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„Blending 4 Futures“: A Teacher Training Course in Blended Learning for Vocational Teachers, Based on Design-Research

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Abstract

Context: In 2022, Berlin’s regional teacher training institution started a voluntary course in blended learning for vocational schools under the academic supervision of Humboldt University.

Approach: This course was developed and evaluated as a design-based research project according to the general model by McKenney & Reeves, with a special focus on knowledge types according to their epistemic categories (cf. Goldkuhl) and knowledge forms according to their materialisation and explication (cf. Johannesson & Perjons).

Results: The results are both pragmatic and theoretical insights on blended learning in vocational schools, manifested in a „Navigator” for the final course design and a „Knowledge Map” for its epistemic categories.

Conclusion: The authors conclude that the conceptual factors of progression and supervision, accompanied by their respective competences, are fundamental differentiating factors in developing a distinct blended learning competence in vocational education.

Keywords: blended learning, vocational education, teacher training, digitalization, design-based research

1 The demand for designing blended learning in vocational schools

In 2022, Berlin’s regional teacher training institution started a voluntary course in blended learning for vocational schools. Members of Humboldt University joined with further education multipliers for digitalization to develop this course as an educational design research project (cf. McKenney & Reeves, 2018), tailored to teachers’ needs and the status quo in vocational schools in Berlin, Germany. This paper delineates the development and evaluation of this training, with a special focus on mapping the diverse types and forms of knowledge (cf. Goldkuhl, 2020; Johannesson & Perjons, 2014) which informed both the design and the theoretical understanding obtained from it.

The demand for such a form of teacher training was based on lessons learned during the COVID19 pandemic’s lockdowns and emergency remote teaching (cf. Hodges et al., 2020). Evidently, online learning environments and digital media allow for new educational settings with the potential to increase and innovate learning effects (cf. Müller & Mildenerger, 2021).



However, technologies and the respective legislatures are developing at a rapid pace (e.g. the European Data Protection Regulation, <https://gdpr.eu/>), so teachers on-the-job need further training to acquire „an increasingly broad and more sophisticated set of competences” (cf. the European DigiCompEdu framework, Redecker, 2017, p. iv). Also, current generations of learners use media in very different ways and for very different aims than their teachers do (cf. Khan & Vuopala, 2019; Feierabend et al., 2017), calling for a reflection and redefinition of media competences for both groups. Focusing on vocational education, ‘new work’ increasingly relies on digital media, specific vocational competences, and self-regulation (cf. Rafiola et al., 2020), which cannot be expected to be covered by current curricula yet.

At the same time, diverse challenges considering online learning have been discovered. It has been evident throughout the COVID19 pandemic that on-site teaching still has various substantial advantages over online teaching. Particularly, schools serve custodial and social functions: They offer students a range of possibilities to meet with and emotionally grow among peers in complex social situations. Also, schools supervise learners on behalf of parents and other custodians. This „baby sitter function”, as Wall (1978) put it cynically, is a socioeconomic prerequisite for most families to partake in work life (as experienced by many in a very stressful way during COVID19 lockdowns). Goudeau et al. (2021) summarize how school closures and remote teaching with predominantly digital resources exacerbated social class disparities in three ways:

- the digital divide (learners’ unequal access to digital resources, tools and skills),
- the cultural divide (unequal familiarity with academic knowledge and skills; unequal dispositions for autonomy and self-regulation), and
- the structural divide (unequal support of learners from schools).

In addition, concerning vocational education with its many lab and workshop settings, hands-on and on-site learning are still understood to be indispensable for the development of practical work skills, which in turn have an effect on students' employability and emancipation.

In consequence, it is not ‘pure’ online learning but deliberate ‘blended’ learning which is of considerable importance for vocational schools, teachers, and learners. „Blended learning” can be defined as „a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home.” (Staker & Horn, 2012, p. 3) Teachers who want to develop blended learning programs then need some specific competences, which both include and exceed the respective competences for online and on-site elements of their programs. The design research project „Blending4Futures” aimed at identifying such competences while developing a suitable teacher training course.

2 Approach: Practice what you preach – design what you study – know what you know

As educational design research aims to combine a specific „maturing intervention” with general „theoretical understanding” (cf. McKenney & Reeves, 2018), the course development was conducted as an agile, iterative process based on collaborative work and formative feedback. In a ‘practice what you preach’ approach to blended learning, both the development process and the final course deliberately blended online and on-site activities. The participating teachers learned how to design blended learning formats for their respective target groups of students of different vocations, while partaking in a blended learning training format themselves. Thus, participating teachers could experience blended learning both from the perspectives of learners and of developers. In effect, trainers, researchers, and participants constantly reflected on conditions, factors, and principles of successful blended learning, in an agile mindset of (re-)designing the course as it progressed.

Inspired by Sandoval's (2014) concept of „conjecture mapping” for design research, a „knowledge map” was created to illustrate the various types and forms of knowledge informing the design and being obtained from it as in- and outflows. Data for this was collected via desk-top research, document analysis, and formative and summative feedbacks both during design meetings (concerning the involved teacher trainers) and during training sessions (concerning the participating teachers). As a learning management system, Berlin's central Moodle platform „Lernraum Berlin” (<https://www.lernraum-berlin.de/>) was used, offering the developers diverse tools for collaboration and evaluation, such as collaborative documents, video calls, and anonymized survey tools.

As Kretz (2020) explains, designing is an interwoven trifold process of understanding, structuring and changing a given situation *simultaneously*. From a designer's perspective, it is inevitable that you study what you design – and to design what you study. It is therefore not feasible to divide this complexity in practice. However, a linear model helps in pre-structuring, documenting, and communicating design research endeavours. In this sense, McKenney & Reeves (2018) propose a three-phase process model with iterations for educational design research. For „Blending4Futures”, this model was utilized to structure both the design project and the knowledge map as one of its results. These phases are:

1. Analysis and Exploration,
2. Design and Construction, and
3. Evaluation and Reflection, plus a parallel dimension of steadily increasing
4. Implementation and Spread

Depending on the phases, the types and forms of knowledge varied and were characterised according to the typologies of Goldkuhl (2020) and Johannesson & Perjons (2014). Goldkuhl differentiates knowledge types according to their epistemic categories. The following knowledge types are especially important in design processes:

- „descriptive knowledge” is about states and effects,
- „explanatory knowledge” is about causes, relations and reasons,
- „normative knowledge” is about values and goals,
- „prospective knowledge” is about reasonable possibilities, potentials and hypotheses,
- „prescriptive knowledge” is about (validated) principles and rules.

In addition, Johannesson & Perjons differentiate forms of knowledge according to their materialisation and explication:

- „explicit knowledge” is symbolised in texts, numbers, media etc., which makes it relatively easy to store and transfer,
- „embodied knowledge” is the internalized experience of people, such as successful patterns of acting, which are usually implicit,
- „embedded knowledge” is incorporated in objects and processes, such as a tool bearing information about how to use it (e.g., scissors usually have an ‘instructional’ shape, indicating that it would be effective to put fingers into its holes and perform a grabbing movement)

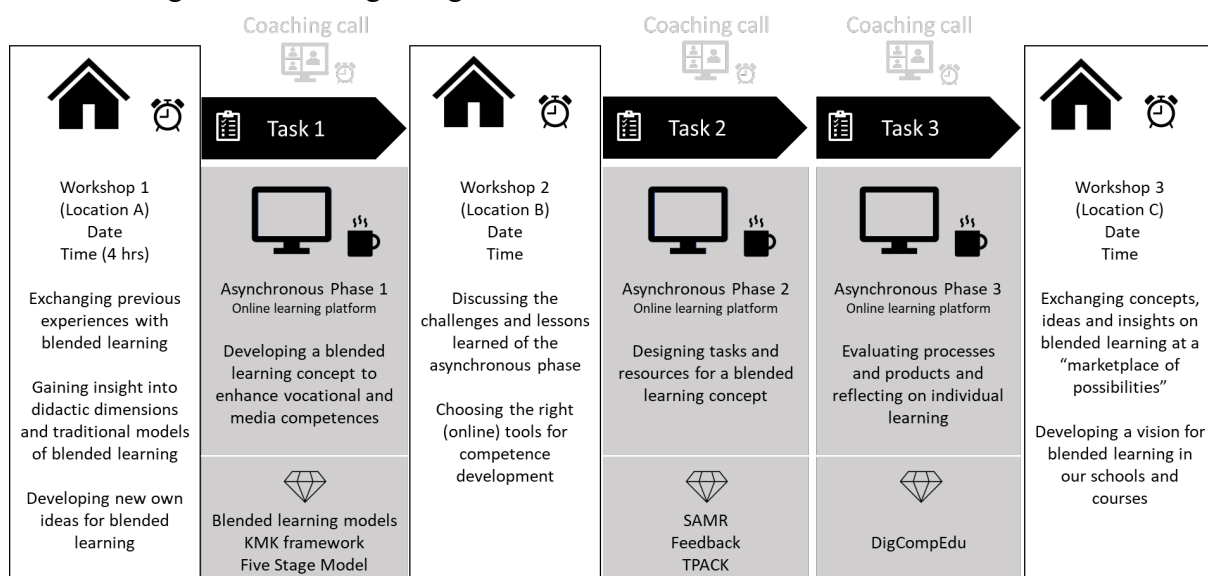
In combination, McKenney & Reeves' (2018) phases, Goldkuhl's (2020) types and Johannesson & Perjons' (2014) forms of knowledge offer a comprehensive framework for structuring and documenting the cognitive dimensions of design research. For example, in the case of Blending4Futures, during „Analysis and Exploration”, relevant knowledge tended to be „explicit” in the form of published literature and „embodied” in the form of participants' teaching experience and best practice. While empirical literature hinted at „descriptive” and „explanatory” knowledge gained in the past and by others, the participants expressed their own „normative” and „prospective” knowledge in designing their new blended learning ideas (e.g., „what we should and could be doing”). During „Evaluation and Reflection” then, knowledge tended to be „embedded” in the form of design artefacts, such as blended learning concept documents,

learning management system courses, and teaching materials/learning media. By identifying their effective design principles, „prescriptive” implications for future developments were formulated.

3 Results

In line with McKenney and Reeves (2018), the project’s results include both the realized design artefacts and theoretical understanding, especially transferrable design principles. The prototypical design includes a written concept, a „Navigator” visualizing the events-and-tasks structure of the course, and the respective learning media (all tasks and materials in a Moodle course). Table 1 shows a generalized version of the final „Navigator”.

Table 1
The Blending4Futures Navigator, generalized version

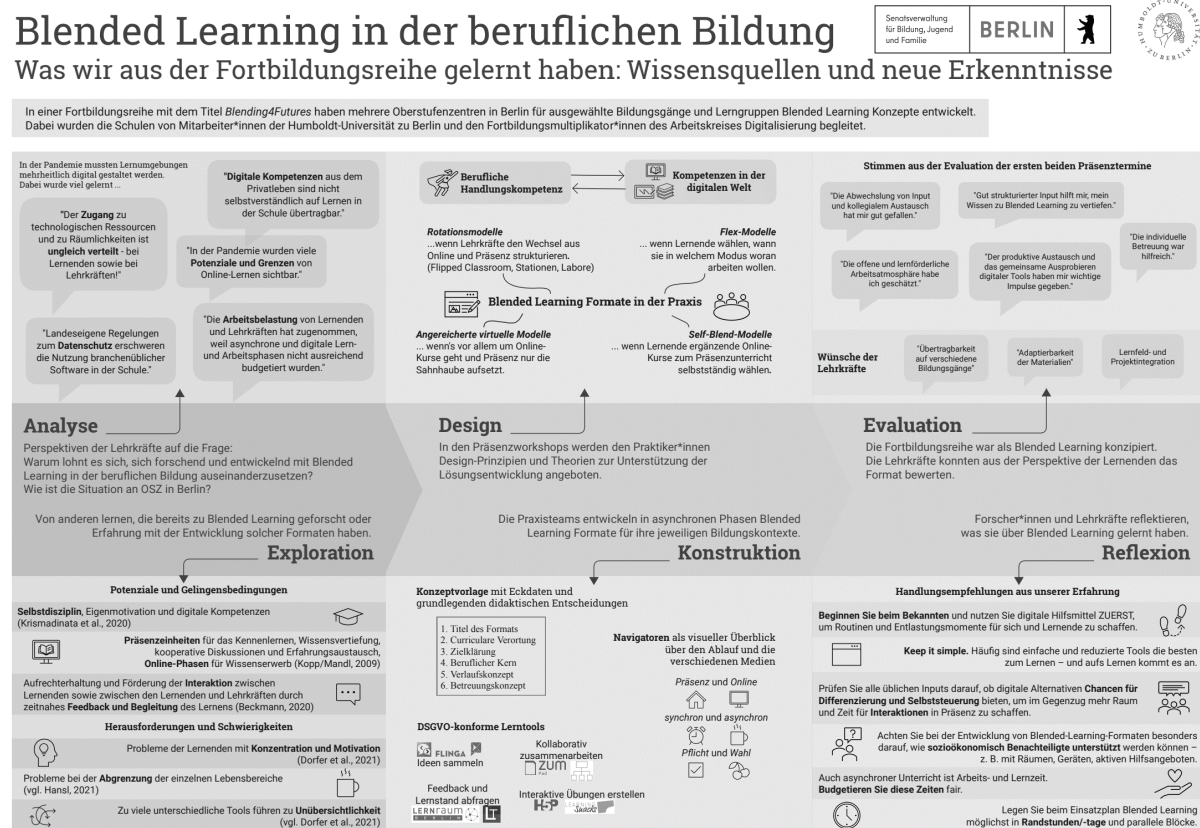


The „Blending4Futures” training course began in September 2022 with an on-site workshop and ended in March 2023 with a presentation marketplace. Another on-site workshop took place in November. Those three on-site workshops were connected via three asynchronous phases with online learning tasks and resources. Optional coaching calls were offered to accompany the online phases. The activity structure, tasks and contents can easily be read from the navigator; however, a very important insight must be added: The final course design actually reflects McKenney & Reeves’ (2018) design research model. The first on-site workshop and online tasks aimed at „Analysis and Exploration”, guiding teachers in exchanging their prior experiences with online and blended teaching and learning, explicating and validating those experiences (cf. „embedded knowledge”) with the help of theories and literature, and analysing their local conditions for blended learning (cf. „descriptive/explanatory knowledge”). The second workshop and asynchronous phase focused on „Design and Construction”, supporting the participating teachers in creating their own blended learning formats with the help of didactical frameworks, potential (online) tools and creativity coaching (cf. „normative/prospective knowledge”). The last asynchronous phase and the final workshop concluded with „Evaluation and Reflection”, by exchanging participants’ products and ideas and looking back on their own learning processes throughout those last weeks and months. By generalizing and validating their latest experiences in a group, they formulated implications for future developments (cf. „prescriptive knowledge”).

Since the partners of Humboldt University had a special interest in knowledge creation through design, a „Knowledge Map” for blended learning in vocational schools based on the experiences from „Blending4Futures” was created. It is available as a dynamic Miro board in German (van Meegeen et al., 2023) and depicted in Table 2. Just like the „Navigator”, the „Knowledge Map” is structured according to McKenney & Reeves’ (2018) model. The following subsections explain some details of this „Knowledge Map”.

Table 2

The Blending4Futures Knowledge Map (for dynamic version via Miro, cf. van Meegeen et al., 2023)



3.1 Analysis and Exploration

With the process of „Analysis”, McKenney & Reeves associate a predominantly empirical, descriptive, and explanatory approach to a specific local problem or issue, using guiding questions such as: „What is the problem? Why is it this way? What would constitute a solution? What are the boundary conditions?” (McKenney, 2022, sl. 52) – This approachable and illustrative wording is cited from an unpublished keynote presentation by Susan McKenney. In McKenney & Reeves, (2018), these questions are elaborated more methodologically. „Exploration”, on the other hand, is associated with a more global, investigative approach to learning from others who have already dealt with similar/related issues, using guiding questions such as: „What is already known? What are best practices? With whom can we collaborate?” (ibid.)

Thus, the whole project started by asking: What lessons have vocational teachers from Berlin learned about blended learning during emergency remote teaching in the COVID19 pandemic? In-depth inquiries were conducted to explore the perspectives of teachers, including the rationale for engaging in research and development on blended learning in vocational education, the current situation at vocational schools in Berlin, and the essential types of knowledge required for designing blended learning formats. To address these questions, information was

gathered through discussion sessions during the initial workshop. The following common insights regarding challenges and difficulties in implementing blended learning were identified:

- There is an unequal distribution of access to technological resources and physical spaces among both learners and teachers.
- Local data protection regulations pose obstacles to using industry-standard software in schools.
- Digital competences from private life do not automatically transfer to learning in school settings.
- The pandemic revealed various potentials and limitations of online learning.
- There was an increased workload for both learners and teachers due to inadequate allocation of time and resources for asynchronous and digital learning and working phases.

These local personal insights („embodied descriptive knowledge”) were then contrasted with the explicit descriptive and explanatory insights from literature and researchers who already investigated blended learning and discovered challenges, potentials, and success factors:

- In blended learning, learners tend to experience difficulties with concentration and motivation which demand special consideration (Dorfer et al., 2021).
- Learning and working digitally poses new challenges in demarcating life domains and privacy (Hansl, 2021).
- The increasing number of available online tools is disorienting and demands well-founded decision-making (Dorfer et al., 2021).
- When chosen voluntarily, online components of blended learning positively impact self-discipline, self-motivation, and digital competences (Krismadinata et al., 2020), as well as knowledge acquisition (Kopp/Mandl, 2009).
- Offline/in-person sessions facilitate in-depth knowledge exploration, cooperative discussions, and sharing experiences. They also sustain and enhance interaction among learners and between learners and teachers through timely feedback and learning support (Beckmann, 2020).

In conclusion, „Analysis and Exploration” confirm the „normative” and „prospective knowledge” that blended learning formats for vocational school settings should be developed deliberately.

3.2 Design and Construction

This phase includes the determination of the local prerequisites for a specific design, as well as its incremental and iterative (‘step-by-step’) implementation and revision with the help of general (or generalizable) construction criteria such as frameworks, tools, patterns, and principles. Guiding questions for the local „Design”-perspective are: „What could we do? What should we do? What would that look like?”, yhose for the global „Construction”-perspective are: „How do we make it? How do we improve it?” (McKenney, 2022, sl. 56)

During on-site workshops, teachers were introduced to design principles and theories for blended learning (e.g., Staker & Horn, 2012). Models and frameworks applicable to the design of blended learning environments showcase what is feasible, but their effectiveness in specific cases is not assured. Throughout this phase, it became evident that the majority of realizable blended learning formats incorporate the concept of flipped classroom as a „homework variant” or „lab rotations” within the school setting (ibid.). Many teachers adopted the trainers’ idea of a „Blended Learning Navigator” akin to an advanced organizer, to provide a visual overview of the content and media sequence. Also, a written concept template proved helpful for teachers in aligning tools with specific learning tasks/processes, such as brainstorming, collaboration, feedback, assessment and testing, as well as interactive media and tasks.

The written concept format which resulted from the training course can be regarded as a standard template for blended learning in vocational schools. Participating teachers employed this template to develop their own blended learning prototypes for learners. The parameters of the template are:

1. Working Title of the format (indicating both content and methods)
2. Curriculum Context (when and why to teach)
3. Learning Objectives (integrating vocational and media competences)
4. Vocational Core (vocational problems, work processes, and products learners will encounter)
5. Progression Concept (events-and-tasks structure as well as the logic of transitions between elements)
6. Supervision Concept (supportive moderation, coaching, social, and custodial activities)
7. Lessons Learned and Development Ideas (incorporating an ongoing redesign of the concept based on teaching experience and student feedback)

Especially the points 5. „Progression” and 6. „Supervision” proved to be important. A peculiarity of blended learning, as opposed to pure online and pure on-site learning, is the need to plan for and manage the transitions between online and offline realms. This has didactical as well as technical dimensions, since special tasks and technologies are needed. For example, technologies for a transition from offline to online are

- recording (photos, audio, video, ...),
- scanning (2D and 3D, QR codes, NFC, RFID, ...), and
- sensors (light, sound, temperature, magnetism, ...);

examples for the transition from online to offline are

- playing (speakers, projectors, ...),
- printing (2D and 3D, ...), and
- programming of actors/automation (CNC, electronic motors, ...).

Under the term ‘supervision’, the participants discussed the broad variety of learning support strategies, such as learning coaching, logfiles, time- and self-management tools, peer learning and more, which deserve a special emphasis in blended learning settings with their „element[s] of student control over time, place, path, and/or pace” (Staker & Horn, 2012, p. 3). While most teachers are experienced in some such strategies in offline contexts, for online activities, they might have to look into relatively new e-moderating practices (e.g., Salmon, 2011, p. 60ff).

3.3 Evaluation and Reflection

In this phase, the aim is to gain insights into the quality of the intervention, with the guiding question „How do we investigate it? What do we see? What does this mean?”, and to reflect on the evaluation in terms of its (theoretical and practical) reasons and implications with the questions „What are its implications for practice? What are its implications for theory?” (McKenney, 2022, sl. 62)

Under the motto ‘practice what you preach’, the training course was intentionally designed as a blended learning experience. Thus, participating educators had the valuable opportunity to experience and evaluate the format from a learner’s perspective, enabling them to critically analyse factors which might be significant for their students in their respective blended learning environments, as well. Throughout the on-site workshops, anonymous written evaluations were collected, and a focus group discussion took place during the final session, from which selected quotations are provided below (own translation, German originals are shown in the knowledge map):

- „I enjoyed the variety of input and collegial exchange!”

- „Well-structured input helps me deepen my knowledge of blended learning.”
- „I appreciated the open and conducive work atmosphere.”
- „The productive exchange and collaborative experimentation with digital tools provided me with valuable insights.”
- „The individual support/coaching was helpful.”

Reflections from additional discussions between the involved digitalization multipliers and the partners at Humboldt University were distilled into a set of ‘lessons learned’, captured in a ‘starter pack’ or ‘first aid’ postcard which was later printed and handed out to more teachers interested in developing their own blended learning formats:

- Begin with familiar elements and prioritize the use of digital tools to establish routines and increase degrees of freedom for both teachers and learners.
- Keep it simple. Often, straightforward and streamlined tools prove to be the most effective for learning.
- Assess all traditional instructional inputs for opportunities to differentiate and foster self-guided learning through digital alternatives, thereby creating additional space and time for face-to-face interactions.
- Pay special attention to supporting individuals facing socioeconomic disadvantages in the development of blended learning formats, ensuring equitable access to facilities, devices, and proactive assistance.
- Visualize the phases, milestones, and interconnectedness of instructional concepts to facilitate navigation for all stakeholders involved.
- Recognize that asynchronous instruction constitutes dedicated work and learning time. Allocate these periods fairly and judiciously.
- When scheduling the implementation of blended learning, prioritize off-peak hours/days and concurrent blocks to optimize its effectiveness.

3.4 Implementation and Spread

At the moment of writing, three levels of implementation and spread can be identified for „Blending4Futures”:

- School level: The potential implementation of the participating teachers’ newly developed blended learning concepts at their respective schools was a central aspect of the training course. Some of the concepts were already tested during the training course, others are ready to be applied in the next school year. Their realization and spread, however, remains in the hands of those teachers.
- Training level: The training course „Blending4Futures” will be repeated in 2023 and probably continued after that, led by the regional further education multipliers for digitalization which have been involved in designing the course.
- Political level: Due to the success of the course and the increased interest of vocational schools to develop innovative blended learning formats, the Senate Department for Education, Youth and Family, Berlin, granted an extensive three-year pilot project according to the state school law, §18 SchulG Berlin. This ‘Schulversuch’ under the same name „Blending4Futures” allows ten participating vocational schools to test and evaluate innovative formats which are not yet covered by local regulations, with academic supervision and evaluation. The authors participate as didactic counsellors in a design-research setting similar to that of the training course. Such ‘Schulversuch’ pilot projects explicitly aim at modernizing regulations to account for educational

innovations. Thus, it can be expected that further implementations and disseminations of blended learning will be supported by political stakeholders in the near future.

4 Conclusion

As stated in section 3.2, the authors conclude that the factors ‘progression’ and ‘supervision’, accompanied by their respective competences, are fundamental differentiating factors in the development of a distinct blended learning competence tailored to blended learning environments in vocational education. These factors transcend the media and methods competences already required for traditional online or on-site education. By intentionally integrating online and on-site educational approaches, new challenges pertaining to progression and transitions emerge. These challenges encompass various aspects, such as the effective transfer of outcomes from online activities to on-site activities and the efficient organization and communication of mandatory and self-organized elements. Furthermore, challenges in supervision arise due to the need to adhere to attendance regulations, particularly in labs and workshops, as well as the application of e-moderating practices (as referenced by Salmon, (2011, p. 60ff), fulfilling communication and feedback requirements, and providing differentiated support to address socio-economic disparities. Consequently, the factors ‘Progression’ and ‘Supervision’ shed light on the specific challenges and design principles that set blended learning in vocational schools apart from other educational settings.

Although the integration of new pedagogical concepts is always accompanied by scepticism and challenges to overcome, it simultaneously presents opportunities and possibilities. Through the design-based research approach, this teacher training course aimed to build on post-pandemic experiences of teachers at a meta-level, to create space for exchange, and to identify, promote, and stimulate reflections on the teaching competencies required, by way of participating in a course of the same concept (‘practice what you preach’). Designing blended learning formats is not only about identifying suitable tools to support online learning processes, but also about identifying the diverse competencies of learners and promoting them through the tailored coordination of online and offline phases. It is not merely about the use of new media, but rather about understanding the respective potentials and challenges of online and offline learning environments, using digital tools for individualization and differentiation, enabling the promotion of personal competencies, and utilizing the social needs and opportunities of offline phases to promote social competencies and, not to be forgotten: the joy of learning and working together.

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References

- Beckmann, A. (2020). *Zur studentischen Akzeptanz von digitalen Tools in der Hochschullehre*. Universitätsbibliothek Dortmund.
- Feierabend, C., Plankenhorn, T., & Rathgeb, T. (2017). JIM 2017. *Jugend, Information, (Multi-)Media: Basisstudie zum Medienumgang 12- bis 19-Jähriger in Deutschland* [JIM 2017. Youth, Information, (Multi-)Media: Basic Study on Media Use among 12- to 19-Year-Olds in Germany]. mpfs.
- GDPR - *General Data Protection Regulation*. (n.d.). Retrieved from <https://gdpr.eu/>
- Goldkuhl, G. (2020). Design Science Epistemology: A pragmatist inquiry. *Scandinavian Journal of Information Systems*, 32(1), Paper 2. Retrieved from <https://aisel.aisnet.org/sjis/vol32/iss1/2>
- Goudeau, S., Sanrey, C., Stanczak, A., Manstead, A., & Darnon, C. (2021). Why lockdown and distance learning during the COVID-19 pandemic are likely to increase the social class achievement gap. *Nature Human*

- Behaviour*, 5(10), 1273-1281.
- Hansl, Nora (2021): *Studieren in der Krise: Entfremdung und E-Learning*. Retrieved from <https://www.derstandard.at/story/2000125051198/studieren-in-der-krise-entfremdung-und-e-learning> [13.06.2023]
- Johannesson, P., & Perjons, E. (2014). *An Introduction to Design Science*. Springer.
- Khan, F., & Vuopala, E. (2019). Digital competence assessment across generations: A Finnish sample using the DigComp framework. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, 10(2), 15-28.
- Kopp, B., & Heinz (2009): *Blended Learning: Forschungsfragen und Perspektiven*, Forschungsbericht Nr. 182, Ludwig-Maximilians-Universität München, Department Psychologie, Institut für Pädagogische Psychologie.
- Kretz, S. (2020). *The Cosmos of Design: Exploring the Designer's Mind*. Walther König.
- Krismadinata, K., Verawardina, U., Jalinus, N., Rizal, F., Sukardi, S., Sudira, P., Ramadhani, D., Lubis, A. L., Friadi, J., Arifin, A. S. R., & Novaliendry, D. (2020). Blended Learning as Instructional Model in Vocational Education: Literature Review. *Universal Journal of Educational Research*, 8(11B), 5801–5815. Retrieved from <https://doi.org/10.13189/ujer.2020.082214>
- McKenney, S., & Reeves, T. C. (2018). *Conducting educational design research* (2nd ed.). Routledge Taylor & Francis Group.
- McKenney, S. (2022). *Educational Design Research: Why, What, and How?* [Keynote address, Jan 20, 2022, DFG Conference on EDR, University of Hamburg/Online]. Unpublished presentation slides.
- Müller, C., & Mildenerger, T. (2021). Facilitating flexible learning by replacing classroom time with an online learning environment: A systematic review of blended learning in higher education. *Educational Research Review*, 34, 100394.
- Rafiola, R., Setyosari, P., Radjah, C., & Ramli, M. (2020). The effect of learning motivation, self-efficacy, and blended learning on students' achievement in the industrial revolution 4.0. *International Journal of Emerging Technologies in Learning (iJET)*, 15(8), 71-82.
- Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu* (Y. Punie, Ed.). Publications Office of the European Union.
- Reinmann, G. (2011). Blended Learning in der Lehrerbildung: Didaktische Grundlagen am Beispiel der Lehrkompetenzförderung [Blended Learning in Teacher Education: Didactic Foundations using the Example of Promoting Teaching Competence]. *Seminar*, 3, 7-16.
- Salmon, G. (2011). *E-moderating: The key to online teaching and learning*Routledge.
- Sandoval, W. (2014). Conjecture Mapping: An Approach to Systematic Educational Design Research. *Journal of the Learning Sciences*, 23(1), 18-36.
- Staker, H., & Horn, M. B. (2012). *Classifying K–12 Blended Learning*. Innosight Institute, Inc.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The Difference Between Emergency Remote Teaching and Online Learning. *EDUCAUSE Review*. Retrieved from <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- van Meegen, A., Casper, M., Augsdörfer, A., Ottliczky, J., & Johnsen, A. (2023). *Knowledge Map „Blended Learning in der beruflichen Bildung“* [Knowledge Map „Blended Learning in Vocational Education“]. Retrieved from https://miro.com/app/board/uXjVPhsRUNw=, via <https://www.erziehungswissenschaften.hu-berlin.de/de/wipaed/international/projekte/blended-learning>.

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