Understanding the Challenges and Opportunities of Hybrid Education with Location Asynchrony

Selina Mayer
Hasso Plattner Institute, University of Potsdam, Germany,
selina.mayer@hpi.de

Abstract

The Covid-19 pandemic has severely disrupted traditional on-site education. One currently deployed alternative are hybrid education formats, which combine online and on-site elements. To successfully orchestrate these formats, educators and educational institutions need to understand the challenges and opportunities hybrid education can pose to both students and educators. This is especially true when hybrid education allows for asynchrony of the learning location, e.g. allowing students to choose whether they attend online or on-site. To understand these challenges and opportunities, we deployed a qualitative research design and identified three challenges and three opportunities of hybrid education allowing location asynchrony. We discuss these findings and highlight three larger underlying themes (balancing flexibility with complexity, the challenge of interpersonal connectedness in highly diverse settings, and digital proficiency), including sometimes opposing perspectives of students and educators.

Keywords: technology-mediated learning, hybrid education, asynchronous learning location, case study

1. Introduction

Information technology has strongly influenced education in the past thirty years (Alavi & Yoo, 1997; Janson et al., 2020; Whitaker et al., 2016). More specifically, technology-mediated learning (TML) is of high interest to researchers and practitioners within the fields of education and information systems. TML refers to the usage of information technologies to facilitate learners' interactions with instructors, peers and learning material (Alavi and Leidner 2001). It bears multiple promises, such as a broad reach to international experts as well as learners, and a high cost-efficiency (Alavi, 1994; Ghemawat, 2017). The "screetching halt" brought to on-site classroom education by the Covid-19 pandemic (Ellis et al., 2020, p. 559) increased the importance of TML tremendously. However, the dynamic development of the pandemic also gave rise to many 'hybrid' learning modes. Hybrid learning usually refers to the combination of synchronous online and face-to-face learning activities (Olapiriyakul & Scher, 2006), so that all learners and teachers meet at the same time. The COVID-19 pandemic showed impressively, how fast the need for flexibility in education can arise (Daniel, 2020). Up to date, educational institutions worldwide are still affected by numerous different regulations concerning on-site attendance. This calls for a higher flexibility and made it necessary to make hybrid learning asynchronous concerning location (and often time), so that learners can fully participate in the educational program, but can choose from where they do so.

While the COVID-19 epidemic made the need for flexible education settings especially clear, it is important to consider asynchrony of location and time in modern education systems for two more reasons.

First, lifelong learning is a concept of growing importance, making adult learners the largest group of online learners (Ke & Xie, 2009). However, adult learners still face multiple challenges when it comes to online distance learning, among them external challenges such as work or domestic related challenges, as well as internal challenges (Kara et al., 2019). In order to allow adults to fully benefit from their chosen education, it is necessary to allow flexibility to accommodate for a variety of working contexts and family circumstances and still offer the opportunity of face-to-face attendance if desired. Second, the rise of TML allows for collaborative learning settings with an international audience (Mittelmeier et al., 2018). However, students have a high variety of interaction preferences and differ in

URI: https://hdl.handle.net/10125/102641
978-0-9981331-6-4
(CC BY-NC-ND 4.0)

their motivation to communicate (Wise et al., 2012). Therefore hybrid education including asynchronous learning concerning location is of interest in order to understand, how educational settings can allow for an international audience and allow for different levels of need concerning face-to-face interaction.

While the importance of TML seems to be clearly demonstrated in previous research and more so in recent practice, not much is known about the asynchrony of location in hybrid education. Previous research demonstrates the high importance of factors such as learning motivation, attitudes towards TML or transparency of the training process for learning success (Bitzer & Janson, 2014; Söllner et al., 2018). Drawing on existing research from TML we can assume that learners and educators attitudes and believes can highly influence the learning experience. However, to our knowledge, research has so far neglected to understand the specific opportunities and challenges that asynchrony of location might bring to hybrid education. Without an understanding of these influencing factors educational institutions are lacking means to address todays highly dynamic demands when it comes to the complex combination of online and face-to-face learning activities, asynchronous and synchronous learning sessions and the flexibility of learners' physical attendance. We thus pose the following research question: *What are the key challenges and opportunities of a hybrid learning environment, allowing for asynchronous learning locations?*

To address this question, we chose a qualitative research approach. Based on 15 interviews with educators and the answers to open-ended questions of 135 learners, we provide rich descriptions of three main opportunities and three main challenges from the perspective of learners and educators.

2. Literature Review

This section gives an overview of the existing literature concerning the overall umbrella term 'technology-mediated learning' and then more specifically about hybrid learning and the asynchrony of location in learning.

2.1. Technology-mediated learning

Technology-mediated learning (TML) refers to "an environment in which the learner's interactions with learning materials (readings, assignments, exercises, etc.), peers, and/or instructors are mediated through advanced information technologies." (Alavi & Leidner, 2001, p. 1). TML encompasses a high variety of different learning modes, including "web-based or computer-based, asynchronous or synchronous, instructor-led or self-paced, individual-based or team-based" learning (Gupta & Bostrom, 2009, p. 687). Besides its importance, research on influencing performance factors of TML is still rather scarce (Bitzer and Janson 2014; Gupta and Bostrom 2009). One recent study offers a comprehensive view, identifying pedagogical factors (e.g. trainer quality, learning materials) to be more influential than technology-focused factors, when it comes to learning success and learners' satisfaction (Söllner et al., 2018).

Overall COVID-19 quick-started a lot of technology-mediated learning programs, raising questions as what the new normal can and should look like in education (Di Pietro et al., 2020; Mulenga & Marbán, 2020; Zhao & Watterston, 2021).

2.2. Hybrid learning and asynchronous learning location

While TML is a large umbrella term used mainly in research, practitioners often use the term hybrid learning. Many universities have started to set up hybrid learning settings already 20 years ago, as rising numbers of students enrollment challenge the limitation of physical space (Twigg, 2003). Researchers who refer to hybrid learning as an educational setting define it concerning the medias that deliver education, e.g. hybrid learning includes face-to-face elements as well as online elements delivered over distance (Bonakdarian et al., 2010).

Hybrid learning traditionally describes a fixed set of hours for face-to-face education and for online learning, therefore having synchronous (e.g. same time face-to-face interaction) and asynchronous time elements (individual paced online learning) (Olapiriyakul & Scher, 2006). Studies demonstrate a variety of different results concerning the effectiveness (e.g. performance and learners satisfaction) of hybrid learning, indicating a high complexity and the existence of various differences in the delivery of hybrid learning (Hall & Villareal, 2015; Kyle et al., 2021). For example hybrid learning settings have been shown to outperform traditional face-to-face learning settings (Aristika et al., 2021; Twigg, 2003). On the other hand, studies found no differences between distance learning and a hybrid setting (Olapiriyakul & Scher, 2006) or between face-to-face and hybrid learning (Delialioglu & Yildirim, 2008).

Researchers have identified different factors influencing the effectiveness of hybrid learning. The clarity of structure and support from the educator can create more student satisfaction (Paechter & Maier, 2010), and asynchronous learning concerning time can

increase learners motivation (Buxton, 2014; Hall & Villareal, 2015; Northey et al., 2015).

However, researchers and practitioners call for modern education to be more flexible, demanding asynchronous learning not just concerning time, but also location, and therefore allowing learners the choice of physical attendance (Abdelmalak & Parra, 2016; Beatty, 2014). While there are some early hybrid formats allowing for this flexibility in attendance (Bonakdarian et al., 2010; Dal Bello et al., 2007), up to date, there is not much known about the effect of asynchronous learning location on educational effectiveness. Understanding the effects of asynchronous learning seems to be especially important when considering modern education beyond pure instructions. Recently, researchers argue for a more holistic approach, which includes a mix of instructions and actual job tasks as well as a mix of pedagogical approaches (constructivism, behaviorism, experiential learning) (Cronje, 2020). This demonstrates further complexity when offering effective hybrid education formats that allow asynchronous locations, as the technology needs to provide for a variety of learning and interactions modes. In other words, giving a lecture face-to-face while streaming it also to online participants falls short when it comes to the inclusion of different pedagogical approaches and allowing for learning by doing.

Therefore, the focus of this study is to understand the different challenges and opportunities hybrid education allowing for asynchronous locations poses to educators and learners, especially in education formats relying heavily on teamwork, peer interaction and problem solving.

3. Method

To study what challenges and opportunities hybrid education bears for educators and students, we adopted a qualitative research design. Up to date, little is known about the influence of hybrid conditions in educational settings, especially considering location asynchrony. We thus followed an inductive approach to derive insights from real life situations, i.e., from students and educators experiencing education in a hybrid setting (Eisenhardt, 1989; Yin, 2011). This procedure is also in line with the grounded theory approach (Corbin and Strauss 1990). In detail, we use a single case to detect slightly subtle effects, but are still able to capture a broad spectrum of the phenomenon, as we included educators with different teaching e backgrounds, as well as students from different courses (Recker 2013; Yin 2011). The single case study approach is a research strategy suitable to IS research, especially when the topic of interest is emergent and interview partners are rather scarce (May et al., 2020; Recker, 2013).

We chose the HPI School of Design Thinking (HPI D-School) as a suitable single case (HPI D-School, n.d.). With about 50 international educators as faculty, different educational formats, and more than 200 students per semester with a high internationality, HPI D-School is only one institution, but provides multiple units of interest for a qualitative investigation.

3.1. Case Context

As a part of a university in Potsdam, Germany, the HPI D-School has over 15 years of experience in teaching design thinking, a creative problem solving approach, to an international audience, with currently students enrolled from 20 different countries. Until the Covid-Pandemic starting in March 2020, the HPI D-School conducted its courses only on-site. From than onwards, the curriculum was moved entirely online, utilizing various software tools, such as Miro, Zoom, Wonder, and Slack. Asynchronous and synchronous learning phases were established, which were managed in a digital learning platform offering videos and materials to download. With the softening of Covid-19 regulations, the HPI D-School allowed more flexibility concerning on-site attendance since the start of the winter semester in October 2021, creating a hybrid educational setting. Students work in teams of 5 to 6, and educators usually facilitated 1 or 2 teams. Full-semester courses have two program days per week, where students and educators are present either online or on-site. Students usually also meet in between to advance their projects. The authors have first-hand experiences with the courses taught at the HPI D-School.

3.2. Data Collection

We relied on two different data sets in order to capture the students' and the educators' perspectives.

3.2.1. Educators. First, we conducted 15 in-depth interviews with educators teaching in a hybrid setting. The interviews took place between August and September 2021 via online calls. Hence, most of our interviewees had experienced on-site education, online education and a hybrid setting. We recorded and transcribed the interviews, resulting in approx. 10 hours and 15 minutes of recordings and approx. 213 pages of transcripts (Arial 11, 1.5 line spacing). While our interviewees varied in their educational disciplines (e.g. information systems, psychology, business), they were all experts in teaching design thinking, and had

at least three years of teaching experience within the HPI D-School, with an average of 7 years of teaching experience. Following the grounded theory approach, we collected and analyzed our data iteratively, going back and forth between data collection, and data analysis (Corbin and Strauss 1990; Coyne 1997). In consequence our interview guideline changed slightly with each interview. Our semi-structured guideline including three main areas: 1) understanding the impact of design thinking on students in general; 2) differences in the learning and learning outcomes between different educational settings (online, on-site, and hybrid setting); 3) specific tools and tricks educators used to adapt to the different settings.

3.2.1. Students. Second, we collected data from 135 students (response rate 135 out of 275) via open-ended questions in an anonymous online survey, before and after they experienced one semester of education in a hybrid setting. The students accessed the survey online via Google Forms. Besides the demographic questions, the participants answered one open-ended question stating their experiences and feelings about the hybrid education setting (e.g. benefits, opportunities, challenges, wishes). An example of the first open-ended question is "The upcoming semester at the D-School will be conducted in a hybrid learning setting. When you think about a hybrid setting, what are your expectations or feelings (opportunities, challenges, wishes)?", which was followed by more detailed questions. In addition, the survey included additional scales, for example on well-being, which were not included for this study. The students who completed the survey ranged from 18-48 years of age, with an average of 27.5 years of age. Sixty students participated in full semester programs, seventy-five students enrolled in more compacted short-term formats (e.g. ranging from 2-5 full days). The majority of students enrolled lived in Europe (106). Other students participated from Asia (15), Africa (6), South America (4), North America (2), Russia (2). The students have studied in a variety of fields, in descending order: Social Sciences (36), Engineering (24), Business (23), Humanities (18), Creative Disciplines, including arts, design, etc. (16), Life Sciences (13), Media (2), IT (1), Law (1), Medicine (1).

Furthermore, we triangulated our two data sources with additional data, matching the insights from our educators' interviews and the student questionnaire answers with observations of and discussions with educators and students during multiple occasions, such as educator meetings or networking events or student opinions from feedback sessions in class (Klein and Myers 1999).

3.3. Data Analysis

We adopted a grounded theory approach to provide "rich descriptions of new phenomena", which has been stated to be a valuable theoretical contribution to the IS Community, alongside new theories or models (Wiesche & Yetton, 2017). The grounded theory approach has been applied in various research areas within the Information Systems research community (Wiesche and Yetton 2017, Schneider and Kokshagina 2020). Therefore, we see the grounded theory approach as most suitable to could combine an understanding of real-life situations based on qualitative interviews and open-ended interview questions with existing literature and secondary data to generate insights on hybrid education.

We followed established recommendations for grounded theory procedures in our data analysis (Corbin and Strauss 1990; Gioia et al. 2013; Wiesche and Yetton 2017). Accordingly, we started with open coding, creating first order codes. Through axial coding, we found patterns in our qualitative data, and clustered them. Through selective coding, we reduced our data into the most relevant second order codes, resulting in six aggregated dimensions. Furthermore, we distinguished between challenges and opportunities as well as the students' and educators' perspectives. Figure 1 displays an example of the described data structure, deriving one aggregated dimension from the respective second order and first order codes.

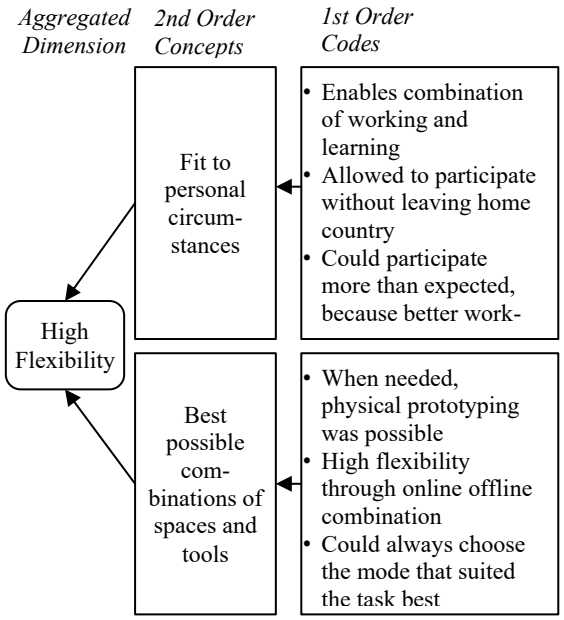

Figure 1. Exemplified Data Structure

4. Findings

In total, we identified six opportunities and challenges when it comes to hybrid education. Students seem to have a more positive attitude towards hybrid education, emphasizing the high flexibility and the connectivity across borders, only missing a personal connectedness, which they perceive as higher in on-site education. Educators on the other hand, describe the high complexity of a hybrid setting and a fear of inequality among learners as challenging. Educators see one central positive effect, the additional learning of digital skills. The next sections provide details about the opportunities and challenges described by students and educators.

4.1. Opportunities of Hybrid Education

We identified three opportunities of hybrid education: a high flexibility for the learner, a high diversity due to a connectivity across borders, and the development of digital skills.

Table 1 displays the aggregated dimensions, the second order concepts along with example quotes for the opportunities.

First, students described the high flexibility as one major advantage of hybrid education, referring to two sub-dimension: creating a better fit to personal circumstances and allowing an adaptation for the best possible combination of spaces and tools to suite their learning goals. Concerning the fit to personal circumstances, many learners described an advantage in being able to work while study, with hybrid education enabling the focus on both aspects in their live (e.g. BE14[1]). Furthermore, learners described the fit to their personal backgrounds, being able to stay in their home country for most of the educational program, but still join important team activities, such as user research field trips, if needed (WB04). In addition, learners emphasized that a hybrid setting allowed them to choose the best possible combination of tools and spaces for their respective tasks (BE14). For example, prototyping could be done physically on-site or digitally, depending on the actually solution needed (YT20).

Table 1. Opportunities of Hybrid Education Settings

Aggregated dimension	2nd order concepts	Example Quotes
		Students
High Flexibility	Fit to personal circumstances	In general, this [hybrid setting] worked well and enabled me to do the AT next to my job more easily (BE14[1]). It [hybrid setting] worked super well, it allowed me to participate in the program [from abroad], and still taking a longer field trip with my team;(WB04)
	Best possible combinations of spaces and tools	Benefits: Physical prototyping (YT20). I enjoyed meeting online and offline flexibly with my team as it suited us best with the respective program days and tasks (BE14).
Diversity / Connectivity across borders		I love the fact that thanks to the hybrid setting, it's possible for people from all over the world to join the HPI Program and enrich the team dynamics with even more international influence (UH14) The ability to have expansive connections and be able to connect with people across borders. (RS07) Team experience with people from very different backgrounds.(WB04)
		Educators
Digital Skills	Becoming digital professionals	They become digital professional for all of this, how to use something [tools], how do I create it digitally, that it also looks good. They were extremely professional. (1)
	Better aesthetics	What I really with the online component, everything is much more aesthetic than before. (9)

[1] Anonymous Indicator of Survey Participants

Second, students praised the high diversity of their learner peers, as a hybrid setting allowed a connectivity across borders. While we did not identify any sub-dimensions, it was one of the most mentioned topic (e.g. UH14, RS07, WB04).

Educators described one central opportunity from their perspective. In addition to the actual taught subject, learners gain digital skills. Educator #1 for example emphasized, that the learners became digital professional, navigating easily between different types of technologies and tools. Furthermore, educators perceive the output of the students' teamwork to be more aesthetic, as digital tools support a high quality documentation (educator #9).

4.1. Challenges of Hybrid Education

We found three main challenges in hybrid education: a lack of personal connection between learners, a high complexity for educators, and a perceived inequality between learners who were physically present and learners who were participating just online. Table 2 displays the aggregated dimensions, the second order concepts along with example quotes for the challenges.

First, students strongly describe a lack of personal connection, especially if the team was constantly split up across spaces (e.g. AP15, BE14, BM04). Again, for this cluster we did not find significant sub-dimensions, although it was referred to by most of our participants. Especially the inclusion of team members participating only online was described as challenging, creating an overall difficulty of achieving a team feeling and interpersonal connectivity.

Educators described more challenges than students. Their main challenge concerns the high complexity of the educational set up, allowing for asynchrony along space and time. We identified two sub-dimensions. The first is a high effort to set up the structure. Educators report, that the learners and the educators were sometimes more concerned with the set-up, which distracted from the actual learning content (e.g. educator 7). In addition, educators report to not really perceive a clear benefit of the hybrid setting, at least not any benefit that justifies the high effort (e.g. educator 4).

And second, educators perceive an inequality between learners attending from different spaces. They describe for example unequal work conditions, emphasizing that a successful hybrid setting needs laptops for each student attending physically, as otherwise people are not represented equally in an online space (e.g. educator 9). Furthermore, educators indicated the feeling of a (social) hierarchy between, learners being physically present and the ones attending online (educator 11).

Table 2. Challenges of Hybrid Education Settings

Aggregated dimension	2nd order concepts	Example Quotes
Students		
Personal Connections		It was challenging to include people who just participated online (BM04). It is challenging if most people are on-site while a few have to join online. Sadly, the online setting did not allow for a lot of "getting to know each other" (AP15). However, it was challenging that not the whole team was in Germany, when we met, there was no way to be as connected with the person online as with those around you (BE14).
Educators		
High Complexity	High effort to set up	It is really so complex for everyone […]. We have so much to do just to adopt to it and to find a good way to deal [with the hybrid setting]. (7)
	No perceived advantage	I am really just missing the imagination and a clear argument so far, to justify hybrid setting [because of the high effort needed for it]. (4)
Perceived Inequality	Unequal work conditions	I think it just works if everyone sits in front of their own laptop. Because that is the only way to make everyone equal. (9)
	Differences in interpersonal connectivity	If there is a hierarchy concerning emotional bonding, I think than the hybrid setting cannot work. (11)

5. Discussion

We identified six opportunities and challenges of hybrid education that allows for asynchrony of location for the learners. In this section, we detail three larger underlying themes of these challenges and opportunities and discuss the different perspectives of students and educators, as we found their perspectives to often be opposing. Figure 2 displays the six opportunities and challenges and gives an indication of the opposing perspectives of educators and students.

First, we found that while students compliment the high flexibility of hybrid education with location asynchrony, educators rather emphasize the high complexity and do not so far see larger advantages. This contrast is in line with existing research. On the one hand, researchers describe the need to offer this high flexibility to students, naming advantages such as mitigating central leaner challenges such as creating balance between work and education and between family /social life and education (Kara et al., 2019) or creating a higher student engagement by allowing for differences in participation needs (Wise et al., 2012). On the other hand, research is ambiguous on the effectiveness of hybrid education (Aristika et al., 2021; Delialioglu & Yildirim, 2008; Hall & Villareal, 2015), reflecting the lack of perceived advantages by educators. Therefore, educational institutions and technology providers for hybrid education need to understand both learners and educators perspectives when creating hybrid educational settings.

Second, the students see an opportunity in being connected internationally across boarders and therefore experience a high diversity. Educators on the other hand rather see the hybrid setting as challenging inclusion, as it creates unequal conditions. While research indicates that diversity can have positive effects, such as predicting innovativeness (Usher & Barak, 2020), it is also often discussed as challenging. Differences in mother tongue for example seem to be a positive predictor for innovativeness during face-to-face interaction, but has negative implications when teams work together online (Usher & Barak, 2020). Effective hybrid education therefore needs to address the challenges that accompany the large opportunity of being connected across borders, especially the challenges posed to online attendees and a perceived inequality in their attendance, in order to leverage the potential benefits of a highly diverse learner group.

Third, and to no surprise, the topic of interpersonal connectedness is one central theme underlying challenges and opportunities of hybrid education. This reflects the growing interest in research topics around collaborative learning (Wambsganss et al., 2021), belongingness and sense of community related to learners' engagement, especially when learning is technology-mediated (Martin & Bolliger, 2018), and the community of inquiry (Garrison et al., 2010). From the students perspective, missing personal connectedness, especially for those attending from a distance, is a key challenge that needs to be addressed for successful hybrid education. This is a topic closely connected to the opportunity of connectivity across boarders and the challenge of fear of inequality, as learners participating from further away often do not have the luxury to decide spontaneously whether they want to attend face-to-face or online due to high travel or accommodation costs. Dealing with asynchrony of location for the learners therefore needs to also take into account the question of how equal the actual choices of learners are.

Last, we found the theme of digital proficiency underlying the opportunities of hybrid education. Research and practice emphasizes the information and communication technologies competencies as one of the most central 21st century skills (Voogt & Roblin, 2012). Therefore, besides teaching a subject, the additional opportunity of gaining a digital proficiency in a variety of tools and technologies is one key opportunity of hybrid education. The Covid-19 pandemic emphasized this, as one study showed the high variety of digital readiness of students when the pandemic tasked them with a fast shift to online learning (Händel et al., 2020). Digital readiness is especially one important factor to consider, as it has a significant effect on the social-emotional perceptions of students (e.g. stress-related emotions, social loneliness etc.).

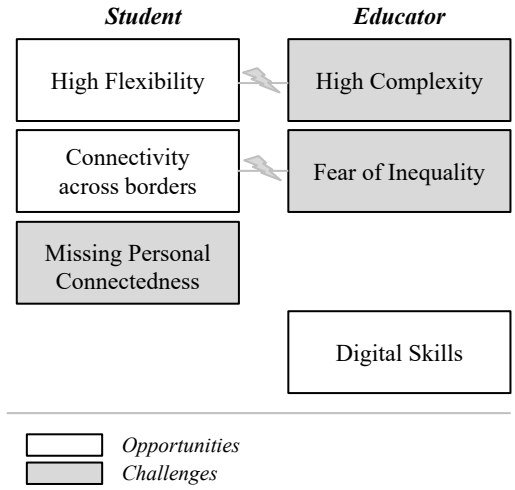

Figure 2. Opportunities and Challenges of Hybrid Education for Students and Educators

6. Conclusion

In this study, we investigated the opportunities and challenges hybrid education with asynchronous location settings bring to students and educators. We answer our research question by offering rich descriptions of in total six opportunities and challenges and discuss three broader underlying themes. Doing so, we support researchers and practitioners in understanding the current struggle of educational institutions when it comes to setting up hybrid education formats with their numerous possibilities. Gaining an overview as well as a rich understanding of the challenges and opportunities is the foundation to creating future hybrid education formats that allow for asynchrony of the learners. Our findings suggest that educational institutions need to carefully consider both, the learners' and the educators' perspectives, as especially for hybrid education, their perception of challenges and opportunities can be contrary.

Our study is not without limitations, which provide opportunities for future research. First, we applied a qualitative research design in order to openly explore hybrid education with asynchronous learning locations. Future research needs to investigate our findings in a quantitative manner for validation.

Second, we used different data sources for the students and the educators, allowing a self-selection on the students' side, while selecting the educators purposefully. And third, we focused on one institution and their educational formats for our research endeavor. Further research should extend the research to other institutions, with the potential to compare different pedagogical approaches.

Acknowledgements

I kindly thank the Hasso-Plattner-Design-Thinking -Research-Program (HPDTRP) for funding our research generously and the HPI D-School team in their support of gathering data, enabling me to investigate this topic. Last, I thank Dr. Martin Schwemmle for his feedback on the initial manuscript idea.

7. References

Abdelmalak, M. M. M., & Parra, J. L. (2016). Expanding Learning Opportunities for Graduate Students with HyFlex Course Design. *International Journal of Online Pedagogy and Course Design*, *6*(4), 19–37. https://doi.org/10.4018/ijopcd.2016100102

Alavi, M. (1994). Computer-Mediated Collaborative Learning : An Empirical Evaluation. *MIS Quarterly*, *18*(2), 159–174.

Alavi, M., & Leidner, D. E. (2001). Research Commentary: Technology-Mediated Learning - A Call for Greater Depth and Breadth of Research. *Information Systems Research*, *12*(1), 1–10. https://doi.org/10.1287/isre.12.1.1.9720

Alavi, M., & Yoo, Y. (1997). Using Information Technology to Add Value to Management Education. *The Academy of Management Journal*, *40*(6), 1310–1333.

Aristika, A., Darhim, Juandi, D., & Kusnandi. (2021). The effectiveness of hybrid learning in improving of teacher-student relationship in terms of learning motivation. *Emerging Science Journal*, *5*(4), 443–456. https://doi.org/10.28991/esj-2021-01288

Beatty, B. (2014). Hybrid Courses with Flexible Participation. In & E. N. L. Kyei-Blankson (Ed.), *Practical Applications and Experiences in K-20 Blended Learning Environments* (pp. 153–177). IGI Global. https://doi.org/10.4018/978-1-4666-4912-5.ch011

Bitzer, P., & Janson, A. (2014). Towards a holistic understanding of technology mediated learning services - A state-of-the-art analysis. *ECIS 2014 Proceedings - 22nd European Conference on Information Systems*.

Bonakdarian, E., Whittaker, T., Yang, Y., & Avenue, S. G. (2010). Mixing It Up - More Experiments in Hybrid Learning. *The Journal of Computing Sciences in Colleges*, *25*(4), 97–103.

Buxton, E. C. (2014). Pharmacists' perception of synchronous versus asynchronous distance learning for continuing education programs. *American Journal of Pharmaceutical Education*, *78*(1), 1–7. https://doi.org/10.5688/ajpe7818

Cronje, J. C. (2020). Towards a new definition of blended learning. *Electronic Journal of E-Learning*, *18*(2), 114–135. https://doi.org/10.34190/EJEL.20.18.2.001

Dal Bello, A., Knowlton, E., & Chaffin, J. (2007). Interactive videoconferencing as a medium for special education: Knowledge acquisition in preservice teacher education. *Intervention in School and Clinic*, *43*(1), 38–46. https://doi.org/10.1177/10534512070430010501

Daniel, S. J. (2020). Education and the COVID-19 pandemic. *Prospects*, *49*(1–2), 91–96. https://doi.org/10.1007/s11125-020-09464-3

Delialioglu, O., & Yildirim, Z. (2008). Design and development of a technology enhanced hybrid instruction based on MOLTA model: Its effectiveness in comparison to traditional instruction. *Computers and Education*, *51*(1), 474–483. https://doi.org/10.1016/j.compedu.2007.06.006

Di Pietro, G., Biagi, F., Costa, P., Karpiński, Z., & Mazza, J. (2020). The likely impact of COVID-19 on education: Reflections based on the existing literature and recent international datasets. In *Publications Office of the European Union, Luxembourg: Vol. EUR 30275* (Issue JRC121071). https://doi.org/10.2760/126686

Eisenhardt, K. M. (1989). Building Theories from Case

Study Research Published by : Academy of Management Stable. *The Academy of Management Review*, *14*(4), 532–550.
Ellis, V., Steadman, S., & Mao, Q. (2020). 'Come to a screeching halt': Can change in teacher education during the COVID-19 pandemic be seen as innovation? *European Journal of Teacher Education*, *43*(4), 559–572. https://doi.org/10.1080/02619768.2020.1821186
Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *Internet and Higher Education*, *13*(1–2), 5–9. https://doi.org/10.1016/j.iheduc.2009.10.003
Ghemawat, P. (2017). Strategies for Higher Education in the Digital Age. *California Management Review*, *59*(4), 56–78. https://doi.org/10.1177/0008125617717706
Gupta, S., & Bostrom, R. P. (2009). Technology-Mediated learning: A comprehensive theoretical model. *Journal of the Association for Information Systems*, *10*(9), 686–714. https://doi.org/10.17705/1jais.00207
Hall, S., & Villareal, D. (2015). The Hybrid Advantage: Graduate Student Perspectives of Hybrid Education Courses. *International Journal of Teaching and Learning in Higher Education*, *27*(1), 69–80.
Händel, M., Stephan, M., Gläser-Zikuda, M., Kopp, B., Bedenlier, S., & Ziegler, A. (2020). Digital readiness and its effects on higher education students' socio-emotional perceptions in the context of the COVID-19 pandemic. *Journal of Research on Technology in Education*, *54*(2), 267–280. https://doi.org/10.1080/15391523.2020.1846147
HPI D-School. (n.d.). *About The HPI School of Design Thinking*. https://hpi.de/en/school-of-design-thinking/hpi-d-school.html
Janson, A., Söllner, M., & Leimeister, J. M. (2020). Ladders for learning: Is scaffolding the key to teaching problem-solving in technology-mediated learning contexts? *Academy of Management Learning and Education*, *19*(4), 439–468. https://doi.org/10.5465/AMLE.2018.0078
Kara, M., Erdoğdu, F., Kokoç, M., & Cagiltay, K. (2019). Challenges Faced by Adult Learners in Online Distance Education: A Literature Review. *Open Praxis*, *11*(1), 5. https://doi.org/10.5944/openpraxis.11.1.929
Ke, F., & Xie, K. (2009). Toward deep learning for adult students in online courses. *Internet and Higher Education*, *12*(3–4), 136–145. https://doi.org/10.1016/j.iheduc.2009.08.001
Kyle, K., Choe, A. T., Eguchi, M., LaFlair, G., & Ziegler, N. (2021). A Comparison of Spoken and Written Language Use in Traditional and Technology-Mediated Learning Environments. *ETS Research Report Series*, *2021*(1), 1–29. https://doi.org/10.1002/ets2.12329
Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning Journal*, *22*(1), 205–222. https://doi.org/10.24059/olj.v22i1.1092
May, A., Sagodi, A., Dremel, C., & Giffen, B. van. (2020). Realizing Digital Innovation from Artificial Intelligence. *ICIS 2020 Proceedings*, *September*.
Mittelmeier, J., Rienties, B., Tempelaar, D., Hillaire, G., & Whitelock, D. (2018). The influence of internationalised versus local content on online intercultural collaboration in groups: A randomised control trial study in a statistics course. *Computers and Education*, *118*(November 2017), 82–95. https://doi.org/10.1016/j.compedu.2017.11.003
Mulenga, E. M., & Marbán, J. M. (2020). Is covid-19 the gateway for digital learning in mathematics education? *Contemporary Educational Technology*, *12*(2), 1–11. https://doi.org/10.30935/cedtech/7949
Northey, G., Bucic, T., Chylinski, M., & Govind, R. (2015). Increasing Student Engagement Using Asynchronous Learning. *Journal of Marketing Education*, *37*(3), 171–180. https://doi.org/10.1177/0273475315589814
Olapiriyakul, K., & Scher, J. M. (2006). A guide to establishing hybrid learning courses: Employing information technology to create a new learning experience, and a case study. *Internet and Higher Education*, *9*(4), 287–301. https://doi.org/10.1016/j.iheduc.2006.08.001
Paechter, M., & Maier, B. (2010). Online or face-to-face? Students' experiences and preferences in e-learning. *Internet and Higher Education*, *13*(4), 292–297. https://doi.org/10.1016/j.iheduc.2010.09.004
Recker, J. (2013). *Scientific research in information systems: a beginner's guide*. Springer.
Söllner, M., Bitzer, P., Janson, A., & Leimeister, J. M. (2018). Process is king: Evaluating the performance of technology-mediated learning in vocational software training. *Journal of Information Technology*, *33*(3), 233–253. https://doi.org/10.1057/s41265-017-0046-6
Twigg, C. A. (2003). Improving Learning and Reducing Costs for Online Learning. *Educause Review*, *October*, 1148–1154. https://doi.org/10.4018/978-1-60566-198-8.ch163
Usher, M., & Barak, M. (2020). Team diversity as a predictor of innovation in team projects of face-to-face and online learners. *Computers and Education*, *144*(September 2019), 103702. https://doi.org/10.1016/j.compedu.2019.103702
Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21 st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, *44*(3), 299–321. https://doi.org/10.1080/00220272.2012.668938
Wambsganss, T., Schmitt, A., Mahnig, T., Ott, A., Söllner, S., Ngo, N. A., Geyer-klingeberg, J., Nakladal, J., & Leimeister, J. M. (2021). The Potential of Technology-Mediated Learning Processes : A Taxonomy and Research Agenda for Educational Process Mining. *Forty-Second International Conference on Information Systems*, 1–17.
Whitaker, J., New, J. R., & Ireland, R. D. (2016). MOOCs and the online delivery of business education

what'snew?what'snot?what now? *Academy of Management Learning and Education*, *15*(2), 345–365. https://doi.org/10.5465/amle.2013.0021

Wiesche, M., & Yetton, P. W. (2017). Grounded Theory Methodology in Information Systems Research. *MIS Quarterly*, *41*(3), 685–701.

Wise, A. F., Perera, N., Hsiao, Y. T., Speer, J., & Marbouti, F. (2012). Microanalytic case studies of individual participation patterns in an asynchronous online discussion in an undergraduate blended course. *Internet and Higher Education*, *15*(2), 108–117. https://doi.org/10.1016/j.iheduc.2011.11.007

Yin, R. K. (2011). *Applications of Case Study Research*. SAGE.

Zhao, Y., & Watterston, J. (2021). The changes we need: Education post COVID-19. *Journal of Educational Change*, *22*(1), 3–12. https://doi.org/10.1007/s10833-021-09417-3