6 Discussion and Outlook

While the previous chapters reflect the two-staged approach of this thesis

1) to identify influence factors of and
2) develop support for personalised learning,

the following discussion aims to summarise and evaluate this thesis' findings with regard to similar research and derive its major contributions.

6.1 Discussion

Beginning with an investigation of the status quo of personalised learning, this thesis replenishes the theories of learning styles (Honey and Mumford 1992) matching practical and theoretical learning styles to enactive and vicarious training methods. If such a matching is achieved in negotiation trainings, better skill acquisition and application of the knowledge learned is proposed leading to more effective, efficient, and fairer negotiation outcomes. These assumptions are tested in a laboratory experiment assigning the participants to negotiation trainings conducted using distinct training methods. While personalised learning – indicated by matching learning style and training method – leads to positive effects on the acquisition of electronic negotiation skills, as well as the efficiency and fairness of negotiation outcomes, the effects of the training method are found to be much stronger.

Dwelling on these results, learning tasks (i.e. the tasks learners perform according to a specific training method) are decided to be the main object of analysis. Creating a generalisable framework of personalised blended learning (i.e. the PLF) the learners are modelled as a self-regulated COI (Garrison 2011). Based on Bloom's taxonomy of learning tasks (Bloom et al. 1984; Krathwohl 2002) and taxonomies of social media learning tools (Churches 2009; Bower et al. 2010), the learners personalise their learning selecting and using learning tasks and learning tools according to their individual respectively group preferences. This process of personalisation is explained using cognitive fit (Vessey 1991). A learning task must fit the mental representation of a learning task-solution, while a learning task supported by a learning tool must fit the mental representation of the learning tool-solution. Furthermore, learning task and learning tool have to be compatible following the notion of task-technology fit (Goodhue and

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Thompson 1995). If such a fit can be achieved, learning performance will increase. Besides this process of personalisation, institutional and contextual variables are of major importance influencing the personalisation of learning tasks and learning tools (Gross et al. 2016; Ganzert et al. 2017).

Building on the PLF, a design and implementation for the course Advanced Negotiation Management (ANM) at the University of Hohenheim is created to show the feasibility of the approach. Developing an explanatory design theory, twelve general requirements are derived from the PLF namely: the personalisation of

1) tasks and tools,
2) website, and
3) communication;
4) freedom and guidance for personalisation;
5) a central platform for learning backed by
6) reasonable infrastructure and support for the users,
7) open communication and
8) collaboration between teacher and learners,
9) practical inquiry as a training method, and a teacher who is responsible for
10) course design and organisation,
11) facilitating discourse, and
12) direct instruction.

While these requirements must be present in any kind of self-regulated personalised learning course, further negotiation-specific general requirements are:

13) teaching negotiation theory and practice,
14) including negotiation experts,
15) addressing face-to-face and e-negotiations, as well as
16) formative and summative assessment.

These requirements are translated into seven general course components, which must be present in any course aiming to personalise learning. They can be structured by balancing didactics (i.e. using a flipped classroom process model, focusing on higher order thinking skills throughout), content (i.e. providing correct and comprehensive content using suitable

tools), and technology (i.e. using one VLE extended by sufficient organisational and technical support for its users). Besides the explanatory design theory, a practical design theory is presented, showing the implementation of a proof-of-concept design of the ANM course, which aims to personalise learning using the method of the flipped classroom (Strayer 2012).

This design and implementation show numerous avenues to operationalise self-regulated personalised learning leading to different course designs at the same time requiring different evaluation concepts. Therefore, a holistic evaluation concept is developed by Melzer and Schoop (2017b) encompassing models and measures from the learning sciences as well as ISs research. Furthermore, following a design-oriented research methodology, mixed-method approaches are often suggested combining the strengths of quantitative and qualitative measurement to achieve a comprehensive picture of the numerous variables involved in a real university course (Anderson and Shattuck 2012; Bishop and Verleger 2013). The proposed evaluation concept focuses on the achievement of the postulated requirements, learning outcomes, adoption, and individual differences.

6.1.1 A Comparison to Recent Work in the Field

The following integrative discussion aims to evaluate the results presented in the previous chapters. Thus, their different foci and research methods are synthesised providing a holistic perspective on influence factors, design, and support potentials for personalised learning. The findings are embedded into related literature.

Modelling personalised learning, learning styles are probably the most prominent measures in the scientific literature. As a comparison, Google Scholar provides 3.780.000 resulting articles regarding learning styles, while personalised learning only leads to 75.700 articles (Google Scholar 2017). Furthermore, learning style theories and instruments, as measures which are easy to understand and apply, are marketed in non-scientific publications and consulting (Honey and Mumford 2000; Kolb and Kolb 2005) and therefore are very influential in policy making, corporate education, and schools. A poll among teachers in Great Britain and the Netherlands revealed that 85% of the participating teachers believed in learning styles and 66% of them used learning styles in their schools (Weale 2017). Furthermore, there is also a broad corpus of scientific literature advocating the use of learning styles for personalising learning admitting positive effects towards numerous variables (cf. Chen and Chiou 2014; Kumar et al.

2011). While the literature supports that learners have individual differences regarding the presentation of knowledge, evidence regarding positive effects of a matching between these learning styles and the mode of instruction is questioned in the scientific literature (Dekker et al. 2012; Scott 2010; Pashler et al. 2009). Literature reviews on learning styles find over 70 different models and instruments often having conflicting underlying assumptions (Cassidy 2004; Coffield et al. 2004). Coffield et al. (2004) analyse the 13 most influential models still finding no consistent picture. Furthermore, evidence that the developed theories and instruments are valid supporting the matching hypothesis is weak (Pashler et al. 2009). This is in line with the results presented in chapter 2, confirming a significant effect of a matching on skill acquisition, however indicating a considerably stronger effect of the training method on learning outcomes. Although individual differences of the learners are at the centre of personalised learning, learning styles alone are an insufficient measure. The PLF is therefore based on observable learning tasks. Such tasks directly relate to the training methods as a subset of the didactic concept laid out by the teacher. Furthermore, the PLF puts emphasis on the context of the learner defining several moderating influence factors.

The theoretical basis of the PLF needs to be discussed as well, as it combines cognitivist and constructionist approaches, which might appear to contradict each other at first. Cognitivist psychology investigates the transmission and processing of information in the brain leading to learning effects (Woolfolk 2014). Cognitive approaches analyse individual differences in information processing, e.g. cognitive processes (Bloom et al. 1984), cognitive load (Sweller 1988), cognitive fit (Vessey 1991), or task-technology fit (TTF) (Goodhue and Thompson 1995) in learning and decision-making. Later cognitivist theories also take into account groups of individuals better reflecting collaborative learning in SCT (Bandura 1977; Bandura 1989). The constructivist learning paradigm and especially constructionism, however, neglect a knowledge transfer between teacher and learner, proposing that knowledge is constructed by the learners themselves. Constructionist approaches are based on practical, collaborative, and situated learning (Kafai 2006) building on late social cognitivist theory. While the basis of the PLF – Bloom's taxonomy of cognitive processes – is rooted in a cognitivist perspective on learning, it is applied in the PLF within a model of learning, which is embracing the constructionist learning paradigm. The original taxonomy (Bloom et al. 1984) has been extended

and transformed to recent learning tasks (Anderson and Krathwohl 2001; Krathwohl 2002) and learning tools in its revised version (Churches 2009; Bower et al. 2010) to encompass a constructivist perspective. Cognitive load theory was applied to learning processes defining course design principles to minimise cognitive load (van Merrienboer and Sweller 2010). The flipped classroom was also able to minimise cognitive load (Abeysekera and Dawson 2014). To the best of my knowledge, this thesis provides the first contribution combining cognitive fit and personalised learning. Furthermore, the PLF models two interdependent processes of cognitive fit, personalising learning tasks and learning tools at the same time. Such interdependent processes have been modelled within the domain of software development (Shaft and Vessey 2006). However, they introduce further complexity bearing the possibility of interference between both processes of personalisation leading to delays and therefore decreased learning outcomes. Finally, the PLF incorporates also a task-technology fit component. TTF has been analysed in the context of e-learning showing positive effects on the impact of a VLE in case of perceived fit (McGill and Klobas 2009; McGill and Hobbs 2008). Such fit is moderated through the learning purpose and the learning process (Sun and Wang 2014).

For the evaluation of the PLF, a real-life personalised flipped classroom course is designed and implemented. To generalise the chosen approach, this course instantiation is compared to the increasing literature on flipped classroom course designs regarding

1) content,
2) learning methods, and
3) operationalisation.

Flipped classrooms are developed in all academic fields and for varying contents, however, course designs are particularly disseminated in the domains of medical education, pharmaceutical education (McNally et al. 2017; McLaughlin et al. 2014; Pierce and Fox 2012), and management education (Findlay-Thompson and Mombourquette 2014; Butt 2014) including ISs (Lehmann et al. 2015). Accreditation councils request active learning approaches in higher education (Pierce and Fox 2012) and at the same time increasing numbers of students require an efficient approach to teaching (Lehmann et al. 2015). All of the aforementioned flipped classroom designs are targeted towards undergraduate students, confirming

the results of the literature review by Bishop and Verleger (2013), while the approach presented in this thesis is one of few designs explicitly focusing on graduate students.

While other course designs see personalisation as a side-effect of the flipped-classroom, the one described in this thesis is the only one particularly focusing on personalised learning employing learning methods and techniques accordingly. This results in a higher level of interactivity and collaboration within the distant preparation phase compared to other course designs. Most designs include pre-recorded lecture videos as means of instruction (Bishop and Verleger 2013; Pierce and Fox 2012), however, including interactive elements to facilitate application of the knowledge, self-control of the learning, and collaboration to a varying degree. A course design similar to the one presented in this thesis by Lambert and Fisher (2013) describing a flipped classroom design implemented in a course focusing completely on distant learning, includes many more active and collaborative tasks such as blog entries, wikiing, and video conferences among the graduate learners. Other courses range from an equal distribution of theory and application (Lehmann et al. 2015) down to 20% complex concepts and application and 80% theory (McLaughlin et al. 2014).

When designing a personalised flipped classroom according to the PLF, the context of the students is very important. Regarding the operationalisation of such flipped classrooms mandatory preparation phases increase entry barriers for students who are joining a course late, since their peers already acquired large amounts of knowledge. Furthermore, it is important to motivate the students to prepare before the lectures (Miller 2012). The literature usually focuses on intrinsic motivation showing the benefits of thorough preparation, requiring, and extending the prepared knowledge in the lecture. However, the importance of formative assessment during the semester is highlighted in the literature motivating the students extrinsically (Bishop and Verleger 2013). Empowering the learners to personalise their learning by selecting different learning tasks and learning tools requires profound metacognition (Zimmerman 2002; Miller 2012) as well as sufficient digital literacy (Lehmann et al. 2015). Those might be less developed in a course involving undergraduate students. With graduate students, however, there are effects of habituation to previous traditional learning experiences and other traditional courses within their curriculum. If students are used to traditional lectures and learning at the end of

the semester, they might be completely overwhelmed by the contents of the preparation phase. In addition, they might not understand that the lecture extends the preparation tasks taking it for a mere substitution for the lecture. Therefore, explicit instructions on the organisation and goals of the flipped classrooms organisation are vital. Furthermore, implementing a flipped classroom requires extensive infrastructure regarding a VLE and respective tutorials of the learners. Therefore, personalised flipped classroom designs are bound to higher education, where all those requirements are met.

6.1.2 Limitations

Design-oriented research originated from the contrast between controlled laboratory experiments and the analysis of real-life learning in situated scenarios (Brown 1992; Hevner et al. 2004). Although DBR aims to achieve the best of both worlds, conflicting underlying assumptions of the methodology lead to several limitations of this thesis.

DBR (Collins 1992) requests teachers as co-investigators, who formulate relevant requirements, as well as a broad range of expertise in different areas addressing the numerous variables involved in learning. However, it also requests an objective evaluation differentiating between the designers of a learning intervention and those who evaluate and test it. The present approach only partly differentiates between designer, teacher, and researcher. In chapter 2, the designer of the trainings also held the trainings and evaluated them in the end, however, being supported by the lecturer of the ANM course. In the design process described in chapter 4, the design was mainly informed by the PLF and the designer was assisting the lecturing of the course ANM, albeit also developing the final evaluation.

DBR requests systematic variation within sites (Collins 1992). Chapter 2 provides such variation investigating different treatment groups in a laboratory experiment having a manipulation as well as a control group. Nevertheless, such a systematic variation can hardly be maintained if a complete university course is modified and implemented due to ethical reasons. Therefore, investigating the ANM course in chapter 4, students were not informed about research interests regarding the course and respective modifications in order to prevent biases. However, there were no treatments providing systematic variation only to previous instantiations of the

ANM course taught in the past. However, comparisons have to be performed with caution. While course contents, lecturers, or curricula might be the same, the course participants have changed.

Finally, DBR as well as design science research request multiple iterative evaluations (Collins 1992; Hevner et al. 2004). While this thesis provides the design of a personalised flipped classroom course as a first evaluation of the PLF, proposing a general evaluation concept for further evaluation, more iterative improvement and evaluation is required.

Although the PLF is meant to be a framework leading to generalisable requirements and components for courses implementing personalised learning, the present analyses are conducted only within the domain of negotiation teaching. Negotiation teaching is identified as a domain, which especially facilitates the acquisition of practical and theoretical knowledge. However, the PLF needs to be applied to other courses teaching different topics. An even greater step towards generalisability would be to transfer the PLF from higher education to schools or professional trainings. Such a transfer, however, is questionable, as the PLF is particularly based on research regarding higher education and the implemented course showed that it matches the requirements of graduate students very well. A third dimension, which requires a transfer of the PLF, is culture. Defined as an institutional context factor in the framework itself, the PLF originated in Western higher education culture being implemented in the German system. However, other learning cultures, university cultures, or national cultures might address self-regulated personalisation differently. From a lecturer's perspective, the German system significantly differs from the Anglo-American system of higher education and research regarding freedom of research, course load, and funding (Eymann et al. 2014). From a learner's perspective, differences emanate from national culture. Eastern cultures for example have been found to put higher value on educational outcomes such as degrees and grades, they focus more on rote learning and avoid conflicts and confrontation if they disagree to the knowledge provided by the lecturer (Bing and Ping 2008; Boondao et al. 2008). Moreover, learning and teaching in different cultures also vastly differ regarding the course size (Schoop and Booth 2016).

6.1.3 Contribution

The major contributions of this thesis are described in the following, focusing on

1) learning tasks as the unit of analysis of personalised learning,
2) cognitive fit as a theory to analyse personalised learning,
3) general requirements and components for the design of personalised flipped classroom courses, and
4) evaluation criteria and instruments for such courses.

While the first two topics resemble the key contributions of the PLF (cf. chapter 2 and 3), the latter two topics result from the proof of concept course design, implementation, and evaluation concept (cf. chapters 4 and 5).

Having discussed the limitations of learning styles as instruments to personalise learning, this thesis uses learning tasks actually performed by the learners as the basis for personalisation. This grounds personalised learning on observable actions instead of conflicting learning style theories. Whilst context, describing different learning strategies, learning motivations, learning cultures, and even learning paradigms, is reflected in learning style theories, it is also driving them apart and therefore making a general application of these theories impossible. The PLF suggests to provide alternative learning tasks and learning tools as well as to let the learners select and use them according to their individual or group preferences. The presented lists of learning tasks and learning tools are non-exhaustive examples, which need to be extended. However, they show a practical method for personalising learning, which can be performed by teachers and lecturers incorporating the motivation and responsibility of the learners themselves. An evaluation of the developed proof-of-concept course ANM from the perspective of the students' shows that they embrace the responsibility, interactive teaching, and metacognitive knowledge acquired (Krieg et al. 2017). Discussing different learning style theories can even be used as a didactic method to create awareness for individual learning preferences with the students.

The application of the theories of cognitive fit and task-technology fit provide a sound theoretical basis for such self-regulated personalised learning. Having been already applied to individual styles in decision-making, they provide a stepping stone for the scientific investigation of self-regulated personalised learning. Cognitive fit enables the formulation of relationships between mental processes of learning, the selection and use of task and tools, and resulting learning performance. Task-technology fit

requesting that learning task and learning tool have to be compatible complements the PLF.

Another major contribution of this work is the design of a personalised flipped classroom course combining the PLF and the learning method of the flipped classroom. By employing the flipped classroom method, the benefits of blended learning approaches can be leveraged making personalised learning possible in an effective and efficient way. Blended learning facilitates several aspects of personalisation such as increased availability and repeatability of the learning materials. Criticism regarding personalised learning is often uttered because of the parallel provisioning of alternative learning methods increasing the effort for lecturers. However, blended learning approaches enable the lecturers to separate these efforts and concentrate on the provisioning of alternative learning tasks before the semester, leaving sufficient time for lecturing during the semester. Regarding the teaching evaluation, the personalised flipped classroom course ANM was evaluated to be the fourth best course taught at the Faculty of Business, Economics and Social Sciences of the University of Hohenheim in the winter term 2017 (Department Information Systems 1 2017), showing very high student satisfaction. However, attendance of the course was perceived to be lower than in previous years, probably showing a divide between flip-endorsers, who constantly prepared, attended and therefore evaluated the lectures, and flip-resisters, who did not attend the course because of the extensive online materials provided or the high degree of interactivity required (McNally et al. 2017).

Finally, the proposed evaluation concept focuses on the achievement of the postulated requirements (i.e. COI; Arbaugh et al. 2008), learning outcomes (i.e. ISSM; DeLone and McLean 1992; Liaw and Huang 2013), adoption (i.e. TAM; Venkatesh and Bala 2008), and individual differences (i.e. MSLQ; Duncan and McKeachie 2005). It thereby incorporates models and instruments from the domains of the learning sciences as well as ISs research leading to a holistic concept for evaluation. From a practical, as well as research perspective, such an integration of theories and instruments is necessary. Teaching in higher education institutions becomes more and more permeated by electronic and blended learning methods, scientific evaluation and teaching evaluation for the purpose of quality assurance are left behind, if they do not incorporate the complete picture.

Therefore, this thesis makes a first step into combining theories and instruments from the learning sciences and ISs research as the two most important research disciplines in this environment.

6.2 Outlook

The present thesis analyses influence factors of personalised learning aiming to lay out design principles for personalised blended learning courses. Beginning with the analysis of learning styles, the thesis finds only weak support for a matching hypothesis between learning styles and specific teaching methods. Therefore, learning tasks – as clearly observable measures – are defined as the object of further investigations, instead of the psychometric properties of learning styles. Following the idea of a COI the PLF is developed, modelling personalised learning as a process of selection and usage of learning tasks and learning tools by the COI based on the theory of cognitive fit. Furthermore, the importance of institutional and contextual moderating variables is highlighted in the framework. The PLF represents the answer to the first research question stated in this thesis, presenting a comprehensive framework of influence factors regarding personalised learning. To evaluate the PLF further, a traditional university course is transformed to a personalised flipped classroom course using the PLF as a basis. Following an explanatory design theory, general requirements and general components are derived from the framework and implemented. This proof-of-concept course is successfully implemented and taught over a complete semester. Finally, an evaluation concept is presented, aiming to evaluate the PLF as a general framework as well as its instantiation in the personalised flipped classroom course highlighting self-regulated learning, learning outcomes, adoption of learning tools, and individual factors. Together the course design, implementation, and evaluation concept answer research question 2 showing how personalised learning can be supported in concrete learning interventions using specific learning methods and technologies.

6.2.1 Implications for Practitioners

Firstly, the thesis at hand is directed at teachers and learners involved in designing and implementing learning interventions. Secondly, the implications of this work might also be helpful to producers of VLEs opening new

avenues for their development and marketing. Finally, it is relevant to educational institutions namely higher education institutions teaching degree-seeking students and companies engaging in the provision of professional trainings respectively human resource development providing in-house trainings. If such institutions are publicly funded the results of this thesis are also relevant to policy makers.

Teachers can use the presented requirements and components as blueprints for developing new courses in different domains providing personalised learning in a scalable manner. While personalisation always means extending existing course contents and didactics, e-learning is able to reduce the effort during teaching shifting it into the preparation phase. In the preparation phase, the flipped classroom increases online student retention due to its personalised approach and formative assessment. In the aspired setting of open communication and interactive discourse inside and outside the classroom student feedback is much more frequent as well as from higher quality.

From a learners' point of view, self-regulated personalised blended learning provides high availability and repeatability of course materials. Learners are free to choose where and when to prepare for the lectures. Furthermore, motivation has been found to be particularly low in online-only courses due to missing social context, delayed feedback, or unclear learning objectives (Renner et al. 2015). This leads to high drop-out rates for example in massive open online courses (Fox 2013). The flipped classroom process model including preparation and lecture phases provides a clear structure for learning objectives and feedback. Moreover, increased responsibility due to the self-regulated approach has also been found to benefit the learner's motivation (Zimmerman 2002). In the end, self-regulated personalised learning enables learning how to learn. Such metacognitive knowledge can be transferred to other courses or trainings.

Regarding the producers of VLEs, the requirements postulated in this thesis could influence future development of such systems. Its theoretical basis building on learning tasks and tools directly address features of VLEs regarding collaboration and communication and their interoperability with other (social media) tools forming a PLE. Furthermore, links between personalised learning and the more mature discipline of personalisation in e-commerce have been pointed out enabling the exaptation of e-commerce solutions in VLEs supporting personalised learning. For example, personalisation in e-commerce has been found to increase customer-loyalty and

retention in online shops (Riemer 2002). Such approaches can be transferred to e-learning increasing retention for VLEs or other e-learning tools. Moreover, methods used to guide users in online shops, such as recommender systems, can be employed supporting personalised learning. While such recommendations are performed by the lecturers in the presented concept, they might be automated on the basis of learning data tracked in previous learning interventions in order to recommend specific learning tasks or learning tools based on individual preferences (Damiani et al. 2015).

For educational institutions and policy makers, the implementation of self-regulated personalisation is the next step towards competence-based life-long learning. Self-regulated personalisation puts more responsibility on the learners focusing on the collaborative and situated application of knowledge, while employing PLEs encourages them to build their own individually-tailored set of tools for learning extending the needs of single trainings or courses. The seamless integration of e-learning tools might require extensive infrastructure and support for the learners, however, provides an additional avenue to improve the learner's digital literacy alongside other learning outcomes. For their students personalised learning promises increased efficiency of learning tailored to their individual preferences using the PLF. For educational institutions themselves, an extended evaluation concept including models from the learning sciences as well as models from ISs research provides a holistic method to measure the success of their products.

All aforementioned groups of practitioners can benefit from an integration of self-regulated and automated approaches to personalised learning. Learning analytics, meaning the automated tracking of educational data (i.e. usage statistics, natural language, scores, etc.) to investigate learning behaviour and derive consequences, enables numerous applications to measure personalised learning regarding whether and how specific learning tasks and tools are used (Greller and Drachsler 2012). Educational institutions or policy makers could inform their strategy development regarding procurement of e-learning tools and curriculum development. Teachers could reflect on their courses and adapt them according to the tracked information and recommendations. Learners could receive personalised warnings if they fall behind or are in danger of dropping out of a course. Producers of VLEs could use the learning analytics data to improve their systems and evaluate new features. Particularly interesting is the idea of

the quantified self (Swan 2012) asking the learners themselves to track their learning behaviour in the process of learning. The PLF could serve as the theoretical basis for a continuous tracking of learning tasks and learning tools using a mobile application or wearable (Rivera Pelayo 2015). Such an application is relevant for students but could also be employed for life-long learning or in professional trainings – irrespective of specific institutions. Based on tracked learning data such a system could provide statistics on the learning process, comparisons to other learners, and recommendations how to improve learning.

6.2.2 Implications for Researchers

Direct implications for future research lie in the systematic variation of the designed course concept according to different contents (i.e. within and across study programmes), learners (i.e. undergraduate, graduate, professional), institution (i.e. cooperative state university, university of applied sciences, university), and educational system respectively culture. By systematically comparing the experiences and results, general requirements could be verified and extended while general components could be clarified with specific characteristics.

Since the application of cognitive fit in personalised learning is an all new approach presented in this thesis, future research needs to disentangle the complex relationships between personalisation of tasks and tools. This includes an isolation of the impact of cognitive fit on the learning performance in general as well as an analysis of the two interdependent processes of cognitive fit regarding learning tasks and learning tools. Whilst this thesis follows a DBR methodology, controlled laboratory experiments are more suitable to isolate and investigate these relationships in greater detail, explaining their antecedents and characteristics. Previous literature on such interdependent effects, states the danger of interference (Shaft and Vessey 2006). Additionally, task-technology fit is integrated into the PLF, opening another dimension of fit, which probably leads to further interference. Furthermore, cognitive load theory has been applied to education and might be interesting to investigate as a complementary theory for personalised learning (van Merrienboer and Sweller 2010).

Another domain for future research is the number of learners under analysis. While cognitive fit and task-technology fit are only investigated for individuals in the literature, the PLF models personalised learning as

an inherently collaborative endeavour represented as a COI. However, neither cognitive fit nor task-technology fit have been investigated in group decision-making. The learners need to find a compromise decision among each other regarding learning tasks and learning tools, which cannot satisfy all of them at once. Furthermore, interference between cognitive fit and task-technology fit are possible. It is, therefore, necessary to investigate how individual fit evolves to group fit regarding the selection and usage of specific learning tasks and learning tools (Gross et al. 2016; Ganzert et al. 2017). Besides this conceptual perspective, implementation and support of such group decision-making remains an area for future research in the realm of computer-supported collaborative work. How can collaborative learning be supported in VLEs in a personalised way?

Finally, self-regulated personalised learning is closely connected to learning motivation. While increased responsibility, group work, and structured preparation for the lecture foster intrinsic motivation, formative assessment benefits extrinsic motivation. Gamification (i.e. applying game-like elements to non-game concepts) represents an approach, which shares several characteristics with the flipped classroom. For example, gamification incorporates collaboration, situated tasks and application of knowledge in an immersive environment. Gamification has been found to increase intrinsic as well as extrinsic motivation, for example by introducing exploration (i.e. story-telling), competition (i.e. leader boards, badges), challenges (i.e. tasks, time-pressure), or collaboration (group tasks) (Blohm and Leimeister 2013). Introducing gamification elements, albeit following a well-structured concept, might therefore be a complementing approach, to improve self-regulated personalised learning even further.