive measures in relation to each other is presented at the end of the section.

The potential of cross-contextuality to resolve problems

As described in Section 5.5, not only problems with regards to the connection between and the integration (encompassing) of learning experiences in different contexts was addressed in the current study, but also missing access and connections to contexts which could foster learning. The different (kinds of) contexts, which can be existing or newly designed, is discussed first. Then, boundary objects, persons, and activities are also discussed, which each support the connection between and the integration of different contexts.

Authentic contexts and learning tasks

Especially in Case B and Case C, the involvement of an authentic context has been seen as the main solution to problems regarding the visibility and experienceable relevance of the learning content (both with regards to understanding and motivation) (Problem Dimension 1 and Problem Dimension 4). The students in the two cases described that elements from the world outside (practice, industry, or daily life) should be integrated into the course. According to the students, this could be implemented through authentic learning approaches and methods, and/or through authentic tasks (e.g., experiments, simulations, practice partner/s). Although the Case A students did not consider it to be the primary solution, they welcomed the idea to integrate elements from future educational contexts and daily life into the classroom as well. In Case D, the learners who participated in the focus groups stated that access to authentic contexts was provided for them, hence this supporting measure did not offer new potential. However, in Case D, the respondents in the focus groups were not the only targeted group, which means that this supporting measure may hold still relevance for Case D with regards to the other target groups (i.e., students).

Digital, virtual worlds

The inclusion of authentic contexts is not always possible, hence the students discussed digital solutions as alternatives. In Case A, Case B, and also in Case C, the implementation of authentic aspects was planned to use, or to be supported by, educational technology. The students saw potential in this regard; however, both the implementation and usage of digital tools (apps or software) was considered important to them. The students described that the tools need to be handled as a means to an end and not as an objective itself; i.e., as a method that could be used to help reach a certain learning objective. For example, in Case B,

the students explained that exploring through simulation did not make sense where there is no prior knowledge. The integration of simulations alone was not considered adequate to reach the given learning objectives. The students in Case A shared this opinion. The app (as the intervention proposed by the teachers) was welcomed by the students, with the requirement that it fostered the application of the learning content. The students critically noted that the app should not be implemented 'just to implement an app as an innovative didactical measure'. Thus, according to the students, the success of the intervention would depend on its implementation.

In Case D, the students emphasised the potential of using digital tools to foster individualisation and flexibility; which for Case D meant the integration of the learning context within the workplace context.

Boundary objects, persons, and activities as connections between contexts

Where different contexts become a requirement for learning, the students reflected on different interventions and supportive measures that could be applied in order to connect the different contexts. This was addressed with regards to seams that they experienced due to cross-contextuality within their respective learning scenarios.

Refreshing prior knowledge

With regards to seams between the prior educational contexts and the current educational context (Problem Dimension 5), the students described two kinds of boundary objects that they experienced to be supportive. In the case where prior knowledge was absent, an *introduction* (starting from the beginning) was used as a means to supporting the students. In the case of a time-lag between the prior and current context, *refreshment* of the required prior knowledge was considered supporting. This approach helped to connect the prior and new knowledge and contexts, which was a reported requirement to understand new knowledge.

Learning resources

In this category, both personal and material learning resources were included as boundary objects. With regards to problems between an instruction-based context and a context where learning content has to be applied (Problem Dimension 2), students in Case A, Case B, and Case C each termed the collective solving of exercises as a supportive measure, as well as teacher availability during the individual solving of exercises. They described scaffolding and feedback as an important approach (personal/teacher resources).

Also, the students described learning materials which helped to make the transition retraceable as being of significant importance for self-study and for the repeating of learning content as/when required. Also, in Case D, learning materials which allow for self-study were emphasised as being important. In this regard, they described ease of resource availability as a requirement together with reliability (as in materials need to be up-to-date, accurate, and appropriate).

Examples

Where deemed not possible to integrate authentic contexts or tasks (for Case A, Case B, and Case C), the students suggested alternative boundary objects to connect to contexts that offer more visible or experienceable relevance (Problem Dimension 1 and Problem Dimension 4). They described concrete examples (introduced by the teachers) as being appropriately supportive. Also, references to future and everyday situations where the visibility became clearer were also considered to be supportive (meta-communication). Although not the same as experiencing actual relevance, this approach can still be seen as supportive. In Case D, the learners described examples as supportive that relate learning context within their workplace context. They described examples that supported their understanding of (the application of) industry norms and standards.

Boundary persons

As described in the section about learning resources, the teacher is often seen as a boundary person. Also, their availability and support were described to be a supportive measure in order to encompass instruction-based contexts with contexts for application (Problem Dimension 2). Also, teachers are seen to be responsible for the design and implementation of the boundary objects. Here, the distinction between boundary objects and persons becomes more difficult.

Beyond the teacher, no boundary persons or brokers were described (in more than two cases). Whilst in Case C the integration of a partner from the industry was described, boundary persons were not mentioned as supportive measures in the other cases.

No boundary activities

Boundary activities were not mentioned in two or more of the cases. In Case C, the students explicitly mentioned acting within the simulation of an authentic context as a desired boundary activity. In this case, one student also proposed reflection as a boundary activity with regards to the seam between theoretical and practical knowledge. The student described how critical reflection between

theory and experience could present an option to learn how to deal with the gap between the learning context and the professional context, as explicitly addressing the gap would help to learn from it.

In the other cases that worked with the boundary objects (e.g., experiments, simulations, apps), the students did not explicitly mention these as boundary activities; instead placing themselves in more of a consumer's role. Boundary objects are supposed to establish or highlight connections; however, the students did not emphasise their own activity, which would help them to cross boundaries themselves. The distribution of boundary objects, persons, and activities are discussed in Section 7.2.

Requirement for an effective implementation of interventions

As described in Problem Dimension 3, gaps between the learning context and assessment context can influence the effectiveness of cross-contextual learning scenarios, interventions, and supportive measures. The students described clear expectations (Case A, Case B, and Case C) (eventually through the implementation of mock exams for Case A and Case B) and feedback (Case B and Case C) as supportive measures to help towards the alignment of the learning and assessment contexts.

In summary, Table 20 presents the relation between problems, solutions, and supporting measures across the cases.

Table 20: Relationships between Problems and Supporting Measures across Cases (Student Perspective)

<i>Problem dimension (student perspective)</i>	<i>Supporting measures (student perspective)</i>
Problem Dimension 1: visibility of relevance and understanding (including MSL 3)	- Authentic contexts, approaches, methods and tasks - Examples
Problem Dimension 2: instruction-based contexts and application (including MSL 3)	- Personal learning resources (teacher availability, scaffolding) - Material learning resources (materials for self-study and repetition)
Problem Dimension 3: aligned assessment as requirement for the implementation of cross-contextual learning	- Constructive alignment - Clear expectations (mock exams) - Feedback
Problem Dimension 4: visibility of relevance and motivation	- Authentic contexts, approaches, methods, and tasks - Examples - Meta knowledge and communication
Problem Dimension 5: consistency and continuity (prior educational context)	- Introduction - Refreshing prior knowledge

6.5.3. Students' Perception Compared with Teachers' Perception

This section compares the student perspective to that of the teachers across the cases. When the differences between these two perspectives were compared across the cases, the following points were considered as being relevant.

The teachers mentioned feeling that they knew about the problems that their students experienced. Mostly, the problems that the students described were not (totally) new to the teachers, being also been described by the teachers. In some cases, the teachers also mentioned certain student-related problems that the students themselves did not mention, which means that some observations were problematised more by the teachers than by their students. This may be due to teachers sometimes not see how they caught and resolved certain problems before they were noted by the students, and that this may change if the teachers had acted differently. In this case, they had not recognised what had been done to prevent such issues from becoming problems that required actual supportive measures (Case A and Case B).

Although the teachers professed to have knowledge of the problems that students experience, the weighting and derivation of the consequences sometimes

differed. For instance, in Case A and Case B, the tangibility of the learning content mainly did not influence student motivation (which the teachers described as the most significant problem), but did influence learning content understandability in reaching the prescribed learning objectives (which the students described as the most significant problem). The students recognised the problems that the teachers described towards motivation; however, they perceived different consequences to these problems.

The perspectives differed more with regards to the interventions and supportive measures. In Case A, the proposed app was welcomed by the students (if their requirements for implementation would be appropriately considered), but unnecessary. In Case B and Case C, the ideas of the teachers and the students for further development were more similar, but in Case B, the students also mentioned other options.

In Case A, Case B, and Case C, the students revealed potential problems with the implementation of ideas which are requirements for effectiveness. They pointed to teachers sometimes focusing on different aspects with regards to the elaboration of ideas over and above that which the students considered necessary.

In Case D, the intervention and supportive measures were developed collaboratively. Here, the perspectives were not found to differ. However, the students questioned if the implementation of the ideas were realistic.

Compared to the teachers, the students mostly described non-cross-contextual and fragmented supporting measures. The students especially took into account both the learning content and its processing, as proposed by either the teacher or the learning materials. This includes the tasks and exercises that the students needed to resolve (Case A, Case B, and Case C). Next to that, the students described aspects of timing, such as the sequencing of learning resources and the just-in-time availability of learning resources (Case B, Case C, and Case D). For each problem that the students experienced, they searched for a single intervention or supportive measure.

The teachers thought more about different learning approaches which would consider different problems together and then aim to resolve all of them at the same time. When the students were asked about the teachers' suggestions, they mostly agreed with them. However, here also, the students discussed aspects regarding the implementation of the approach, and largely the same aspects (as mentioned being their ideas for supporting measures) moved to the fore. The students often discussed requirements with regards to the effectiveness of the proposed interventions and supportive measures, building upon existing sup-

portive measures that were already considered to work well. Overall, the students seemed to be more differentiated with regards to the implementation, whilst the teachers thought more cross-contextually and integratively.

Both the students and the teachers discussed issues such as time, group size, cost-benefit, and guidelines from their respective higher education institution, and both seemed to be attentive to being realistic more than idealistic.

6.5.4. Students Perception in Educational Design Processes

The cases were also compared based on the involvement of the students' perspective within educational design processes. The comparison was applied according to categories derived from the literature and then (adapted and) used in the coding. In all of the cases, the results were found to be very similar.

Importance

Both the students and teachers in all cases reportedly considered it important that the student perspective was considered within educational design processes. The main reason for this being mentioned across all cases was its consideration as a customer-orientation perspective. A didactical design needs to be received well by the students in order to make it work, but for that to happen, designs need to be adapted to the students. The tendency seems to be that students would like to influence course designs, but that this wish decreases where students are already satisfied with the existing course design. This became especially visible in Case C, where a within-case comparison over time could be made and was found to be in line with the results of both Case A and Case B, where the students expressed satisfaction with the course and thereby did not feel the need to demand additional influence over its design. Also, the learners in Case D were reportedly satisfied with their level of involvement. However, they explicitly mentioned that the involvement of the student or learner perspective was important in all cases (independent of satisfaction level). Overall, the teachers emphasised the importance of the involvement of the student perspective. However, they did not necessarily demand any greater involvement of the student perspective (with regards to the current situations).

Forms and potential forms

Both students and teachers preferred personal contact for enquiry into the student perspective. In Case A and Case B, the students preferred having direct exchanges with their teacher. The teachers mainly shared this viewpoint; however, they also saw certain advantages to other forms that were implemented by someone independent, and who was therefore unbiased (Case B) and had no relationship of dependence with the students (Case B and Case C). However,

because of their continual general close contact with their students, the teachers felt that the focus groups held with the students did not provide much additional information.

Overall, the actual forms of collaboration between students and teachers seems to have been experienced positively by both parties. There did not seem to be any demand to change the (quantity of, or kind of) involvement of the student perspective other than what had already actually taken place.

The form of enquiry for the student perspective did not seemingly play a significant role as the students were mostly satisfied with the overall course design (in Case C, the evaluation of all forms was more positive after the course was evaluated more positive as well). In Case D, the learners emphasised that different learners had different preferences with regards to forms of enquiry or collaboration.

The teachers also discussed participative student involvement within educational design processes (compared to supportive involvement; see Section 4.4). All teachers in Case A, Case B, and Case C were open to trying participative approaches, although they believed that the return on investment would not be sufficiently high so long as they felt they were already able to represent the student perspective. In Case B, the teacher could only imagine student participation with regards to specific topics.

In Case D, student participation was preferred compared to more supportive ways of involvement. The students who were participatively involved evaluated their own participation as having been positive (meaningful as well as informative for themselves).

Timing (and quantity)

Both students and teachers preferred continuous enquiry (and integration) of the student perspective.

The students negatively evaluated the possibility of influencing the course design in advance of a course being held. Presumably, this could be explained by the descriptions given that some students did not feel competent in advance of their course (with regards to expectations and experiences).

The students who did experience (and feel competent) in participation (in Case C and Case D) had argued for student participation from the beginning in order to collaboratively design the objectives.

Integration and implementation

The project member students in Case C questioned the integration of their perspective in the design processes, and were not sure to what extent their perspective would be taken up. The learners in Case D trusted the project leaders, however, they expressed the difficulty (for the project leaders) to integrate all perspectives.

All of the teachers in Case A, Case B, and Case C described adapting their courses continuously and intuitively according to their insights into the student perspective. For Case D, it was described that the implementation was not distinguished from the integration and implementation of the learners' perspective (see Section 6.4.4).

Conditions

For the students, competence was described as the relevant issue. Next to that, students' motivation for involvement was raised in each of the cases, and students need to be convinced that their perspective is both wanted and needed (as previously described for Case A, Case B, and Case C). Also, for those students who had experienced some level of participative involvement, they described having been personally convinced and willing to participate (in order to contribute or to personally benefit).

The teachers in all of the cases described that one important condition for a reliable enquiry of the student perspective was the group size. When a group was larger or more heterogeneous, it was said to be more difficult to realise a representative picture. With regards to the integration and implementation of the student perspective, the main issues revolved around the resources of the higher education institution (e.g., requirements, guidelines, resources, workload).

Power and control

The topic power and control was not discussed very extensively with the students. In Case C and Case D (which were the only cases where actual data was collected), the respondents believed that it was the teachers who should decide, considering that teachers hold the position of decision-making responsibility.

All teachers and project leaders themselves also felt responsibility for decisions to be made. Also, they felt responsible to reflect both the student and maybe other perspectives prior to integrating and implementing appropriate changes (because what students want is not always what is best for them).

In summary, in all cases, both the students and teachers mainly seemed satisfied with the kind of collaborations implemented in the investigated educational design processes. This was considered to be of particular interest, because the means of collaboration differed across the cases. Next to that, it was interesting to note that the teachers felt that they already had an awareness of the students' perspective, based on the actual forms of collaboration, although the results of the study as described in Section 6.5.3. showed that discrepancies existed between these two perspectives. Explanations for this result and the potential different means of collaboration (despite the satisfaction of the respondents) are discussed in Chapter 7 and Chapter 8.

7. Discussion

In this chapter, the main results of the study are interpreted and discussed. First, what was learnt about the problems experienced with regards to cross-contextuality are discussed. Second, the results regarding appropriate supporting measures are centralised to inform educational design. Third the study's findings with regards to the involvement of the student perspective within educational design processes are discussed.

7.1. Problems with Cross-contextual Learning

Problem Dimension 1 (*When the access or connection to contexts –which makes visible and experienceable relevance of the learning content– is missing, problems with the tangibility of abstract learning content emerge*) was mainly found to be caused due to learning that happened over some considerable timeframe (*MSL 3: learning across time; MSL 3: prior educational contexts/degrees; MSL 3: future courses/work*).

As described in Section 2.1, learning happens through learning experiences which are inevitably gained over time, by visiting and revisiting of knowledge and competences (following Sharples et al., 2007). This cyclical type of experience leads to the continual, further development through the elaboration of knowledge and competences, and as time progresses and situations change, this inevitably leads to student learning being cross-contextual. It was described that individual learning experiences that occur within different contexts need to be related to each other in order to integrate the experiences so that they become sustainable competences (Dilger et al., 2019). However, different theories (e.g., transfer theories, seamless learning, boundary crossing) have shown that it is not self-evident to relate learning experiences with each other, especially when the contexts wherein the experiences are gained differ from each other (Akkerman & Bakker, 2011; Dilger et al., 2019; Solga, 2008). This was also found in the results of the current study.

Problem Dimension 1 concerns the consequence of (timely) separated contexts for the visibility and experience of relevance. The contexts where abstract knowledge becomes relevant, are contexts where the learning content is applied and becomes concretised (Brown et al., 1989). In the current study's four cases, the application of abstract knowledge took place after the abstract knowledge had been gained, because the abstract knowledge was conceptualised as fundamental knowledge, and a requirement for its subsequent application. Through the eyes of the students, the application and use of their new knowledge, for instance in authentic tasks and contexts, actually would take place within

other, subsequent contexts (e.g., future courses or post-education employments).

Abstract knowledge is difficult to acquire, sustain, and apply in the correct way when the context of its usage remains unclear. As explained within the theories of situated cognition and situated learning, it may be seen as like knowing everything about a certain concept, but not actually knowing how, where, or when to use it (Brown et al., 1989). Knowledge about a concept, combined with knowing about the context in which it should be used, has a reciprocal influence over one's understanding of the concept (Brown et al., 1989). This is the core idea behind context-bounded and experience-based learning (Kolb, 2014).

A separation of learning processes, as a means to understanding and applying knowledge and competences (*MSL 8: multiple learning tasks; MSL 10: multiple pedagogical or learning activity models and approaches*), leads to a separation of abstract and concrete knowledge (*MSL 9: theoretical vs. practical knowledge*). This hinders a learner's understanding, because the understanding itself is actually gained through application (Brown et al., 1989).

The students in the current study confirmed this problem, having described experiencing issues with understanding abstract knowledge. Abstract knowledge (e.g., mathematical principles, project management theory) were not be tangible or concrete for students, which complicated their understanding and retention of the learning content. Both students and teachers in the current study experienced that students were unable to apply or use their competences at the moment they should be able to, whether in-class (see Problem Dimension 2) or out-of-class.

For the students, this problem does not appear to be very cross-contextual at the moment the problem emerges, because they may not have access yet to or may not recognise potential authentic contexts of application that are open to them. Next to that, they may not be able to oversee what this lack of access means to their degree of understanding at the time the opportunity is presented. Students mainly just experience that their prior knowledge is insufficient to gain new knowledge or competences; or, that they have difficulties understanding abstract, decontextualised knowledge.

Next to Problem Dimension 1, Problem Dimension 4 (*When access or connection to contexts –which make visible and experienceable relevance– are missing, problems with student motivation emerge*) also looks at the consequences of (timely) contextual fragmentation. However, in Problem Dimension 4, students consider this according to motivation as a requirement for learning. Problem Dimension 4 was introduced by the teachers, who shared the assumption that visibility and

experience of relevance increases motivation. This approach is also in line with the literature, which explains that students often differentiate between applied and conceptual relevance, wherein the former suggests that knowledge gained can be used in some applied context, and the latter that knowledge fits within or otherwise relates to other knowledge schemas (Albrecht & Karabenick, 2015). Depending on the context, a student encounters knowledge and concepts as meaningful (to them) (Dourish, 2004). Over recent decades, the idea that education should be made relevant to students has been studied and endorsed by researchers on the topic of motivation in education and psychology (Albrecht & Karabenick, 2018). In the educational design literature, it is a question of how a particular concept can be presented in a way that is meaningful for the students.

Problem Dimension 1 and 4 may seem difficult to resolve because learning, by its very nature, will always stay cross-contextual and sequential. However, the literature and also the teachers in the current study described possibilities existing whereby relations between contexts do not always suffer from the issue of time lag, namely:

- Relations to contexts that students know from daily life; or,
- Integrating elements of future contexts into the current context.

The teachers namely complementary described the problem as students not being able to relate the learning content in the classroom with observable phenomena in practice outside of the classroom in their daily life. Equally, they described that the students inadequately experience the meaning of a learned theory, which is often essential to its understanding and motivation.

The results of the study (in line with the literature) point to both the potential and need for cross-contextual learning with regards to the MSLs 8, 9, and 10. However, it also points to the need to address MSL 3. The combination of the MSLs as presented in the current study, for instance leads to questions about learning theories and approaches that build upon the classical sequencing of instruction and application. Thus, there seems to be potential in different ways for cross-contextual learning; instead of considering cross-contextual learning over the natural course of time, there can be cross-contextual learning at a singular point in time, or at least within a reduced, narrower timeframe.

However, the results from the current study also showed that (new) combinations of different contexts, learning approaches, methods, tasks, and also fragments of knowledge within a different timeframe is, in itself, not without a risk for fragmentation. The support of the relations between contexts and their integration are considered to be of significant importance for all four MSLs.

Together with Problem Dimension 1 and Problem Dimension 4, Problem Dimension 2 showed that educational designs cannot stop at just making visible or experienceable relevance for the purposes of understanding or learner motivation, but that further examination of the relationship between those contexts (aspects) is important, together with the subsequent application of design-based changes.

Problem Dimension 2 (*When there is an instruction-based context as well as a context to apply the learning content (e.g., in class), problems emerge when the theory and practice are not bridged*) concerns different contexts within a class which have a different affordance towards a certain element or part of a competence (e.g., understanding theoretical principles vs. applying them). Problem Dimension 2 may occur within the same class, because two or more tasks or activities often demand different contexts. Although both contexts find place within a narrower timeframe, the data from the current study showed that the switch between those different contexts and tasks can be challenging for the students.

Next to that, the study found that a change in sequence (compared to a classical design with instruction followed by application) can also lead to the occurrence of new problems. In Case B, a reversed design was introduced, which started off with an explorative task with simulation that introduced contexts and possibilities for application during the course. However, the students felt overwhelmed, having not really understood what they were doing and what was expected from them (with regards to the levels of understanding and application). Also in Case C, the students felt as if they had been pushed in at the deep end, having been expected to applicate principles directly.

Consequently, like Problem Dimension 1, Problem Dimension 2 also showed that changes or transitions between contexts needs to be planned and appropriately supported (e.g., through timing and the sequencing of tasks). Next to that, Problem Dimension 2 showed that it can be a complex balancing act to find the right supporting measures to address and overcome seams. The current study showed how a cross-contextual learning design change can lead to the emergence of new seams.

Last, the current study also showed another risk that could result in the emergence of new seams. The relation between the learning context and the assessment context was discussed within Problem Dimension 3 (*When there is a cross-contextual learning arrangement (approach, tasks), students experience it problematic when the cross-contextuality is not mirrored in the assessment setting*). For instance, in Case C, it was shown that a change in learning method, but not in the assessment setting, led to the emergence of a new seam. The theory of constructive

alignment has shown for years the importance of alignment between learning objectives, learning methods, and assessment (Biggs, 1996). It might not be all that surprising, that this issue does not change with regards to cross-contextual learning designs. Hence, this remains an important aspect of design also in this regard.

In summary, according to the findings of the current study, students clearly centralise the MSLs 3, 8, 9, and 10. From the student perspective, the MSLs 1, 2, 4, 5, 6, and 7 were experienced as being less problematic; however, the students also perceived them as supportive measures for cross-contextual learning as well. Next to that, there were both problems noted with the access to and recognition of learning contexts. However, when there was a relation between certain contexts, the most important thing was the design of the relations and transitions between the contexts, and also the integration of the learning experiences within the contexts. What was learnt from the current study's findings with regards to supporting measures and educational design will be further discussed in Section 7.2, whilst the meaning of the results according to the (theoretical) dimensions of Wong and Looi's (2011) model will be discussed in Section 8.2. With regards to a broader spectrum of learning psychology and pedagogical literature, it can be summarised that the problems reportedly experienced in the current study relate to very classical issues which have been discussed in the literature for decades (e.g., the relation between theoretical and practical knowledge, sequencing and modular structures, transfer). Looking from the perspective of cross-contextual learning, they become again or even more observable.

7.2. Educational Design Including the Student Perspective

Authentic contexts and learning tasks

As described in the case-comparison, the students perceived authentic learning contexts and tasks as the best solutions to making abstract knowledge more understandable and concrete (Problem Dimension 1). They considered these contexts or access to these contexts as being missing. Several learning theories can also be referred to in confirming this and which describe how instruction-based learning is often inappropriate with regards to the actual competences that students are required to develop. Situated learning, experience-based learning, and contextualised learning are each examples of approaches which aim to bind and integrate concrete experiences with reflection (see Chapter 2) (Brown et al., 1989; Illeris, 2009a; D. A. Kolb, 2014). And, as described in Section 1.3.3, also, actual research towards high impact pedagogies has called for more authentic learning approaches and tasks (Kukulska-Hulme et al., 2020). In the reports of

2019 and 2020, different pedagogies were proposed such as action learning (finding solutions to apply in daily life) and place-based learning (Ferguson et al., 2019; Kukulska-Hulme et al., 2020). Place-based learning was described by Ferguson et al. (2019) as to,

...help students connect the abstract concepts in their textbooks with practical issues and challenges in their own community....Any place is rich in learning opportunities. Place-based learning takes learners outside the classroom and can also make place or location a part of online learning. (p. 33)

In this regard, the findings in the current study, fit with the potential of both authentic learning contexts and tasks as described in the actual literature.

Digital and virtual worlds and simulation as a moderate and integrative intervention

As the inclusion of authentic contexts has been described not always to be possible or even desirable in formal educational contexts (see Chapter 3), virtual contexts offer potential to access and include authentic contexts through educational technology.

The students in the current study welcomed simulations as a positive solution, where the integration of authentic contexts or tasks (e.g., experiments) is not possible. This is in line with the literature, where it is described that it is often considered too dangerous to experiment within natural contexts. Kukulska-Hulme et al. (2020) described online laboratories as an upcoming trend that provides a viable alternative to remote laboratories:

An online laboratory is an interactive environment for creating and conducting simulated science experiments. The lab could be accessed through the web or as a program running on a computer, either in the classroom or at home. The aim is for a student to experience the procedures of carrying out a science experiment, including the consequences of making mistakes, and to get results. (p. 45)

As emphasised by the seamless learning community, the learning space is no longer defined by physical contexts, but can be enlarged by the use of educational technologies (e.g., Looi et al., 2010).

In summary, the integration of missing (access to) contexts in current learning contexts (and thus the potential of cross-contextual learning scenarios) is confirmed from the student perspective, and can happen both physically and digitally.

The current study showed that (next to the integration of missing (access to) contexts) students require some form of support in order to relate authentic contexts and tasks to other contexts and tasks so as to prevent new seams from emerging. Also, within such authentic learning approaches, the transitions between different tasks and activities need to be supported with boundary objects or persons (Problem Dimension 2). As described in Section 6.5.2, the students found the following measures to be supportive:

- **Refreshing:** Overcoming time lags between prior and new knowledge, when prior knowledge is required to understand new knowledge.
- **Learning materials:** Fostering flexibility and independence from in-class context and just-in-time learning (e.g., documented approaches and steps of a solution, making them retraceable for self-study).
- **Examples:** Overcoming seams between understanding and knowledge application, as well as between theoretical and practical knowledge.
- **(Just-in-time) Teacher availability for:**
 - Questions
 - Support (and scaffolding)
 - Feedback

Interpreting the current study's results through a comparison with the published literature, it can be seen that they align especially on the points about learning materials, the availability of teacher support (scaffolding) and feedback. In the model of Wong and Looi (2011), ubiquitous access to learning resources was one of the features noted for seamlessness in learning. Having support available from the teacher has been shown as a design principle for boundary crossing by Veltman et al. (2019). However, three points are worthy of noting here. First, the students portray their teachers as being responsible for being a boundary person, and for the development and implementation of the described boundary objects. They did not describe boundary activities which would allow them to bridge different contexts and tasks themselves. Second, in terms of the missing orientation towards competence development, the inclusion of boundary activities could foster the development of competences that may allow them to learn how to bridge the contexts themselves. Third, the strong orientation towards interventions and in-class solutions (to build relationships between contexts and to integrate learning experiences from different contexts) may neglect further potential of cross-contextual learning. These three points are discussed further in the following sections.

Teacher-orientation

The first notable point was that the study established that students perceived that the responsibility for successful cross-contextual learning lay with the teacher. They considered the teacher as being responsible for providing access to and integrating authentic contexts and tasks into the current learning context (analogue or digital). Next to that, the students perceived that their teachers were responsible for the development and integration of interventions and supporting measures that would help them to relate different contexts and tasks with each other, so as to be able to integrate learning outcomes into their competences.

Overall, the students were found to considerably depend upon their teachers and the learning resources they provided: During the focus groups and TAPs, both the problems experienced and the supportive measures offered were, by the students, perceived as aspects that the teachers could potentially change. The students' own learning strategies did not become a topic of discussion though. Although there were some examples such as students starting learning groups and or undertaking self-study using YouTube videos, they did not relate these strategies to the problems that they had described. Instead, the students sought supporting measures such as 'more examples' and 'more extensive learning materials' (which then should be provided by the teachers).

Next to the students who held their teachers as responsible, the teachers themselves also appeared to see these kinds of supporting measures as within their remit of responsibility.

This attitude does not fit to the discussed socio-constructive understanding of learning (see Section 2.4) and the discussion on shared responsibility for learning between teacher and their students (see Section 4.4). It therewith raises the question as to whether some alternative understanding of learning and/or learning culture is required to foster cross-contextual learning.

Missing competence orientation

The second (related) point noted was that the data in the current study highlighted a focus on changing contexts (aspects) in order to support cross-contextual learning (the physical, technical, social, and task- and activity-related aspects) and the relations between them. However, as discussed in Sections 2.2.2, 2.3, 2.4, 3.2, and 3.5, this was not considered desirable in every case, because reality is that the world will never be rid of seams and boundaries, and thereby students require certain competences in order to learn cross-contextually themselves (Dilger et al., 2019). There were no points found through the

analysis of the study's data (problem descriptions or supporting measures) whereby the objective was to foster students' competences to learn cross-contextually; not from the students, nor from their teachers. The supporting measures from both perspectives, did not have the objective to empower students to make relations and integrations themselves, but to support the students by making visible relations and supporting the integration of learning experiences from different contexts. It has already been criticised that competence development for cross-contextual learning was not found to widely exist in the literature; and now, also, the data from the current study was also found to criticise this same point. Next to the teacher dependence, the one-sided focus on interventions and supporting measures towards the context is questioned.

Missing orientation to existing resources

The third point noted was that the interventions and supporting measures researched were all and only situated within the classroom. The students asked for interventions and supporting measures which the teachers could implement in order to make visible the relations between contexts (refreshing, learning materials, examples, and availability of the teachers) and for the integration of authentic contexts, approaches and tasks. However, the students did not mention other resources from contexts situated outside of the classroom, although learning is not limited to the classroom environment alone (Chan et al., 2006; Erstad et al., 2016). This finding is not considered negative, yet does neglect further potential of cross-contextual learning. Next to that, it is perhaps unfortunate, because the use of resources that already existed, could be used to help students to recognise them, and therefore offer the chance for students to learn how to use these resources themselves.

The one-sided focus on in-class solutions might be explained due to it being difficult for students to think beyond a system of familiarity. In the actual system, students think about a course or class as the main place for learning. As the teachers explained, students do not relate (abstract) learning content to concrete experiences in their daily lives. The data collected in the current study confirmed this. The students did not seem to reflect upon resources out-of-class as a potential source of learning or a supporting measure to deal with any learning problems they may experience. They appeared to have difficulties in using their imagination to think outside of or beyond the system in which they were situated.

The teachers were also similar, in that they recognised relevant topics within the students' lives and utilised such opportunities (e.g., editing pictures), but

did not make use of the students' existing experiences. They 'only' helped students to gain new or further experiences in areas that they already knew (instead of using the so-called existing resources the students would not recognise).

From the teachers' perspective, the main focus on new resources (rather than the use of alternate resources that exist in students' lives) might be explained as teachers not automatically having insight of the contexts where students move (and their teacher dependence) (Reinmann & Jenert, 2011). This makes it inherently more difficult for them to consider potential resources that may be available within their students' learning biographies. With regards to this insight deficiency, the question may be whether such a challenge can be resolved through alternative forms of educational design. This moves the focus of discussion from the designed product (chosen contexts, approaches, tasks, boundary objects, and boundary persons) to the design process itself. The educational design process will be discussed in the respective sections, but first, discrepancies between the student and teacher perspectives will be discussed, as they have influence on the educational design process as well.

Discrepancies between student and teacher perspectives

As could be seen from the cross-case analysis, the students and teachers had partly similar, partly different, and partly complementary perspectives on the problems that students experienced within the current learning contexts, as well as with regards to the best interventions and supporting measures applied to help students attain the prescribed learning objectives. In line with the discussions of Reinmann and Jenert (2011) towards student-orientation, one weakness of the teacher perspective is that they may possess limited insight as to what interventions and supporting measures are experienced as actually being supportive. This is of significant importance though, because the current study showed that (the implementation of) supporting measures can be situated (e.g., explorative learning to apply theory was welcomed by students in Case C more than by those in Case B. In both cases, the students listed different requirements for a successful implementation). Thus, as previously described, what is perceived to be supportive in one context may be seen as hindering in another. Therefore, teachers need to possess insight to these phenomena.

Although the teachers in the current study experienced discrepancies between the perspectives as being rather small, these discrepancies may later become more significant when learning scenarios become increasingly cross-contextual (e.g., using available resources and learning experiences, and the potential of cross-contextual learning, which may increase due to societal developments

that foster individualised and flexible learning biographies (see Chapter 1). This may be especially pertinent when cross-contextuality goes beyond the course or even school level. In this case, these discrepancies may become even more relevant in terms of educational design processes.

Educational design processes for cross-contextual learning

The results of the current study showed that the student perspective was enquired and integrated in a rather supportive (rather than participative) way (Reinmann & Jenert, 2011). However, if the learning experiences that students bring with them are used to a greater extent, then the importance of educationally designed connections and the support of competence development in building connections may increase for students. Teachers may be better able to support this; however, the actual contextual teacher dependence could also become more problematic.

In order to be able to use the potential of cross-contextual learning scenarios and prevent realisation of its negative risks, a change to the learning culture (moving from teacher dependence more towards shared responsibility) as well as a change of educational design processes (moving from supportive ways of involvement as found in the data of Case A, Case B, and Case C, towards a more participative way as found in Case D) is proposed in the following section.

Consolidation: Collaborative design of cross-contextual learning scenarios

A collaborative educational (meaning to also include a more participative involvement of the student perspective) design process could help to address the problems of teachers needing to acquire insight to their students' (problem) experiences, and insight to their students' need for support in relating and integrating their learning experiences. At the same time, students could be better supported in their (personal) cross-contextual learning processes. With the proposed process, it is aimed to think more in terms of connections between the contexts where students (want to or even need to) move in. This can only be established through the collaboration of both teachers and their students (following Kuh, 1996; Reinmann & Jenert, 2011). The proposed collaborative process is visualised in Figure 14.

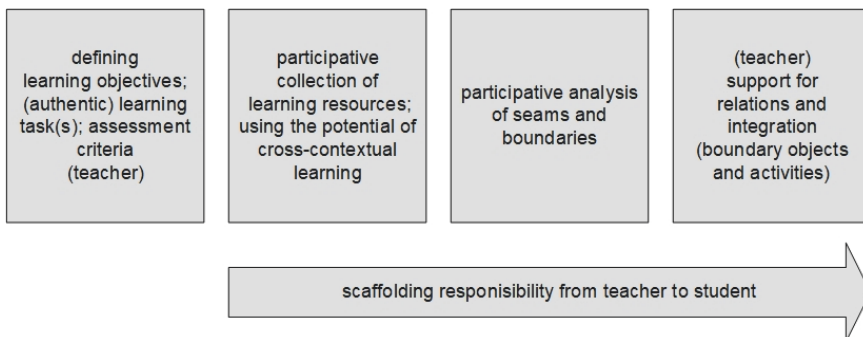


Figure 14: *Scaffolded Collaborative Design for Cross-contextual Learning*

In the first step of the proposed process, the objectives, (authentic) tasks, and assessment are to be defined by the higher education institution in conjunction with (or by) the teacher. Following the seamless learning design paradigm from Rusman (2019), through the design of triggers, intents, and goal-oriented activities, the specifics for cross-contextual learning can here be set.

As was highlighted both in the literature (Biggs, 1996; Veltman et al., 2019) and also from the results of the current study, there is significant importance attached to the alignment between the objectives, assessment, and the learning approach and methods. This alignment should be taken into account as a matter of significant importance in order to prevent new seams and boundaries from emerging.

In the process, the first step is not collaborative or participative with students. Whilst Bovill and Bulley (2011) showed that power and control could theoretically be shared, Reinmann and Jenert (2011) argued that this is difficult for students. Next to that, the results from the current study showed that both the teachers and students were convinced that this was the responsibility of the teachers (and the higher education institution). It could therefore be derived that teachers and students consider collaboration to be of significant importance; however, that is assuming that the teachers hold the balance of power with regards to those framing didactical decisions.

In the second step of the proposed process, both the teachers and students are meant to bring in available learning resources. Students could bring experiences, authentic contexts in which they move, or even search or design new contexts (Anastopoulou et al., 2008). Teachers could also design new contexts, or offer access to authentic contexts, experiments, simulations, examples, or explanations of new knowledge. Through this approach, there would likely be:

- more conscious use of contextual and different affordances for learning;
- to make better use of the contexts' affordance in which students already move;
- the opportunity to design new contexts (or to organise access to and visibility of contexts), and to integrate them within the course context.

In the third step of the process, a participative analysis of the seams and boundaries between contexts, tasks, and learning resources should take place. This needs to be participative in order to provide insight into the students' cross-contextual problem experiences and their needs.

After the participative analysis of the seams and boundaries, the teachers could (adoptively) support their students to connect and integrate their learning experiences (the fourth step of the process). Discontinuity could be addressed through the introduction of the following design mechanism (following the seamless learning design paradigm of Rusman, 2019): boundary objects, persons, and boundary activities, framing and alignment (e.g., thematically, contextually).

Here, the responsibility (power and control) can (situation-dependent) range from 'tutors control decision-making informed by students' feedback' to 'students control decision making and have substantial influence' (the options 'tutors being in control' and 'students being in control' have been discussed not to be appropriate for a participative approach to the design process (Bovill & Bulley, 2011).

A process of scaffolding the responsibility is argued for, whereby students are placed more and more in the driver's seat (Blais & Sheehan, 2015). This aims to support students in becoming more active and responsible for their own development, and to become more competent cross-contextual learners themselves. Content-based, students would learn (supported and scaffolded by the teacher) how to construct relevance for understanding (scaffolded relevance construction, Albrecht & Karabenick, 2018), and thus build competences so that they could then utilise the potential of different contexts for learning purposes. With regards to educational design competences, through scaffolding processes, students could learn to take on a greater share of the responsibility (for their learning). They may then develop competences as to how and when to use and to create (combinations of) contexts (with different affordances) for learning. Beyond that, students could learn about the problems that lay behind certain seams, and thereby become more conscious about how knowledge can differ within different contexts, what learning strategies may be necessary, how they may differ across different contexts (how to use, adapt, and integrate), and how attitudes can also differ according to different contexts (Dilger et al., 2019). This approach fosters seam-aware and seamful learning (which was argued for in

Section 2.4) and uses seams and boundaries as positive triggers for meaningful learning within the formal higher education context as a place to bind together various learning experiences (which was argued for in Section 1.3.3 and Section 2.2.2).

Requirements for implementation

In the context of the current study, the possibility for increased collaborative design was discussed. As the results of the study showed, for the students, their perceived competence to participate in educational design processes was an issue to them, which should be regarded together with the process of scaffolding. Next to that, the results of the study showed that the relationship of dependence is considered as a significant issue (honesty, trust, dependency of the teacher for grading). This should be regarded with regards to the culture within the proposed process.

The teachers questioned the return on investment of participative design processes. As described in the Results chapter, the teachers considered that they could already represent their students' perspective in the workshops (after enquiring on their perspective). Next to that, in the actual system, the teachers feared that the students would not want to actually participate in workshops. They questioned the students' motivation, engagement, as well as resources in this regard. In this regard, the culture as well as the context or system in which the process would be implemented, need to be considered. Other hindering factors in the actual system are discussed in the next section 'Hindering factors in the actual system'.

It was remarkable that the discrepancies between the students' and the teachers' perspectives did not seem to influence the perception of importance of student involvement. Independent of the discrepancies, both the teachers and students appeared satisfied with the supportive (rather than participative) way of involvement of students. In Case A, Case B, and Case C, the students did not seek any greater influence in terms of course design, although the discrepancies between the perspectives of the teachers and the students were greater compared to Case D, where the learners also seemed content with their involvement. It appears that, as long as the participation in design is not experienced as being valuable for the students, even if only due to a lack of experience with it, the motivation for participative forms of collaboration is rather low.

Hindering factors in the actual system

Both the implementation of a different design process that fosters cross-contextual learning and the cross-contextual learning scenarios themselves need a system that enables this (Travia, 2020). The current study showed that both the

teachers and their students experienced hindering factors which blocked them from designing and implementing interventions and supporting measures which could foster cross-contextual learning. Both parties (in some cases) described the types of learning approaches and methods that could be considered ideal for learning; however, they had not followed up on those thoughts, because the actual system would not allow them. On both sides, especially time (and other resources for the teachers) was described as being problematic. The teachers did not have sufficient time to support students' processes 'out-of-school' (e.g., providing feedback), and the students described that an approach like that would cost too much time, considering the other courses they also attended (with regards to the ECTS). This points to a need for a greater level of change, if the potential of cross-contextual learning is to be taken seriously.

As described in Section 3.5, the study builds upon the assumption that for change to be effective, a systematic approach is required. The circumstances and resources need to fit to the organisational and study programmes, and at the micro-didactical level (Brahm et al., 2016). The changes proposed in the current study require changes on different levels, which means that more significant changes within the system and the learning culture might also be necessary (Carey, 2013). These are points to be considered within future research, and will be discussed in Section 8.3.1.

8. Implications

8.1. Practical Relevance

In this section, the practical implications of the study are derived for the field of higher education. The learnings from the study are presented for different target groups. As described in Chapter 1, the main target groups are teachers and faculty developers. Students are also especially meant to benefit from the results of the study. Although they are not seen as readers of the study, they are targeted indirectly.

The study focuses mainly on the meaning of cross-contextual learning at the micro-didactical level. Higher education institutions (e.g., programme managers and institution managers) are indirectly affected. No practical implications are derived at this level: because, as described, further research is required first in this area.

In general, readers are pointed to the relation of this section and the research agenda in Section 8.3. Although some of the implications can be implemented directly, others might rather be supported and tested within a research context.

Teachers

The study provides insight to students' experiences in learning across different kinds of contexts. The study showed that the problems that the students focussed on learning over time, learning with different approaches and methods, different learning tasks, and different kinds of knowledge (e.g., theoretical and practical knowledge). The study showed that students do not always have access to, or recognise, authentic contexts and tasks that could be utilised within their learning. This access/recognition of contexts could be supportive in helping students to understand abstract learning content and secondly, to increase their motivation.

Teachers can support students by using contexts consciously, enabling students access to contexts (cognitively or experientially), integrating authentic contextual elements into the actual learning context, and in designing new contexts (physical and digital). The study also showed the importance of support in making a transition or connection between contexts, and the integration of learning experiences from different contexts. The students experienced refresher learning, learning materials that showed the derivation to progress from understanding to application, examples, and the possibility to ask questions and feedback as being supportive. However, the study emphasised that, where possible, it

may actually help students more when they learn to build relations and bridges by themselves.

Collaboration is important in order to be able to support students in their studies. The current study especially highlighted collaboration with teachers in prior educational contexts, other, and future educational contexts (e.g., other, related courses), and also collaboration with those working in the students' (future) professional field.

In order to learn more about the specific, context-bounded experiences of students, collaboration with the students themselves is key. Although the current study showed that the problem analysis of teachers and students shared a certain degree of similarity, the derivation of interventions and supporting measures seemed to differ. Insight into the students' experiences helps to reflect and make decisions on the most effective supportive measures.

Next to that, in order to be able to make best use of the resources that students have access to in their non-academic life, collaboration with students is clearly a necessity.

A process for collaborative designing for cross-contextual learning was proposed in Section 7.2. In the proposed model, the role of the teacher changes as cross-contextuality increases (especially when outside of the classroom), with greater focus applied to orchestrating students' learning experiences and to supporting them in learning how to relate and integrate learning experiences.

Educational and faculty developers

For educational and faculty developers, the study specifically differentiated the potential and risk of cross-contextual learning. The current study raises awareness to make use of contexts, organise and show access to other contexts, integrate elements of other contexts within the current context, and the possibility of designing new (authentic or simulated) contexts. Next to that, the study offers points of references that helps students by designing transitions and relations between contexts. However, the study also raised questions regarding the importance of other boundary objects, persons, and activities. It aimed to increase the focus on the development of competences for students in order that they learn cross-contextually themselves. These kinds of awareness could be transmitted in faculty development (courses).

In general, the design of cross-contextual learning has been shown to be a complex area. Teachers often do not possess the educational or pedagogical background to analyse their students' problems on a learning psychological level,

either for the purposes of creating and/or implementing interventions and supporting measures. This can already be a challenge for the current amount of cross-contextual learning scenarios, but might also be increased when cross-contextuality is increased.

With regards to the process for educational design and the implementation of cross-contextual learning scenarios, a process was proposed as shown in Section 7.2. In order to enable cross-contextual learning, a change of mind-set (for teachers and students) is critical. This is not easy, because most people think in terms of frames that are familiar, and this may make thinking in different frames challenging. The design of cross-contextual learning scenarios opens up certain possibilities to making better use of the potential that modern learning formats offer. However, faculty developers would probably need to support the implementation.

Students

The current study aimed at students being better understood, in order that educational designs can be adapted more to cater for their needs. With the implications described, the aim was for students to benefit from the potential of cross-contextual learning, but also to be safeguarded from the risks of fragmentation of learning. If each of the described implications were implemented, students should experience less discontinuity between existing and newly-involved contexts (Problem Dimension 1 and Problem Dimension 4), as well as between instruction-based contexts and contexts to apply (Problem Dimension 2), between prior and new knowledge (Problem Dimension 5), and between the learning and assessment contexts (Problem Dimension 3).

In the proposed process for the design of cross-contextual learning, the students would take on a new role. Next to that, competence development with regards to students being able to learn cross-contextually themselves would add a new angle to the current state of play; and this would have implications for student practices as well.

8.2. Theoretical Relevance

The conceptual framework as described in the Chapters 2, 3, and 4, did not provide one overriding theory or model for cross-contextual learning (design). Cross-contextual learning has many dimensions such as the multiple aspects of each context, the interaction of individuals with the context, and the means of learning in each of those contexts. Different theories and models have focused on different dimensions (e.g., in-class and out-of-class, analogue and virtual, individual and social learning activities), and it is therefore challenging to create

a singular, extensive overview that encompasses each different dimension. Beyond that, the different dimensions strongly correlate with each other. For instance, the features for seamless learning according to Wong and Looi's (2011) model showed that learning over time automatically influences learning in different social practices, with different pedagogical approaches and learning tasks. This alone points to the complexity of didactical situations (Reinmann, 2013).

It seems unrealistic, therefore, to abstract an extensive model (including all selective dimensions) for cross-contextual learning based on the results of the current study. Next to that, the current study mainly considered the student perspective. This would neither suffice to provide an extensive model. However, from these results, what can be visualised are the problems that students may experience when learning across different contexts, and what aspects they may (potentially) experience and therefore require support with. Based on the study's results, the following dimensions should be taken into account:

*Overview*²¹

²¹ The visualisation only includes aspects which were derivable from the study. The aspects which were discussed as missing in the data (see Sections 7.1-7.2) are therefore not visualised, but addressed in the research agenda (see Section 8.3):

- Competence orientation
- Students as boundary persons and boundary activities

Table 21: Overview of Cross-contextual Learning Dimensions from the Student Perspective

In-School*		Out-of-School*	
Prior courses** Other & future courses** Actual course** Instruction-based context Context for application		Prior education** Daily life (experiences/learning situations)** Future education** (Future) job**	
* Based on regular educational system with different institutions, programs, and courses in each/regular/standard learning biography.			
** All contexts can be instructional or applied contexts.			
** All contexts can include self-study (contexts and activities)			
** Transitions and relations between contexts are necessary for integrative and sustainable learning (=actual problem according to the students).			
BOUNDARY PERSON: Teacher is held responsible for educational design, the implementation, and learning materials (BOUNDARY OBJECTS) for cross-contextual learning scenarios, integrated in class (actual / formal educational context in focus)			
Problems			
Missing relations between contexts / access to contexts		Transition between (instructional and application) contexts	Encompassing learning experiences across contexts
Supporting factors / in-class solutions*			
▪ Refreshing ▪ Examples ▪ Integration of authentic context (elements) in formal learning context (course) ▪ Design of authentic learning tasks and assessments		▪ Explanations and learning materials which show of thinking logic (derivation; approach) ▪ Feedback ▪ Scaffolding	▪ Adaption/'fit' ▪ Reflection (of fit and non-fit)
* Mostly in-class due to the actual system (see limitations) and understanding of responsibility for (sustainable) learning.			

In order to obtain a/this accurate and encompassing overview, different theoretical concepts were applied in the analysis; after being adapted to create a better fit with the data. As these adaptations may also be considered relevant for other projects, they are detailed here as follows:

MSL-Dimensions of Wong and Looi

In the study, the 10 features for seamlessness from Wong and Looi's (2011) were employed. However, some dimensions were differentiated:

MSL 3 regards seams that hinder the integration of learning experiences over time. The dimension was differentiated according to three sub-dimensions:

- Problems with bridging the actual learning context with prior educational contexts;
- Problems with bridging the actual learning context with future learning contexts such as future courses or a future job; and,
- Problems regarding just-in-time learning (e.g., access to resources at the right moment/sequencing of different approaches and tasks of the learning process).

For MSL 8 and MSL 10, a number of seams were described with regards to the alignment of the learning context (mainly approaches and tasks) and the assessment context (approaches and tasks; including the grading).

Also, the students described problems in the transition from instruction-based settings to more practical settings, where the knowledge learnt would then actually be applied. This can mainly be related to gaps between different kinds of tasks, and between tasks with different levels of complexity (MSL 8).

MSL 9 refers to seams that hinder the integration of different fragments and knowledge types. The dimension was differentiated according to three sub-dimensions:

- Problems regarding the integration of different pieces of knowledge (e.g., smaller pieces which are supposed to lead to a singular, holistic understanding of a certain phenomenon);
- Problems regarding the integration of theoretical or abstract and practical or concrete knowledge;

- Problems towards the integration of new learning content with prior knowledge. In this regard, the students described a misfit due to disciplinary differences or gaps regarding complexity levels between prior and new knowledge.

Notably, the third sub-dimension here correlates significantly with the first dimension of MSL 3.

Next to the differentiation of the dimensions, two more reflections can be made, which each point to ideas for further research as well:

From the student perspective, MSL 2, 4, 5, 6, and 7 were barely mentioned as problem dimensions. Some problems were reported with regards to MSL 2 and 5; however, they did not surface within the cross-case analysis. However, the dimensions did surface with regards to the supporting measures. This means that the dimensions play a role with regards to seamlessness and continuity. Although it would be necessary to research as to what extent this result is generalisable, based on the study, it would be interesting to deepen the correlation and dichotomy between problems and supporting measures. Some dimensions do not seem to appear as problems, whilst others do not seem to appear as supporting measures. However, some dimensions appeared on both sides (e.g., ubiquitous access to resources (MSL 5): for the students it is a problem when they do not have this access (to materials, at the right time, in the right form, the teacher), but was described as a supporting measure to overcome (other) seams and boundaries). At least from the student perspective, it might be interesting to distinguish and investigate the dimensions and their correlations in this regard to support the application of the model in practice.

Also, as presented with regards to the codebooks and the results, a differentiation can be made on how the dimensions influence seamless and cross-contextual learning. From the one side, there is the continuity; however, from the other, the current study showed that from the student perspective, there are other outcomes such as understanding as well as motivation (which seem to be moderated by the visibility and experience of relevance and is fostered by cross-contextual learning). In the literature, seamless learning is often argued with regards to continuity and motivation (to learn whenever and wherever a student is interested and motivated). However, next to the current study, also the studies from Brockmann and Loer (2016) and Voon et al. (2020) showed that other outcomes are also of interest (e.g., practical relevance, understanding, sustainability of learning outcomes, context-awareness, and peer learning). It might be interesting to research other influences of cross-contextuality and seamlessness, such as flexibility and individualisation, or also requirements such as self-

discipline. These are complex fields of tension that might influence how cross-contextuality can be applied for the purposes of learning.

In summary, one implication for the theory could be to more clearly distinguish between the dimensions.

Boundary crossing

The concept of boundary crossing has proven very useful in researching supporting measures that could help to overcome seams and boundaries. With regards to the current study, some ideas for further development of the concept were also identified. In terms of further analysis, different boundary objects, persons, and activities could be differentiated. The described boundary activities were partly differentiated and described as a means to fostering learning at boundaries. However, it was not described how students could be prepared, nor how this 'learning at the boundary' could be achieved. From the perspective of the current study, the correlation of learning processes and competence development may be considered to have potential to further develop cross-contextual learning.

Other contributions with the current study

In general, the current study contributes to the theory with thick descriptions of the student perspective; the students' actual experiences of problems were described. Also, the relations between those problems and appropriate supportive measures were deepened from their perspective. This contributes to better understand the students' perception of their study practices from a multi-contextual understanding. Therewith, the answers to RQ1 and RQ2 may help to improve the conceptualisation of cross-contextual learning. Next to that, the student perspective has been shown to partly differ from other perspectives, and that the relevant theories should distinguish this differential (RQ3). Derived from the theoretical implications, some first questions for further research have already been established, which will be elaborated upon in Section 8.3. In the following section, the theoretical implications of RQ 4 are taken up.

Student voice / Educational design

The literature regarding the involvement of students within educational design processes concerns a number of different aspects:

- Students' and teachers' perceptions of the importance of the enquiry and integration of the student perspective in educational designs;
- Advantages and disadvantages of different forms of enquiry and collaboration;
- The timing of enquiry and collaboration;
- Distribution of (decision) power and control; and,
- Conditions and circumstances important for involving students in the processes of educational design.

The current study shows how these aspects apply to different phases of educational design processes, which were DBR-processes in the context of the study. Figure 15 visualises how the application of the different aspects to the different phases was found.

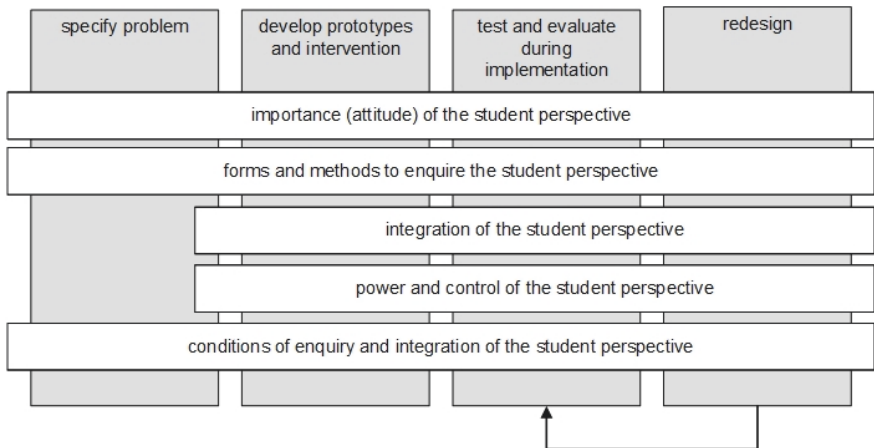


Figure 15: *The Student Perspective in Educational Design*

The current study aimed to contribute to the process and to the literature through its specific focus on the collaborative design of cross-contextual learning scenarios. It helps to understand the visions of both students and teachers towards the processes to design cross-contextual learning scenarios, with a specific focus on the involvement of the student perspective in those processes. Although the current study found that all parties in all cases appeared satisfied with the current situation, reflections on the results pointed to the potential for further development and change. They especially implicate the need for further research, which is discussed in the next section.

8.3. Research Agenda and Outlook

The primary or initial objective of the current study was to describe the problems and supportive measures experienced by students when learning across different contexts; from their perspective. Next to answering the research questions, the study showed there to be potential to improve cross-contextual learning as well as a need to undertake further research in this area. From the perspective of the students, the problems and supporting measures they experienced may well change if the potential of cross-contextual learning is applied to a greater extent.

The second objective of the current study was to describe how the student perspective was taken up within educational design processes for cross-contextual learning scenarios. In addition to answering the research questions, a range of other possibilities became apparent from the study. Again, there was also potential noted here for further research on the topic.

For this section, the ideas for further research were derived from the discussion of the results and their implications. Next to that, the limitations of the current study were considered in order to present more ideas for further research in this area.

8.3.1. Based on the Results and their Implications

Researching the different problem dimensions in depth

In a follow-up study, the different problem dimensions (e.g., the understanding of abstract knowledge) and the (potential) supporting measures as they were found in the current study could be researched in greater depth. Questions that could be addressed include:

- What kind of authentic contexts and tasks make abstract learning content more tangible?
- How can students be better supported to see relations between different learning contexts and to integrate learning experiences gained in different contexts?
- What should assessment look like within cross-contextual learning designs?
- How can prior-knowledge be enquired and used within a certain learning context?

The study provided certain points of reference; however, there remains considerable potential in order to become more concrete and specific. This is especially pertinent because these questions stretch right back to some of the fundamental

and classical problems associated with teaching and learning, which still appear to be problematic in practice, and which are likely to be exacerbated within instances of increased cross-contextuality. There is potential, therefore, to further research these questions from the perspective of cross-contextuality.

Comparison of the teacher perspective

The student perspective was central to the current study. Although the teacher perspective was enquired in order to be able to compare the student and the teacher perspectives, the data regarding the teacher perspective was not compared across the four cases in this research. This could, therefore, form an alternative angle for any future research agenda.

Testing different supporting measures

In the current study, the evaluation data regarding the implementation of developed interventions and supporting measures did not form part of the analysis. Therefore, a further item on the agenda for future research could be to analyse this data with a view then to relate it back to the problems as reported in the students' experiences. Next to that, the interventions and supporting measures that were proposed by the students because they expected them to be supportive could be evaluated.

Researching competence orientation

As described in Section 7.2, the focus on competence development was not found in the actual data. Additionally, in the literature, this topic was also found to be limited. This is a clear research gap that could be naturally seen as high on the agenda for future research. One key question to address would be, How can we develop and foster students' competences in order that they themselves can learn cross-contextually? First, however, it is necessary and relevant to research which competences students would actually need in order to be able to do so (Dilger et al., 2019).

Researching the proposed model for collaborative design of cross-contextual learning scenarios

Section 7.2 introduced a process model for the collaborative designing of cross-contextual learning scenarios. A next step could be to research the model in practice. This would require several key questions to be answered, including:

- How do students and teachers experience the processes proposed in the model?
- How effective are these processes?

Also, it could be further researched what the proposed model would mean at the institutional level, addressing questions such as:

- What change does the implementation demand on levels beyond the micro-didactical?
- What kind of learning culture is needed for the model to be effectively implemented?
- How could this learning culture be best developed?

8.3.2. Based on the Limitations of the Study

In this section, first, the limitations of the current study, which may have influenced the results, are discussed. While most methodological issues have already been discussed in Chapter 5, this section focuses on issues which came to the surface during the execution of the current study. The potential or possible influence on the results of these issues is therefore described. After, ideas for future research to further develop and mitigate these issues.

Researching problems and supporting factors: how far does imagination reach?

One of the biggest challenges faced in the current study has been to encourage students and teachers to think about cross-contextuality. The concept was introduced to the students and teachers, and whilst they appeared to appreciate what was meant by it, it was challenging for the researcher to be sure of a level of shared understanding. The current study worked with the theory that contexts were distinguished from one another as soon as one aspect of the context changed. Similarly, a learning scenario was defined as being cross-contextual as soon as more than one context came into play with regards to the learning intentions or objectives. This means that, in actuality, students move across numerous contexts during their academic studies. During the current study, the students were asked about cross-contextuality, both directly and indirectly. In the case of the latter, their learning was enquired through a focus on the problems that they experienced. The problems were then categorised by the researcher in terms of their cross-contextuality based on the definition. This approach was undertaken because the students themselves often seemed to exhibit a narrower understanding of cross-contextuality. Whilst they were clearly able to explicitly describe problems between locations, between courses, and between their schooling and professional work contexts, they were less able to explicitly describe problems between different pedagogical contexts within a

single course or class (e.g., instruction and application contexts). Most problems with regards to less clearly distinguishable contexts for students, came to the surface through their being asked more open-ended questions about what they perceived as hindering factors and challenges with regards to learning. Although the problem-centred enquiry helped them to discuss and view certain problems as being cross-contextual (looking at the problem from a certain angle), to research the specific phenomenon (as understood in the current study) did not prove to be an easy task. The students were often not conscious about both the contexts and the relations, transitions, and integrations they went through on a daily basis.

For both direct and indirect enquiry, the understanding of where the learning took place played an important role. During the study, it became especially clear to what extent the students viewed formal educational contexts as a place to learn, and this may have influenced the problems they took into account. As previously described in the discussion, the students often did not come up with informal contexts which could actually help them to better understand a topic. The absence of these contexts in their understanding of learning also points to the challenge of researching problematic relations (including absent relations) to those learning contexts. When questions were asked about other possible (eventually unconscious) contexts for learning, it seemed very difficult for the students to think beyond their current understanding of formal learning contexts. It seemed to be very difficult to make explicit implicit additional contexts for learning, and therefore to research the relation between those explicit and implicit learning contexts. For instance (problematic) missing relations could only be interpreted with regards to the contexts and tasks that the students would like to have (access to). Therefore, in this case, there may also be other contexts available within students' existing environment; however, they may simply not be equipped to recognise or relate to them in this way. This means that there may be other problems within cross-contextual learning than were identifiable in the current study.

The fact that some students were unable to recognise certain contexts as learning contexts might relate to students often not being used to thinking cross-contextually. In the current system, this is often not explicitly relevant, hence there are less learning approaches and tasks which make explicit the relations between different contexts in order to reach certain learning objectives. The same counts for exams, which have a strong steering influence in students learning processes.

The same challenge exists for the enquiry of interventions and supporting measures. In the current study, the students were clearly able to think of factors

that supported their learning, or about factors that could help them to consider a certain problem. So long as they had experiences to draw upon from these kinds of supportive measures, they were able to describe these measures and relate them to the problems they had experienced. As Henry Ford once said: 'If I had asked people what they wanted, they would have said faster horses'. This phenomenon also occurred with the students in the current study. The students seemed to describe supportive measures that they knew to be fostering from their other (similar) experiences, and to come up with ideas that were not within their former realities was seen as challenging. This may be explained by the deficiency that people generally have in utilising their imagination beyond for them unknown and unexperienced ideas. To know more about what students' actual situational experiences in terms of support is of considerable value. However, it should be taken into account that other possibilities may also be worth considering when searching for solutions to problems associated with cross-contextual learning.

Researching the involvement of the student perspective in educational design processes

With regards to the involvement of the student perspective, similar challenges surfaced in the current study. Although it was the objective of the current study to research and describe the actual, natural situation, it seemed to be difficult for the students to evaluate their involvement, because they had inadequate experiences with which to compare the current processes to. This lack of alternative experiences made it more difficult for them to reflect the actual experience. Especially with regards to the cross-case analysis in the current study this became visible. Therefore, the different understandings and experiences with student participation (beyond the experienced supportive ways of involvement) made it difficult to compare the results. With regards to the current situation, the objective to describe this situation was reached. However, as to the interpretation of this situation (by the students and the teachers), there is considerable potential for further research with other research designs.

Research in practice: design processes vs. learning processes

Especially with regards to researching the problems and supporting measures, the previously described limitations of the current study were reinforced by the fact that the data was collected within the design processes to foster cross-contextual learning. The students were interviewed (via focus groups and TAPs) and enquired (via questionnaires) outside of their current learning situations (referred to as 'offline methods', van Hout-Wolters, 2009). For the researcher, who was not well versed in the discipline (content-based as well as with regards to typical learning approaches, methods, and tasks in the different disciplines),

it was challenging to understand the students' practices from only their limited verbal descriptions. Observation (as an online method) and discussions regarding the observations would might have helped to foster the researchers' understanding. Collected insights within certain contexts could have helped to introduce the research phenomenon in a way that was better adapted to the students' realities. Beyond that, it may have fostered an even stronger student-oriented interpretation of the collected data. The problem was attempted to be resolved using strategies for communicative validation. However, there is also a potential to verify these interpretations through further research.

With regards to the previously described limitations of the current study, two different kinds of research can be proposed to complement the current study. These are believed to potentially counter the issues that may have influenced the data in the current study, or at least to verify them. Next to that, they may also offer some level of complementary insight.

Design based research

Some of the challenges and limitations of the actual study, could be addressed through complementary, design-based research. As described in Section 5.3, design-based research allows for an analytical approach to a problem, and in parallel to develop and research solutions to those problems. Therefore, it allows to research designs to existing problems.

A design-based research approach values research-practice communication (Euler, 2014, p. 6) in order to be able to develop a new intervention or supporting measures. This could foster a shared understanding of cross-contextuality, which might better allow to research the phenomenon.

Also, it would allow for the researching of appropriate interventions and solutions (including interventions and solutions outside the formal education context and the actually limited cross-contextually-oriented higher education system), because design-based research allows for the testing of new learning scenarios, contexts, and activities (Euler, 2014). Therefore, it allows students and teachers to experience the interventions (and processes), which may then be more concrete to question them about. Similarly, different ways of integrating the student perspective within design processes could be developed and researched. Thus, in this way, the participants would have access to the developed ideal form (solution) for the situation, which provides an alternative frame of reference in which to conduct complementary research.

Longitudinal research

As described in Section 8.3.1, in the current study, the evaluation data with regards to the implementation of the developed interventions and supporting measures was not used for analytical purposes. With data from the current study, this would be possible, albeit limited because the data collection took place during the design process, where time lags existed between the data collection of the initial situations (focus groups) and the data collection of the experiences with the interventions and supporting measures. This means that often, different students were the respondents in the data, and that there may therefore be some bias towards analysing the correlation between the problems and the experiences of the supporting measures. In this context, it might be more interesting to conduct longitudinal research involving the same students. A second argument for longitudinal research is to be able to better focus on cross-contextual learning over time. The results in the current study showed that this problem dimension caused most of the problems that were reportedly experienced. In terms of researching learning across time, longitudinal research offers greater potential insights into this problem dimension.

In summary, the current study offered new insight with regards to the problems that students experience in cross-contextual learning designs, the need for cross-contextual learning designs, and the kinds of support that students need in order to be able to learn cross-contextually. Next to that, the current study offered insight into the way that the student perspective was taken up within educational design processes for cross-contextual learning, and the influence of cross-contextuality on educational designs. At the same time, the current study also raised new and interesting questions that will hopefully elicit further meaning to the current study's results.

Let's stay interested in that what we do not yet fully understand
Adapted from Nick Cave

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Appendices

The attachments in the appendices are presented in the original language to prevent translation bias. For translation or further question, please get in contact with the author.

Appendix A: Interview Guide for Focus Groups

Introduktion:

- In unserem 4-jährigen Projekt SL geht es darum Lehr/Lernszenarien zu verbessern. Es ist dabei sehr wichtig die Perspektive der Studierenden einzuholen (d.h. Ihre Bedürfnisse, Interessen, Probleme usw.). Sie sind schliesslich der Endkunde und wir möchten nicht am Bedarf vorbei entwickeln. Dafür führen wir heute stellvertretend mit Ihnen eine Gruppendiskussion durch, wo wir Ihre Perspektive auf die Lehrveranstaltung einholen.
- Persönliches Vorstellen: Wir sind Pädagogen – keine Fachexperten. Bitte möglichst genau erklären.
- Wir würden das Gespräch gerne aufzeichnen, was für die Auswertung sehr wichtig ist. Was sie sagen wird nur anonymisiert verwendet. Sind sie damit einverstanden, dass wir aufzeichnen?

Fragen:

- Können Sie Ihre schulische und/oder berufliche Laufbahn beschreiben?
- Was kommt Ihnen spontan zu dem Fach in den Sinn?
- Auf einer Skala von 1-10, wie interessant ist das Fach? Warum? (MSL 3)
- Auf einer Skala von 1-10, wie schwierig ist das Fach?
Was hat es schwierig gemacht?
Typische Aspekte auf die man schauen kann: Fach, Lehrperson, Ziele, Material, Assessment (alle MSLs)
- Was hat Ihnen geholfen und was hätten Sie noch brauchen können?
- Knüpft das Fach an etwas schon Bekanntes an? (MSL 1, MSL 3)
- Wie beschäftigen sie sich während des Semesters mit dem Fach?
(Wie haben sie sich bis jetzt mit dem Fach beschäftigt...)
(MSL 2, MSL 4, MSL 5, MSL 6, MSL 7, MSL 8, MSL 10)
- Wie bereiten sie sich auf die Prüfung vor? (MSL 10)
- Wenn eine gute Fee käme und sie hätten drei Wünsche frei um die Lehrveranstaltung zu verbessern – was würden Sie sich wünschen? (Alle MSLs)

Projekt spezifische Fragen (exemplarisch für Fall A):

- Bruch zwischen Mathematik-Unterricht in der Vorbildung und Mathematik-Unterricht an der FH (Frage an Studis im 1. Jahr)
 - Vorbildung
Welches ist Ihre Vorausbildung (Maturität/Berufslehre, wenn Berufslehre welcher Bereich?)
 - Worin unterscheiden sich der Mathe-Unterricht hier und in ihrer Vorbildung massgeblich? Welche Aspekte sind vergleichbar? Hatten Sie Schwierigkeiten,

sich im 1. Jahr an die veränderten Bedingungen im Mathematik-Unterricht zu gewöhnen? Worin lagen diese Schwierigkeiten?

- Bruch mathematische Theorie / Anwendungskontext (Frage v.a. an Studis im 3. Studienjahr)
- Denken Sie an ein Beispiel (nennen Sie das Beispiel), in welchem Sie Ihre im 1. Studienjahr erworbenen mathematischen Kompetenzen in einem Fachmodul haben anwenden müssen.
- Was hat Ihnen geholfen, den Transfer der Mathe auf die Anwendung zu schaffen? Welche Schwierigkeiten traten dabei auf?
- Lernphasen: Ich möchte hier erfahren, ob es bei den Studierenden manchmal zu einer "Blockade" kommt, wenn sie zuhause für sich alleine (oder in Gruppen) den Stoff selber erlernen erarbeiten müssen.
- Herleitung/Modellieren vs. Lösen/Berechnen: Ich vermute, dass die Studierenden vor allem damit zu kämpfen haben, die Problemstellung überhaupt mathematisch formulieren zu können, d.h. sie starten in der Anwendung oft mit einem ungenügend formulierten Problem und können es deswegen dann auch nicht richtig lösen.

Appendix B: TAP Material

Interview guide

Einleitung und Vorstellung:

Begrüßung: Guten Tag!

Dozierende:

- Wir arbeiten im Rahmen eines Projekts an ein Re-Design dieses Kurses.
- Wir sind neugierig, wie sich die Veranstaltung aus Ihrer Perspektive entwickelt.
- Darum führen wir in der nächsten halben Stunde eine qualitative Zwischenevaluation durch.
- Wir möchten das Feedback in den Re-Design Prozess aufnehmen.

Interviewer:

- Mein Name ist ...
- Normalerweise machen wir eine solche Zwischenauswertung zur zweit oder sogar zu dritt. Ich werde vielleicht ab und zu einen kurzen Moment brauchen, um mich und die verschiedenen Aufgaben die ich habe zu koordinieren und hoffe, dass Sie Verständnis dafür haben.
- Auch werde ich Sie bitten, mir an bestimmten Stellen zu unterstützen.

Der erste Teil funktioniert so:

- Sie beantworten drei Fragen zu dieser Veranstaltung.
 - Wodurch lernen Sie in dieser Veranstaltung am meisten?
 - Was erschwert Ihr Lernen?
 - Welche Verbesserungsvorschläge haben Sie für die hinderlichen Punkte?
- Diese teile ich Ihnen gleich auf Zetteln aus.
- Die Fragen nach Erschwernissen und Verbesserungen sind aufeinander bezogen. Bitte finden Sie zu jedem Lernhindernis auch einen Verbesserungsvorschlag. Bitte schreiben Sie diese auf die gleiche Linie.
- Notieren Sie Ideen, Vorschläge der Gruppe auf dem Arbeitsblatt. Bitte leserlich schreiben!
- Achten Sie beim Aufschreiben darauf, dass Ihre Stichworte möglichst anschaulich und konkret sind. (Beispiel: Also z.B. nicht nur das Stichwort „Präsentation“, sondern: Die Schriftgröße auf der Powerpoint ist zu klein.).
- Danach verständigen wir uns im Plenum über die wichtigsten Punkte.
- Im zweiten Teil habe ich dann noch einige spezifischen Fragen. Da kommen wir später drauf.

- Ihre Anmerkungen und Vorschläge gebe ich anonym an die Dozierenden weiter.
- Die Dozierenden werden in der nächsten Sitzung auf die Rückmeldungen Bezug nehmen.
- Bitte achten Sie darauf, dass alle zu Wort kommen
- Jetzt bitte ich Sie, so wie Sie sitzen, Gruppen zu möglichst 4 Personen zu bilden. Bestimmen Sie in den Gruppen einen Protokollanten und bearbeiten sie den Fragebogen.
- Sie haben insgesamt 7 Minuten dafür Zeit.

Gibt es dazu noch Fragen?

Jemand suchen die Blätter einsammelt – und die mitschreibt, bzw. der Plenumteil protokolliert.

Zuerst alle positiven Sachen durchgehen, dann 2 und 3 zusammen.

Nachvollzug: Stichworte konkretisieren, nach Erläuterungen und Beispielen fragen, Bezug bei Frage 2 und 3 (und Priorität). Fragen wie:

- *Was ist gemeint mit...?*
- *Können Sie ein Beispiel geben für...?*
- *Wie sieht einen Verbesserungsvorschlag aus...?*
- Ich habe ein Sample genommen, was haben Sie noch notiert, was wir bis jetzt noch nicht besprochen haben?

Spezifische Fragen (exemplarisch für Fall C)

Abgeleitet aus der Fokusgruppen:

- Wie kommen sie zurecht mit dem Erreichen von mehreren unterschiedlichen Lernzielen (Projektmanagement, App entwickeln, Kommunikation)?
- Wie empfinden sie der Praxis / Realitätsnahe von den Elementen im Kurs?
- Wie ist die Unterrichtsatmosphäre? (Konkurrenzdenken zwischen den Gruppen, war im letzten Jahr ein Problem)
- Wird ihr Bedarf an Feedback abgedeckt?
- Wie fühlen sie sich bewertet / Wie kommen sie mit der Bewertung klar?

Schluss: Weiterarbeit und Dank

Vielen Dank für Ihre Mitarbeit! Sie haben nun Ihre Ideen dazu beigetragen, wie sich die Veranstaltung verbessern kann. Ich werde Ihre Punkte an Ihre Dozentin weitergeben. Sie wird entscheiden, worauf sie vielleicht jetzt schon eingehen möchte und das mit Ihnen in der nächsten Sitzung besprechen.

TAP

Teaching Analysis Poll – Zwischenauswertung

Wodurch lernen Sie in dieser Veranstaltung am meisten?

--

Was erschwert Ihr Lernen?

Welche Verbesserungsvorschläge haben Sie für die hinderlichen Punkte?

--	--

Alle Informationen werden vertraulich behandelt. Bitte geben Sie Ihre Rückmeldung ehrlich und machen Sie möglichst konkrete Anmerkungen/Vorschläge.

Appendix C: Questionnaire



In welcher Form haben Studierenden Einfluss auf der Kursgestaltung gehabt?

Der Einfluss von Studierenden auf der Kursgestaltung war:



Wie fanden Sie die folgenden Massnahmen, um als Studierende Einfluss auf die Kursgestaltung nehmen zu können.

Wenn Sie möchten, können Sie im Textfeld zu der jeweiligen Form begründen warum diese für Sie (nicht) geeignet war.

Wenn Sie nicht teilgenommen haben, wählen Sie bitte "trifft nicht zu".

	Geeignet	Nicht geeignet	Trifft nicht zu
Fragebogen am Anfang der Veranstaltung 	☐	☐	☐
(Informelle) Gespräche mit dem Dozenten 	☐	☐	☐
Mündliche Befragung von extern / TAP 	☐	☐	☐
Fragebogen am Ende der Veranstaltung (dieser) 	☐	☐	☐

Appendix D: Interview Guides for Interviews

Teachers / Project leaders

Thema: Einbeziehung der Studierendenperspektive in Educational Design Prozesse

Dahinterliegende Forschungsfragen:

1. What seems are relevant from the teachers' perspective? (*second priority, there's different data as well to answer this question, such as documentation*)
 2. What role does the students' perspective play in educational design processes that aim to enhance seamless learning? (*first priority*)
 3. How do teachers and students experience the design processes regarding the integration of the students' perspective? (*first priority*)
-

Einleitung

- **Ziel des Interviews:** ich schreibe meine Dissertation innerhalb des Projektes Seamless Learning (Basisprojekt). Der Fokus meiner persönlichen Forschung liegt auf der Integration der Studierendenperspektive. Einerseits: es wurde innerhalb der Seamless Learning Literatur noch kaum erforscht, wann und wie Studierende «seams» wahrnehmen. Dazu haben unter anderen die Fokusgruppen gedient. Andererseits gibt es die Frage, ob und wie man die Studierendenperspektive in Educational Design Prozesse aufnehmen und integrieren (oder Studierende einbeziehen) sollte. Educational Designer beschreiben in der Literatur sowohl Vor- als Nachteile (Potenzial und Grenzen). Dieses Interview dient dazu dies aus der Perspektive der Dozierende zu betrachten. Wie siehst DU das? Findest du es sinnvoll, die Perspektive der Studierende mit in die Planung und Gestaltung aufzunehmen? Wann? Warum, oder warum nicht? Was sind Vor- und Nachteile? Wie sollte man das idealerweise umsetzen? Ist das realistisch?
- **Startsituation:** allererst möchte ich nochmal betonen, dass ich beschreibende Forschung mache. Das heisst, dass ich keine Hypothesen oder Idealvorstellung habe. Es gibt keine richtige oder falsche Aussage zu den Fragen. Ich möchte wirklich offen, explorativ herangehen und so differenzieren wie möglich rausfinden, ob, in wie fern oder wann es sinnvoll ist, die Studierendenperspektive mit einzubeziehen. Und auch WIE? Aus Deiner individuellen Sicht.
- **Rollenklärung:** was ich unbedingt auch explizit anspreche möchte, ist meine Doppelrolle als P1-Mitarbereitin UND Doktorandin. In dem Interview hat es teilweise Fragen die direkt oder indirekt dem Prozess betreffen, den wir zusammen im Projekt durchlaufen. Ich hoffe, dass wir das gemeinsam konstruktiv-kritisch anschauen können, in einem vertraulichen Rahmen. Wenn es Fragen gibt, die Du nicht beantworten möchtest, bist Du natürlich frei das zu sagen.
- **Datenschutz:** Ich würde das Gespräch gerne aufnehmen, damit ich die Interviews transkribieren kann. Nachher würde ich die Transkripte so gut wie möglich anonymisieren und analysieren. Ist es in Ordnung für dich, wenn ich das Gespräch aufnehme?
- **Vorgehen:** Ich habe Fragen vorbereitet. Doch ich stelle mir ein Dialog vor, mehr als ein Frage-Antwort-Gespräch. Es sind teilweise Fragestellungen, die man vermutlich nicht sofort, eindeutig und klar beantworten kann, sondern wo man mit «thinking-out-loud» innerhalb von Spannungsfelder und Dilemmas ein Gefühl, eine Meinung oder eine persönliche Vision beschreibt. Das ist völlig in Ordnung. Ich werde die Interviews wie gesagt transkribieren, die wichtigsten Sachen zusammenfassen und dann nochmal auf dich zukommen, ob ich das richtig verstanden und interpretiert habe und dann könnten wir allenfalls auch nochmal ändern, falls du etwas doch anders siehst.
- **Hast du, vor wir anfangen, noch Fragen?**

Einleitende Fragen

- Wie nimmst du den Entwicklungs-/Designprozess der Entwicklung Seamless Learning Massnahmen (den wir bis jetzt zusammen durchlaufen haben) bis jetzt wahr?

Sprache/Definitionsklärung einlegen. Mein Gegenstand ist der Prozess worin wir (gemeinsam) Seamless Learning Massnahmen/Konzeptionen entwickeln. Ich nenne das persönlich: der Entwicklungs- oder Designprozess. Wie nennst du das?

- Was läuft gut, was weniger gut? Was ist anders, als du es dir vorgestellt hast?
- Was würdest du allenfalls anders machen?
- Was wäre deine Idealvorstellung von einem Prozess der Entwicklung Seamless Learning Massnahmen?
- Wer sind die wichtigsten Akteure im Prozess?

Themen-bezogen Fragen

Subthema: Formen des Abholens der Studierendenperspektive

Sprache/Definitionsklärung einlegen. Mit der Studierendenperspektive meine ich alle mögliche Informationen die die Wahrnehmung der Studierende repräsentieren können. Das können formelle aber auch informelle Quellen sein. Informationen aus Evaluationen, aber auch aus Gespräche, Beobachtungen usw.

- In wie fern hast du das Gefühl, dass du die Studierendenperspektive kennst?
- Wie hast du/holst du die Studierendenperspektive ab?
 - Welche bestehende Informationsquellen werden genutzt um die Wahrnehmung der Studierenden rauszufinden (Evaluationen, Sprechstunden, ...)?
 - Nimmst du zusätzlich noch *konkreten eigenen Aktivitäten* vor um die Wahrnehmung der Studierenden rauszufinden (aktive Gespräche, Befragungen, ...)
- Wann wird die/wann holst du die Studierendenperspektive ab? (*co-design vs. re-design*)
- Wie kann/sollte die Studierendenperspektive am besten/idealerweise abgeholt werden? Welche Form eignet sich deiner Meinung nach dafür am besten? (*auch hier: formell, informell, organisiert von der HEI oder individuell*)
- Wann kann/sollte die Studierendenperspektive am besten abgeholt werden?
- Wie findest du den Output der Fokusgruppen?

Subthema: Bedeutung / Relevanz der Studierendenperspektive

- Welche Rolle spielt die Studierendenperspektive für eine erfolgreiche Lernprozessgestaltung aus deiner Sicht?
- Wozu ist die Studierendenperspektive am wichtigsten?
 - Wie wichtig ist die Studierendenperspektive für die *Entwicklung des didaktischen/Kurs Konzeptes*? Warum?
 - Wie wichtig ist die Studierendenperspektive für die *Implementierung* des didaktischen Konzeptes? Warum?

Subthema: Integrieren der Studierendenperspektive

- Wie hast du vor, die Studierendenperspektive (die gesammelten Informationen) in den Designprozess aufzunehmen?
- Welche Rahmenbedingungen (könnten) beeinflussen, welche Form man wählt? (*desirability vs. possibility*)
- Wie würdest du die Informationen/Studierendenperspektive idealerweise aufnehmen?

In der Literatur werden verschiedene Formen/Möglichkeiten beschrieben, welche ich gerne durchdiskutieren würde (um den Blick allenfalls noch etwas zu erweitern). Pro Form:

Ist diese Form wünschenswert oder nicht? Warum, warum nicht? (Vor- und Nachteile) In welcher Situation? Realistisch?

- No role
- Feedback
 - Allg. Evaluationsinstrumente, organisiert von der HEI
 - Spezifische Fragebogen (quan)
 - Interviews/Fokusgruppen (qual)
- (Haus)-Arbeiten / Prüfungen / Noten
- Informelle Gespräche
- Co-creation Team / Workshop
 - User check
 - Mitentwicklung (von Brainstorm bis Prototyp bis Konzeption)

Welche Rahmenbedingungen (könnten) beeinflussen, welche Form man wählt? (*desirability vs. possibility*)

Wer sollte schlussendlich bestimmen? (im Fall unterschiedliche Meinungen). Warum?

Diskussionspunkt / Spannungsfeld: auseinanderlaufende Visionen in der Literatur: Studierende selbst weil studierende-zentriertes Lernen vs. Dozierende weil die Studierende nicht übersehen können was sie langfristig brauchen.

- Wer weiss am besten was/wie die Studierende lernen «sollten»?

Abschliessende/Zusammenfassende Fragen

- Wärest du bereit darüber nachzudenken, wie wir die Studierenden im Laufen des Prozesses einbeziehen können, und damit zu experimentieren?

Dank

Students

Interviewleitfaden: Pre-Interview mit in den Einzelprojekten einbezogenen Studierenden

Thema: Einbeziehung der Studierendenperspektive in Educational Design Prozesse

Dahinterliegende Forschungsfragen:

1. What role does the students' perspective play in educational design processes that aim to enhance seamless learning? *(first priority)*
 2. What role should the students' perspective play in educational design processes that aim to enhance seamless learning? *(first priority)*
 3. How do teachers and students experience the design processes regarding the integration of the students' perspective? *(first priority)*
-

Einleitung

- **Ziel des Interviews:** ich schreibe meine Dissertation innerhalb des Projektes Seamless Learning (Basisprojekt). Der Fokus meiner persönlichen Forschung liegt auf der Integration der Studierendenperspektive. Einerseits: es wurde innerhalb der Seamless Learning Literatur noch kaum erforscht, wann und wie Studierende «seams» wahrnehmen. Dazu haben unter anderen die Fokusgruppen gedient. Andererseits gibt es die Frage, ob und wie man die Studierendenperspektive in Educational Design Prozesse aufnehmen und integrieren (oder Studierende einbeziehen) sollte. Educational Designer beschreiben in der Literatur sowohl Vor- als Nachteile (Potenzial und Grenzen). Dieses Interview dient dazu dies aus der Perspektive der Studierende zu betrachten. Wie siehst DU das? Findest du es sinnvoll, die Perspektive der Studierende mit in die Planung und Gestaltung aufzunehmen? Wann? Warum, oder warum nicht? Was sind Vor- und Nachteile? Wie sollte man das idealerweise umsetzen? Was ist realistisch?
- **Startsituation:** allererst möchte ich nochmal betonen, dass ich beschreibende Forschung mache. Das heisst, dass ich keine Hypothesen oder Idealvorstellung habe. Es gibt keine richtige oder falsche Aussage zu den Fragen. Ich möchte wirklich offen, explorativ herangehen und so differenziert wie möglich rausfinden, ob, in wie fern oder wann es sinnvoll ist, dass die Studierendenperspektive mit einbezogen. Und auch WIE? Aus Deiner individuellen Sicht.
- **Rollenklärung:** was ich unbedingt auch explizit ansprechen möchte, ist das wir alle Doppelrollen im Projekt haben. Ihr seid da als angestellte Mitarbeiter im Projekt. Ich frage euch aber, aus der Studentenrolle oder Perspektive zu sprechen. Ich bin Mitarbeiterin im Basisprojekt, bin aber da als Doktorandin. In dem Interview hat es teilweise Fragen die direkt oder indirekt dem Prozess betreffen, den wir zusammen im Projekt durchlaufen. Ich hoffe, dass wir das gemeinsam konstruktiv-kritisch anschauen können, in einem vertraulichen Rahmen. Wenn es Fragen gibt, die Du nicht beantworten möchtest, bist Du natürlich frei das zu sagen.
- **Datenschutz:** Ich würde das Gespräch gerne aufnehmen, damit ich die Interviews transkribieren kann. Nachher würde ich die Transkripte so gut wie möglich anonymisieren und analysieren. Ist es in Ordnung für Euch, wenn ich das Gespräch aufnehme?
- **Vorgehen:** Ich habe Fragen vorbereitet. Doch ich stelle mir ein Dialog vor, mehr als ein Frage-Antwort-Gespräch. Es sind teilweise Fragestellungen, die man vermutlich nicht sofort, eindeutig und klar beantworten kann, sondern wo man mit «thinking-out-loud» innerhalb von Spannungsfelder und Dilemmas ein Gefühl, eine Meinung oder eine persönliche Vision beschreibt. Das ist völlig in Ordnung. Ich werde die Interviews wie gesagt transkribieren, die wichtigsten Sachen zusammenfassen und dann nochmal auf Euch zukommen, ob ich das richtig verstanden und interpretiert habe und dann könnten wir allenfalls auch nochmal ändern, falls Ihr etwas doch anders siehst.
- **Habt ihr, vor wir anfangen, noch Fragen?**

Einleitende Fragen

- Wie genau seid ihr im Projekt angestellt?
- Wie seid ihr auf der Stelle/bei der Anstellung gekommen?
- Wie findet ihr die Projektidee um den Kurs im Rahmen/mit Hinblick auf Seamless Learning zu überarbeiten?

Sprache/Definitionsklärung einlegen. Mein Gegenstand ist der Prozess worin wir (gemeinsam) Seamless Learning Massnahmen/Konzeptionen entwickeln, bzw. den Kurs gestalten. Ich nenne das persönlich: der Entwicklungs- oder Designprozess. Wie nennt ihr das?

- Wie nimmt ihr den Entwicklungs-/Designprozess der Entwicklung Seamless Learning Massnahmen bis jetzt wahr?
- Was läuft gut, was weniger gut? Was ist anders, als ihr es euch vorgestellt habt?
- Was würdet ihr allenfalls anders machen?
- Was wäre deine Idealvorstellung von einem Prozess der Entwicklung Seamless Learning Massnahmen?
- Wer sind die wichtigsten Akteure im Prozess?

Themen-bezogen Fragen

Subthema: Formen des Abholens der Studierendenperspektive

Sprache/Definitionsklärung einlegen. Mit der Studierendenperspektive meine ich alle mögliche Informationen die ihr dem/der Projektleiter/in/Mitarbeiter/in aus eurer Sicht geben könnt um erfolgreiche Seamless Learning Massnahmen entwickeln zu können (um die Überarbeitung oder Neukonzeption des Kurses erfolgreich zu machen).

- In wie fern habt ihr das Gefühl, dass die Lehrperson/Projektleiter die Studierendenperspektive kennen?
- Welche Quellen können Lehrpersonen nutzen um die studentische Perspektive kennenzulernen?
 - Welche *bestehende Informationsquellen* gibt es um die Wahrnehmung der Studierenden rauszufinden (Evaluationen, Sprechstunden, ...) ?
 - Was für *zusätzliche Aktivitäten* unternehmen Lehrpersonen um die Wahrnehmung der Studierenden rauszufinden (aktive Gespräche, Befragungen, ...)
- (Wann) Wurde die Studierendenperspektive eingeholt? (*co-design vs. re-design*)
- Wann kann/sollte die Studierendenperspektive am besten eingeholt werden?
- Wie kann/sollte die Studierendenperspektive am besten/idealerweise eingeholt werden?
- Welche Form eignet sich eurer Meinung nach dafür am besten? (*auch hier: formell, informell, organisiert von der HEI oder individuell*)
- Was fand ihr von der Fokusgruppe?
- Wie fand ihr die Mitarbeit in den Workshops (explizit Rolle eines Studierenden)?

Subthema: Bedeutung / Relevanz der Studierendenperspektive

- Welche Rolle spielt die Studierendenperspektive für eine erfolgreiche Lernprozessgestaltung aus eurer Sicht?
- Wozu ist die Studierendenperspektive am wichtigsten?

- Wie wichtig ist die Studierendenperspektive für die *Entwicklung des didaktischen/Kurs Konzeptes*? Warum?
- Wie wichtig ist die Studierendenperspektive für die *Implementierung* des didaktischen Konzeptes? Warum?
- Was wäre anders gewesen, wenn es euch (in der Rolle der Studierende) nicht gegeben hätte, bzw. wenn ihr keine Erfahrung mit dem Kurs gehabt hätten?

Subthema: Integrieren der Studierendenperspektive

- Wie haben die Projektleiter/die Lehrpersonen die Studierendenperspektive (die gesammelten Informationen) bis jetzt aufgenommen? (Im Prozess, bei der Konzeption)
- Welche Rahmenbedingungen (könnten) beeinflussen, welche Form die Lehrperson wählt? (*desirability vs. possibility*)
- Wie sollten die Projektleiter/die Lehrpersonen die Informationen/Studierendenperspektive idealerweise aufnehmen?
- Kennt ihr andere positiv oder negativ Beispiele, wo die Studierendenperspektive gut oder schlecht aufgenommen wurde, bei der Überarbeitung oder Neugestaltung eines Kurses?

In der Literatur werden verschiedene Formen/Möglichkeiten beschrieben, welche ich gerne durchdiskutieren würde (um den Blick allenfalls noch etwas zu erweitern). Pro Form:

Ist diese Form wünschenswert oder nicht? Warum, warum nicht? (Vor- und Nachteile) In welcher Situation? Was sind Voraussetzungen um die Form erfolgreich einsetzen zu können? Realistisch? (ACHTUNG: Sicht der Studierende!)

- No role
- Feedback
 - Allg. Evaluationsinstrumente, organisiert von der HEI
 - Spezifische Fragebogen (quan)
 - Interviews/Fokusgruppen (qual)
- (Haus)-Arbeiten / Prüfungen / Noten
- Informelle Gespräche
- Co-creation Team / Workshop
 - User check
 - Mitentwicklung (von Brainstorm bis Prototyp bis Konzeption)

Welche Rahmenbedingungen (könnten) beeinflussen, welche Form man wählt? (*desirability vs. possibility*).

Wer sollte schlussendlich bestimmen? (im Fall unterschiedliche Meinungen). Warum?

Diskussionspunkt / Spannungsfeld: auseinanderlaufende Visionen in der Literatur: Studierende selbst weil studierende-zentriertes Lernen vs. Dozierende weil die Studierende nicht übersehen können was sie langfristig brauchen.

- Wer weiss am besten was/wie Studierende lernen «sollten»?

Abschliessende/Zusammenfassende Fragen

- Gibt es dieses Themas bezüglich noch etwas, was ihr anmerken möcht?

Dank

Appendix E: Guide for Transcription

Entscheidungen im Rahmen der Transkription, bzw. Data-Aufbereitung.

Prozess

1. Interview durchgeführt und aufgenommen (mit Zusage)
2. Aufnahme transkribiert mit F4, sehe Anmerkungen.
3. Transkript an Dozierenden geschickt. Er/Sie darf bei Bedarf Veränderungen, Anmerkungen und Ergänzungen machen (im Word mit «Änderungen nachverfolgen»).

Darstellungen in der Transkription

- Denkpausen wurde angedeutet mit drei Punkten (z.B. Uhm... oder (...))
- Wann schriftlich unerkennbar war, ob etwas bestätigend oder ablehnend gemeint war, wurde das in Klammern angegeben.
- Bei bestimmten Bezugnahmen (Verweisworte) gibt es Anmerkungen (worin ich nochmal explizit mache, worauf die sich bezogen haben).

Übersetzung Schweizerdeutsch auf Hochdeutsch:

- Worte die es im Deutschen nicht gibt, habe ich ins Hochdeutsch übersetzt. So wurde das schweizerdeutsche «luegen» übersetzt mit «schauen». «übercho» wurde «bekommen». «öppis» wurde «etwas», «öpper» wurde «jemand». «e chli» wird «ein bisschen»... usw. Das hat teilweise auch einen Einfluss auf dem Satzbau. Ich habe mich, auch wenn es grammatikalisch auf Hochdeutsch nicht stimmt, jedoch so viel wie möglich an dem Satzbau auf der Aufnahme festgehalten.
- Worte wobei die schweizerdeutsche Bedeutung anders ist als die hochdeutsche, habe ich ins Hochdeutsch übersetzt, zum Beispiel «Schaffen» (schweizerdeutsch für sowohl arbeiten als «erreichen») wurde somit Arbeiten. Reden und Sprechen wurde im Gegensatz nicht verändert, weil die Worte die gleiche Bedeutung haben. Auch wenn man auf Hochdeutsch in bestimmten Fällen vermutlich eher «sprechen» sagen würde.

Appendix F: MAXQDA File

In this appendix it is referred to the MAXQDA file, which includes all data (a list of documents, e.g., transcripts), categories (and the codebooks with descriptions of the categories, examples, distinctions), the coding itself, queries for analyses, visual tools for analyses, and memos (e.g., document memos, memos for analyses, reflective memos). In this appendix, some (exemplary) elements are presented in order to provide insight in the data, collection, and analyses. Thus, to make traceable the research process. When the file is needed for further understanding of the dissertation, please check this with the author (luci.gommers@unisg.ch).

The following (exemplary) elements can be found:

- List of categories (excluding descriptions, examples, distinctions, and non-used categories)
 - Problems
 - Supporting measures
 - Involvement of the student perspective in design processes
- Visual tool (maps)

Lists of Codes

Problems

<i>Cross-contextual learning problems (incl. context missing) (vs. other problems)</i>		
<i>Main categories: MSLs adapted from Wong and Looi (2011)</i>	<i>Subcategories (Hawelka, 2016/inductive)</i>	<i>Subcategories (Hawelka, 2016/ inductive)</i>
MSL 1: Formal_Informal		
MSL 2: Individual_Social		
MSL 3: Time (setting/content-wise)	- Prior educational contexts/degrees - Future courses/work	
MSL 4: Location		
MSL 5: Resources/Knowledge	- Lernmaterialien - Personelle ressourcen (Ansprechpartner bei Problemen)	Lernmaterialien: - Form - Zugriff / Auffindbarkeit - Software / LMS
MSL 6: Physical_Digital		
MSL 7: Devices_Hub		
MSL 8: Tasks	- Anwendung (missing)	
MSL 9: Knowledge synthesis	- Prior knowledge (disciplinary, complexitiy) - Theoretical vs. practical knowledge) - Elaboration (breite/tiefe)	
MSL 10: Approaches_Methods	- School vs. authentic - Instruction vs. application - Learning vs. assessment	
Outcomes (other than continuity and understanding)	- Motivation	- Relevanz - Interessantheit - Autonomie - Kompetenzerleben - Soziale Eingebundenheit
Requirements	- Zeit - Competences (e.g., self-regulation, organisation, discipline)	

Supporting measures

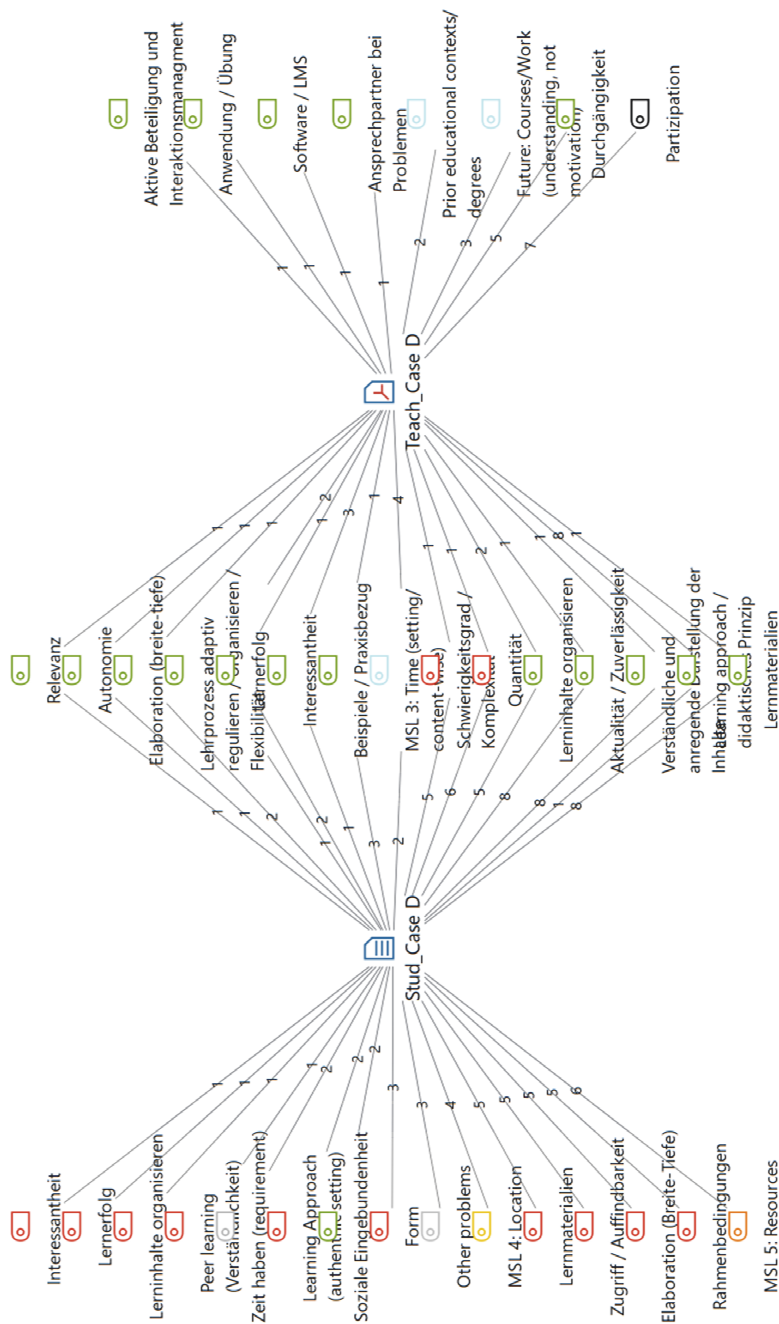
<i>Supporting measures</i>		
<i>Main categories: adapted from Hawelka (2016)</i>	<i>Subcategories (Hawelka, 2016/inductive)</i>	<i>Subcategories (inductive)</i>
Inhalte	- Schwierigkeitsgrad - Quantität - Aktualität / Zuverlässigkeit	
Interaktion	- Veranstaltung leiten - Aktive Beteiligung und Interaktionsmanagement - Verständliche und anregende Darstellung der Inhalte - Peer learning	
Subjektive Konstruktion der Lernaufgabe / Assessment	Bewertung	
Motivationale Regulation	- Relevanz - Interessantheit - Autonomie - Kompetenz erleben - Soziale Eingebundenheit - Interesse und Engagement der Lehrperson	
Kognitive Verarbeitung	- Lerninhalte organisieren - Wiederholung - Elaboration - Inhalte kritisch prüfen	
Steuerung des Lernprozesses	- Lehre planen und strukturieren - Adaptivität - Lernfortschritt überprüfen / Feedback	Lehre planen und strukturieren - Lernapproach / didaktisches prinzip - Authentic context / methods
Ressources	- Lernmaterialien - Personelle ressourcen (Ansprechpartner bei Problemen)	Lernmaterialien: - Form - Zugriff / Auffindbarkeit
Rahmenbedingungen		
Competences		

Involvement of the student perspective in design processes

<i>Einbezug/Partizipation der Studierendenperspektive</i>		
<i>Hergeleitet aus der Literatur</i>		
Einschätzung: Doz-Wissen über die Stud-Perspektive		
Wichtigkeit / Wozu der Stud-Perspektive?		
Wahrgenommener Diskrepanz Stud-Doz Perspektive		
Form: Wie Stud-Perspektive abholen?	- Real - Ideal	Form Real: - Nicht / Negativ
Zeitpunkt (des Abholens/der Integration)	- Real - Ideal	
Integration der Stud-Perspektive	- Real - Ideal	
Power/Control		
Rahmenbedingungen		
Folge/Konsequenzen von Partizipation		



Zwei-Fälle-Modell





Curriculum Vitae

Personalia

Name	Luci Gommers
Date of Birth	August 27, 1991
Nationality	Dutch

Education

02.2016-01.2021	PhD at the University of St. Gallen (Switzerland) Programme Organisation Studies and Cultural Theory
09.2012-02.2015	Masters at the Antwerp University (Belgium) Programme Educational and Training Science Graduation: Master of Science
09.2008-06.2012	Bachelors at the HAN University of Applied Sciences (Netherlands) Programme Education (Pedagogiek) Minor Programme Personal and Professional Development Bernard Lievegoed College for Liberal Arts (Netherlands) Graduation: Bachelor of Arts

Experience

04.2015-01.2021	Institute for Business Education and Educational Management University of St. Gallen (Switzerland) Academic assistant
03.2014-03.2015	Antwerp Rail Repair (Belgium) Assistant Human Resources
01.2010-01.2013	'Pedagogiek PLUS' HAN University of Applied Sciences (Netherlands) Development of honours program for the bachelors 'Pedagogiek'
09.2010-06.2011	Child Care and Protection Board Ministry of Justice and Security (Netherlands) Internship