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Blended Learning in Engineering Education: challenging, enlightening – and lasting?
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Blended Learning in Engineering Education: challenging, enlightening – and lasting?
COVID-19, A LASTING CHANGE?: FACTORS FOR INSTRUCTORS TO DEVELOP BLENDED LEARNING

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ABSTRACT

The COVID-19 pandemic ushered in a rapid shift to online learning. Nearly all university instructors gained experience in emergency remote teaching. Prior to the pandemic, embracing blended learning was a choice for instructors\(^1\); however, the pandemic made it a requirement. The question arises if the existing factors for instructors to adopt blended learning are still valid. After witnessing emergency remote teaching due to the pandemic, this study aims to re-investigate and re-examine the influential factors for Dutch technical university instructors to develop blended learning. A literature review is undertaken to recognize intrinsic influential factors (technical literacy, pedagogical readiness, belief and attitude) and extrinsic influential factors (time commitment, Organization incentive and professional development support). Future improvements and new influential reasons for instructors to incorporate blended learning are identified. Beyond COVID-19, the findings of this study serve as a source of information and a new starting point for successful professional growth and support in blended education.

1 INTRODUCTION

Two-thirds of higher education institutions (HEIs) had to make an immediate transition to online education during the COVID-19 pandemic (UN, 2020). In part

\(^1\) In this article, the term instructor is used in the higher education context, instead of teacher or lecturer.
because of the COVID-19 experience, JISC in the UK predicted a potential blended education model in partnership with over 1000 UK higher education organizations (Maguire, 2020). According to a recent study at University Twente, in the Netherlands, both instructor and student groups chose blended learning as the most favored education model when they returned to campus after the pandemic (Pei, 2020).

The COVID-19 pandemic has accelerated the adoption of digital technology. University instructors have gained experience in teaching online, which they may not have had prior to the pandemic (Crawford et al., 2020). Prior to the pandemic, blended learning was a choice. In the future, it might be necessity. The university education landscape is being reshaped by COVID-19. In this transformative time, the instructors are the most important players. The quality of any educational advancement is likely to be decided by how instructors embrace innovative ideas and put them into effect. The importance of researching and re-examining the influential factors for instructors to improve blended learning is recognized in this study. This study aims to answer the following questions:

- What are the influential factors for instructors to implement blended learning in higher education?
- Are there any new influences or changes on the existing factors as a result of emergency remote teaching after the pandemic?
- What are the recommendations for professional development on blended learning beyond COVID-19?

2 LITERATURE REVIEW

2.1 Blended learning

Blended learning is not a new phenomenon for higher education. There are multiple definitions which put the focus on various aspects (Vandeput, Tambuyser, & De Gruyter, 2011). This study chooses the definitions of Graham (2006), which emphasizes the combining technology with face-to-face teaching led by an instructor (Graham, 2006). In the past, a considerable number of studies have been carried out to supply recommendations for university instructors to ensure the effective implementation of blended learning (Albrecht, 2006; Bonk, Kim, & Zeng, 2005; Duderstadt, Atkins, Van Houweling, & Van Houweling, 2002; Garrison, & Vaughan, N. D., 2008; Güzer & Caner, 2014). Among them, Garrison and Kanuka (2004) has further pointed out blended learning is “the thoughtful integration of classroom face to face learning experiences with online learning experiences”, which requires a careful design with use of the best features of online and face-to-face components to foster deep learning.

2.2 Factors for influencing instructors to adopt blended learning

Numerous studies have been conducted to investigate the factors that influence the production of effective blended learning (Lim & Morris, 2009; Moskal, Dziuban, & Hartman, 2013; So & Brush, 2008; Stacey & Gerbic, 2008). A few studies further categorize the influential factors on instructors to develop blended learning as
intrinsic factors (such as beliefs, attitude, skills and competences) and extrinsic factors (institutional factors, technological infrastructure, support, workload) (Brown, 2016; Osika, Johnson, & Butea, 2009).

2.3 Intrinsic factors

Technological literacy

One of the most significant obstacles for instructors to develop blended learning is to acquire sufficient technical competency. Instructor’s technological literacy is considered as one of the intrinsic factors (Brown, 2016; Lightner & Lightner-Laws, 2016; Rasheed, Kamsin, & Abdullah, 2020). Instructors’ ability to build blended learning courses can be hampered by a lack of 1) technological ability, 2) awareness, and 3) trust (Allen & Seaman, 2012). Moreover, instructors’ decisions to build and manage blended education can be influenced by unreliable technological infrastructure and incompatible hardware and software (Derntl & Motschnig-Pitrik, 2005).

Pedagogical readiness

In a blended learning environment, the instructor's position shifts from teacher to facilitator to build and sustain a learning community, in which students can be socially connected to collaborate, discourse and reflect (Garrison & Kanuka, 2004). This requires instructors to adapt or even create new pedagogy to redesign teaching strategies and learning activities. To maximize the teaching and learning process in such a blended learning context, instructors need to integrate the knowledge of technology (TK), knowledge of pedagogy (PK) and knowledge of domain content (CK) and reinforce relationships between TK, PK and CK (Mishra & Koehler, 2006).

Belief and attitude

Instructor skepticism and misunderstandings about blended learning have been proven as a predictor of blended education creation failure (Benson et al., 2011; Lightner & Lightner-Laws, 2016). Instructors need to be assured of the value and efficacy of blended learning before they can begin the blended learning design process (Benson et al., 2011; Lightner & Lightner-Laws, 2016). Bruggeman et al. (2021) reported simply having an educational belief was not enough, instructors need to realize a pedagogical need for change. Diverse pedagogical needs such as activating students in large groups or promoting student-centered learning experiences act as triggers for instructors to implement blended learning (Bruggeman et al., 2021).

2.4 Extrinsic factors

Time commitment

New skills and expertise need extra effort and time, which is often overlooked and can have a detrimental effect on instructors' attitudes toward blended learning (Brown, 2016; Ooms, Burke, Linsey, & Heaton-Shrestha, 2008). In the past, instructors find developing and teaching blended learning courses to be time-consuming and difficult (Benson, Anderson, & Ooms, 2011; Ibrahim & Nat, 2019;
Ocak, 2011; Vaughan, 2007). Instructors in higher education also have several roles. When compared to research and projects, teaching is rather a lower priority. This, logically, means that less time is invested in educational creativity.

**Organization incentive**

Blending learning, “on the course, program, and institutional levels, is a dynamic process” (Brown, 2016; Garrison & Kanuka, 2004). To safeguard blended learning development, higher education institutions need to be reshaped and reorganized, which could include improvements to strategy, policy, ICT facilities, technological infrastructure, technical and pedagogical support, and faculty incentives (Brown, 2016; Graham, Woodfield, & Harrison, 2013; Mishra & Koehler, 2006; Ocak, 2011).

**Professional development support**

Among these extrinsic factors, professional development is recognized by the literature as necessary to successful blended learning endeavors (Moskal et al., 2013). Instructors receive professional development support to help them better integrate blended learning instructional design concepts and standards into their courses (Garrison & Kanuka, 2004; Martin, 2003; Porter, Graham, Spring, & Welch, 2014). Prior study advocated that an effective professional development itself increases the instructor’s knowledge and skills and can have a positive impact on their attitudes and beliefs, which in turn improve their instruction and eventually increase student learning (Desimone, 2009; Philipsen, Tondeur, Roblin, Vanslambrouck, & Zhu, 2019). Moreover, professional development must interweave pedagogical and technological skills together with a good strategy (Wach, Broughton, & Powers, 2011). A few professional development recommendations for blended learning are as follows:

- exploring the use of educational technologies available to design and manage the online portions of blended learning (Bower, 2001)
- facilitating instructors to understand the wide variety of pedagogical methods and choose proper pedagogical instructions for a blended choice (Graham et al., 2013; Sharpe, Benfield, Roberts, & Francis, 2006)
- working in teams (Bower, 2001)
- developing a learner-centered mindset (Garrison, & Vaughan, N. D., 2008)
- embedding blended learning into the academics’ daily practice (Rienties, Brouwer, & Lygo-Baker, 2013; Gast, Schildkamp, and van der Veen, 2015)

### 3 METHOD AND DATA ANALYSIS

To find answers to the research questions proposed in the introduction, instructors at University Twente were invited to fill in a questionnaire. The questionnaire has been designed with multiple choice questions, questions with a Likert scale and open-ended questions to validate the influential factors for instructors to develop blended education. It consisted of 25 questions. The questionnaire has been distributed to 68 instructors of four different bachelor programmers across three faculties: International Business Administration (faculty of Behavioural Management and Social sciences), Electrical Engineering (faculty of Electrical Engineering
Mathematics and Computer Science), Chemical Science and Engineering (faculty of Science and Technology), Advanced Technology (faculty of Science and Technology). The results were analyzed using a software package called ‘EvaSys’.

4 RESULTS
In the end, 47 out of 68 instructors have completed the questionnaire (response rate: 69%). (This questionnaire is available upon request.)

5 CONCLUSION AND DISCUSSION
In addition to the known influencing factors in the literature, several new factors have been identified as well. The specific conclusions and discussion of the data are presented accordingly below:

5.1 Technical infrastructure and technological literacy
Prior to the pandemic, technical awareness and competency have been identified as one of the biggest barriers for instructors in designing blended learning from the literature study. According to the questionnaire’s results during the pandemic, more than half of the instructors from this study (61.7%) possess the technical equipment and software they needed to teach online. The rest of the instructors group did not indicate major problems caused by the COVID-19 shift. Evidently, having a stable internet connection also plays a key role in teaching online, the instructors have rated theirs with an average 8.3 out 10.

Furthermore, instructors have reported to use drawing tablets, video conferencing platforms and different other tools to stream and record video lectures. According to the questionnaire, instructors have clearly improved their technical skills in a relatively short period of time. However, there’s room for improvement and professional development on education design with ICT competences.

5.2 Beliefs attitudes and willingness to invest time for blended learning
66% of instructors from the research group have chosen blended learning as the preferred education mode in the future. Further, instructors recognize the potential of blended education and would like to get more allocated time to experiment with online and blended learning (41.5%).

“Online teaching could make the teaching experiences more flexible and diverse. A blended learning for students would be the interest for both teachers and students” – instructor

Instructors from our research clearly demonstrate strong interests and confidence in blended learning. The instructor's willingness to spend time exploring blended learning reflects this optimistic mindset and appreciation of blended learning for the future.
5.3 Pedagogical readiness

The primary goal of higher education during an epidemic, particularly at the start of the lockdown period, is to ensure continuity of teaching. The attention and time of the instructors are inevitably focused on the technical aspects. However, as the pandemic continued and time passed, concerns about the quality of teaching and learning became more prevalent. On the one side, the majority of instructors claim to be able to teach without difficulty (31.9% strongly agree; 42.6% agree). On the other hand, maintaining social connections with students and keeping them motivated and engaged in learning is challenging for them:

“Motivation issue will have a stronger impact because the social distancing makes it harder to create a motivation environment for the student.” – instructor

According to the literature, blended learning requires different pedagogical skills to foster a learning community and design teaching and learning activities to keep students socially connected (Garrison & Kanuka, 2004). The results of the questionnaire revealed that, while instructors can quickly pick up technical skills, they still need to improve their pedagogical skills, especially in terms of designing and implementing social activities in the learning process.

5.4 Organization

At the organizational level, COVID-19 makes reshaping and reorganizing necessary. Due to COVID-19, education made a quick switch to online education. Strategic policies, ICT facilities and the support structure also need to be adjusted to keep up with the changed reality and make this quick change a lasting change. The questionnaire results clearly show the needs from the instructors to explore and experiment with online and blended learning further. To support these initiatives and promote innovational education, universities needs to look beyond the COVID-19 crisis and create long-term strategies for a future-proofed university.

Next to developing a long-term strategy, the university needs to focus on the support infrastructure. Instructors reported that they would like to receive didactical and technical support in the future, but they also highly value the opportunity to exchange experience with their colleagues.

5.5 Professional development

COVID-19 forced a large number of instructors to switch their face-to-face education to online education. Even instructors highly critical towards online education suddenly needed to make this mandatory change. In the past, most of the formal professional development activities (courses, information) are focused on individual innovative lecturers. This study recognize new opportunities for future professional development:

During COVID-19, 72.3% of the instructors (n=47) from our study got the information support, training to study online from colleagues. An effective professional
development should take this into consideration and focus more on the team level (Bower, 2001). The innovative competent teachers can provide a great deal of support to the less experienced co-workers.

6 LIMITATIONS AND FUTURE RESEARCH

The findings of this study have to be seen in light of some limitations. First, the questionnaire was only distributed to a select number of programmes that agreed to participate in this survey. This also led to a relatively small group size (47 instructors completed the survey), compared to the total number of instructors at University Twente. Future research should preferably focus on a broader target group. Secondly, due to the sudden nature of the COVID-19 change we have no pre-COVID-19 comparison group. Thirdly, due to time constraints, we were unable to include qualitative data in this research paper. There is a need for focus group sessions to gain a deeper understanding of possible changes after instructors have experienced online teaching during the lockdown time. Further, the focus group interview would help us to understand their perceptions for professional development in blended learning for the future. A qualitative research could give us insights in how to move the professional support from emergency support to long term professional support. Nonetheless, we hope that the results of this study will be useful as feedback for successful blended education professional growth beyond COVID-19.

REFERENCES


