

The Influence of Online Media Platforms on Student Perception of Blended Learning

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Abstract. Blended learning, defined as the combination of multiple teaching approaches in one educational context, has been referred to as “the new norm” in higher education. In modern blended learning, “blending” often entails traditional classroom lecturing combined with online lecturing to facilitate remote education. In parallel to this educational shift, societal norms of how we digest information for self-learning and leisure are also changing towards more usage of internet-based platforms, e.g., YouTube, and streamed video content.

Research problem: In this study, we investigate whether this switch in societal norms has a connection to students’ perceptions of blended learning in the software engineering sub-field of software testing.

Methodology: The study was performed with students taking a graduate level course in software testing (PA2552 Software Testing) in the spring of 2020 at Blekinge Institute of Technology (BTH). Data were acquired through an online questionnaire consisting of 78 questions, to which a sample of 19 students responded.

Results: Results show that students’ previous experience of blended learning, motivation to learn, and the use of online platforms for self-learning and leisure impacts on their current perception of blended learning and its helpfulness. These results provide valuable insight for decision-making about blended learning, especially for student groups where more conservative mind-sets to online learning may prohibit the use of internet-based technology.

Keywords: Blended Learning · Higher Education · Survey · Longitudinal Study

Abstract: Blended learning, definierat som kombinationen av multipla läroformer i en gemensam utbildningskontext, har kallats "den nya normen" inom högre utbildning. I modern blended learning så innebär detta en blandning av traditionell klassrumsundervisning kombinerat med digitala inslag. Parallellt med denna pedagogiska utveckling så har sociala normer kring hur våra studenter tar till sig information för såväl lärande som underhållning ändrats mot användningen av mer internetbaserade plattformar så som YouTube och strömmade videor.

Forskningsproblem: I denna studie undersöker vi om detta skifte i sociala normer har en koppling till studenter syn på blended learning i sub-fältet mjukvarutestning inom Software Engineering.

Metodik: Studien genomfördes med studenter på mastersnivå i en kurs inom mjukvarutestning (Software Testing, PA2552) under våren 2020 på Blekinge Tekniska Högskola (BTH). Data samlades in genom en online enkät bestående av 78 frågor som besvarades av 19 studenter.

Resultat: Resultatet visar att tidigare studenterfarenhet med blended learning, motivation till lärande och användning av online plattformar för självständigt lärande och underhållning har påverkan på studenternas upplevelser och syn på blended learning. Detta resultat ger värdefulla insikter för beslutsfattande om blended learning, speciellt för studentgrupper med mer konservativ syn på digitalt lärande, vilket kan begränsa användandet av internetbaserade teknologi.

1. Introduction

Despite being coined in the late 1990s (Newswire, 1999), there is still a lack of a shared blended learning terminology (Katzin, 2020). Hrasinski (2019) even characterizes the discourse on blended learning as "pre-paradigmatic, searching for generally acknowledged definitions and ways of conducting research and practice" as he urges the need for established and clear definitions and conceptualizations (Hrastinski, 2019). It has been suggested that the lack of a shared terminology has limited the effect of blended learning (Parks et al., 2016). Consequent upon the wide and influential definitions described above, the discourse on blended learning has also resulted in a vast and varied body of knowledge, with both theoretical and empirical studies that present secondary data on the use, perceptions, challenges and attributes of blended learning (Alaidarous & Madini, 2016; Wright, 2017), as well as literature reviews that synthesize these results (Eradze et al., 2019; Maertens et al., 2016; Rasheed et al., 2020; Van Laer & Elen, 2017; Wong et al., 2019). Although different learning models have been suggested, blended learning models find common ground in their key ingredients of face-to-face and online instruction or learning (Gurley, 2018; Lim et al., 2007). Face-to-face instruction is here synonymous with the traditional classroom setting, where a teacher meets the students in a physical learning space (Dziuban et al., 2018). With online learning, also referred to as distance learning and e-learning, access to a learning environment is achieved through a computer (or mobile media) mediated via the internet (Bishop et al., 2013; Maertens et al., 2016). While some researchers and practitioners distinguish between these terms, for others they carry the same meaning. For this article, we follow this broader definition of blended learning (Gurley, 2018; Lim et al., 2007) and use the terms online learning, distance learning and e-learning interchangeably (Moore et al., 2011).

This study presents a report based on empirical experience of blended learning but focuses on student norms (e.g., experience with similar teaching methods or technology) and their influence on student perceptions of the learning approach (Zundel, 2013). The study draws inspiration from both cognitive and constructivist theories to evaluate student perception of blended learning in higher education, in particular in the software testing sub-field of software engineering (Pritchard, 2017; Sweller, 2011).

The motivation for the study stems from the observation that more societal services are becoming digital and connected as the internet is used to improve their accessibility and usability. This trend of digitalization has inherent effects on our societal norms, i.e., how we digest information; and this trend is also present in higher education. This potentially explains why blended learning has grown in popularity in the last two decades and why it is currently referred to as "the new norm" in higher education (Dziuban et al., 2018; Graham, 2006). Nonetheless, whilst blended learning has been the subject of much research, to the best of our knowledge no studies have explicitly investigated the impact of digitalization on the students' perceptions towards the approach. As such, our study builds on the key assumption that student perception of blended learning is influenced by experience of blended/online learning and/or use of online platforms and content (e.g., YouTube) for self-education or leisure. Our assumption originates from observations of how many people create their own leisure entertainment, which has changed from viewing TV programs to viewing recorded or streamed content over the internet, such as games, art or other hobby-related content. The popularity of these new media, enabled by the digitalization of society, implies a change in our norms of how we absorb content and thereby knowledge (Duffy, 2008; Kruse & Veblen,

2012; Snelson, 2011)—a change that potentially opens up for more acceptance of blended learning.

To verify our assumption, data were collected through an online questionnaire from graduate students studying the course PA2552 Software Testing, hosted by BTH in the spring of 2020. The questionnaire was comprehensive, containing 78 questions about students' experience of blended learning, use of online media, motivations for learning, and perceptions about digitalization. Results of the questionnaire were analyzed using descriptive statistics as well as thematic analysis of open questions. The analysis shows that there is a connection between use of online media and perceptions of blended learning that helps confirm our assumption. This result is presented, leading to the study's main contribution:

C: Student norms—influenced by previous experiences of blended learning, use of online platforms for leisure and learning, and motivation to learn—have a direct connection to students' perception of blended learning with online lecturing. This conclusion is influential as it provides insights into how student groups may react to the teaching approach given their background, culture, and/or familiarity with digital learning.

The rest of the paper is structured as follows: The methodology is presented in Section 2, followed by the results of the study in Section 3. These results are then discussed in Section 4. As part of this discussion, Section 4.1 will consider related work and provide an overview of systematic literature reviews and closely related studies. Conclusions are drawn in Section 5.

2. Background and Methodology

The objective of this study is to evaluate how the participants' norms regarding online platforms (e.g., YouTube) and online content affect their perception of blended learning. These results are used to formulate and discuss insights into how students with varying degrees of experience, norms and culture perceive this approach to teaching.

The study was performed with students on the course PA2552 Software Testing at BTH, which has used blended learning for three consecutive years. The course is split into four two-week themes, ending with two weeks of project work (thus 10 weeks in total). During the first week of each theme, traditional lectures with PowerPoint presentations are held, followed in the second week by an online lecture that aims to answer student queries and give more depth to the content from the first week. The online lectures further aim to stimulate deeper learning of the subject matter (Elmgren & Henriksson, 2018) by encouraging students to reflect on their knowledge, or knowledge gaps, and prepare questions.

2.1 Research Questions

The objective of this study is to answer the following research question:

– **RQ:** With regard to studies in software testing, how do student norms, previous experience and motivation connect to students' perception of blended learning with online lecturing?

This question relates to digitalization and whether use of online platforms in education/society has changed the societal norms regarding how we digest information (Duffy, 2008; Kruse & Veblen, 2012; Snelson, 2011). Additionally, how is this change reflected in students' perceptions of blended learning with online lecturing? Norms and values have been highlighted in recent software engineering research as key factors for acceptance of change or adoption of new procedures in industrial practice (Chiocchio et al., 2011; Lenberg et al., 2019). It is therefore likely that a similar connection could be seen in studies on topics relating to software engineering.

2.2 Research Design

To acquire a rich understanding of the effective use of resources, a questionnaire survey was performed with all students (N=42) in course PA2552 Software Testing 2020, which thereby represents the sample frame for the study. The questionnaire included 85 questions (78 on the subject)—half of them on a 10-point Likert-scale and half open questions where the students could motivate their answers. The questions were varied and explored the students' perceptions and experiences of blended learning as well as their motivation to learn, their study goals, and their course participation.

In addition, two questions were posed about the students' use of online platforms (e.g., YouTube) for learning and leisure¹.

The questionnaire, created using Google Forms, was sent out by means of the course learning platform (CANVAS) but was not made compulsory so as to mitigate biased answers. To improve the response rate, only the 10-point Likert-scale questions were mandatory, whilst open (clarifying) questions were kept optional. Further, the questionnaire was sent out before the course had ended, and was available to students for two weeks, making it possible for the course supervisor to remind students to answer.

Despite these efforts, only 19 responses were collected, giving a response rate of only 45 percent. This response rate is lower than the rule of thumb of 60 percent and the average reported response rate of 52.7 percent in organizational research (Baruch & Holtom, 2008). This delimits our results in terms of generalizability, but they are still considered valid for the sample frame as students of both positive and negative persuasion filled in the questionnaire.

The questionnaire was designed by the leading researcher but reviewed and analyzed by the co-authors to minimize ambiguity and maximize consistency. This analysis was carried out through a form of semantic coding, where each item on the questionnaire was associated with a set of codes by each of the authors. The purpose of the coding was to evaluate whether all authors had the same conception of the purpose of each question.

After coding, the questions were compared to give a high-level view of whether they captured their expected intent in a similar way to an inter-rater agreement (Graham et al., 2012). Results showed that, on average, the three authors coded the questions with a 77 percent similarity, which is considered high. Because of this positive result, the questionnaire was not further piloted; instead, it was sent to the students.

¹ The complete questionnaire can be found on the following URL:
<http://mimicservice.com/resources/pq.docx>

Note that the results only utilize a subset of the questions since many were seen as beyond the scope of the research objective that we focus on in this paper. Specifically, questions Q2, Q19, Q28, Q29, Q33, Q34, Q35, Q36, Q37, Q38 and Q39 were used for the analysis and presented results. However, when applicable, results from open questions, not listed above, were included if they provided input to explain the study's quantitative results.

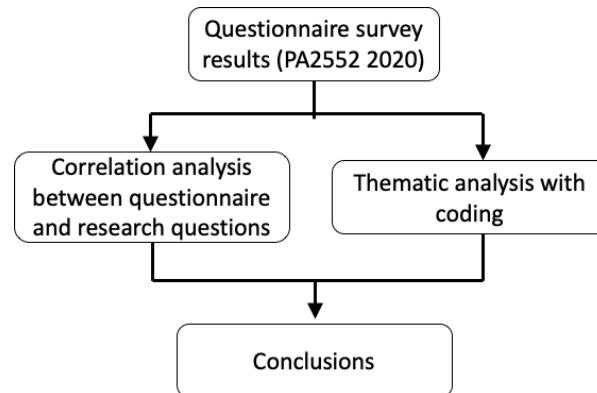


Fig. 1. Visualization of the analysis process.

Data analysis, as depicted in Figure 1, was undertaken, with quantitative analysis applied to the Likert-scale questions, which is possible since Likert-scale questions can be assumed to be approximate ratio-scale (Brown, 2011). As a complement, open-ended questions were analyzed qualitatively.

Phase 1: Correlation analysis of questions to find patterns: This analysis was done with non-parametric Spearman correlation (Hauke & Kossowski, 2011) and provided insight into which questions showed a strongly correlated pattern. In particular, patterns associated with the students' perception about the course were targeted, e.g., whether they enjoyed it and/or found it valuable, and whether they used online platforms for learning or leisure.

Additionally, the patterns were studied to see whether any questions were more commonly correlated with other questions in the set. This identified question 19 (*"I had a positive experience with blended learning in the Software Testing course"*) as a key question with a high correlation to 25% of the other questions. We stress, however, that correlation does not imply causality; but from semantic analysis of the students' answers, and the interdependent nature (i.e. context) of the questions, we can conclude that this question is key to the questionnaire.

Phase 2: Clustering to find groups of students with different perceptions: Complete hierarchical clustering, using Euclidean distance, was applied to group the questionnaire participants based on their answers. The analysis identified four main groups and one isolated student, i.e. five clusters in total (Result shown in Figure 2). The quantitative answers of these groups were then analyzed using descriptive statistics to ascertain differences in the groups' perceptions and variations among the groups regarding key questions, or concepts (set of questions).

To explain the results of the quantitative analysis, the open-ended questions of the questionnaire were analyzed using thematic analysis (Cruzes & Dyba, 2011; Robson, 2011). The analysis was performed with open coding in two increments, meaning that the responses

to the questions were used to establish an initial set of codes that were then reviewed, grouped semantically, and redistributed on the data set. Initially, 24 codes were identified; these were narrowed down, through semantic partitioning, to a final set of 21. In the end, the 21 codes were associated with 113 quotes from students, where one code could be associated with one or several quotes. The codes were as follows:

“ENJOYMENT”, “TEACHER”, “ONLINE>PHYSICAL”, “PHYSICAL>ONLINE”, “TECHNICAL_ISSUES”, “FOCUS”, “NEW_EXPERIENCE”, “TECHNICAL_COURSE”, “ZOOM”, “INTERACTION”, “RECORDED_LECTURES”, “DISTRACTION”, “PRACTICAL”, “EXTRINSIC/INTRINSIC”, “PROFESSION_SWTESTING”, “PROFESSION_SWENGINEERING”, “PROFESSION_OTHER”, “E-LEARNING”, “DIGITALIZATION”, “LEISURE” and “BLEND_OTHER_COURSES”. These codes, related to a minimum of two quotes each, were then grouped into themes that form chains of evidence from conclusions to individual sets of codes (Runeson & Höst, 2009). These themes were used to help explain the results of the quantitative analysis and provide support for causal relationships whenever possible. Once more, in a similar way to the questionnaire questions, only themes that supported the results and conclusions within the scope of this paper were taken into account.

3. Results and Analysis

To gain finer insights into the archetypes of students that answered the survey, a cluster analysis was performed that resulted in five clusters of students.

Cluster 1 (Negative student): The first cluster consisted of just one isolated student, whose perception of blended learning was negative in comparison to all other groups. It was quite clear that this student favored physical lectures compared to the online lectures and that the student had experienced technical challenges, which had negatively affected their enjoyment of the approach. Additionally, this student stated a lower use of online media and did not favor the digitalization of society.

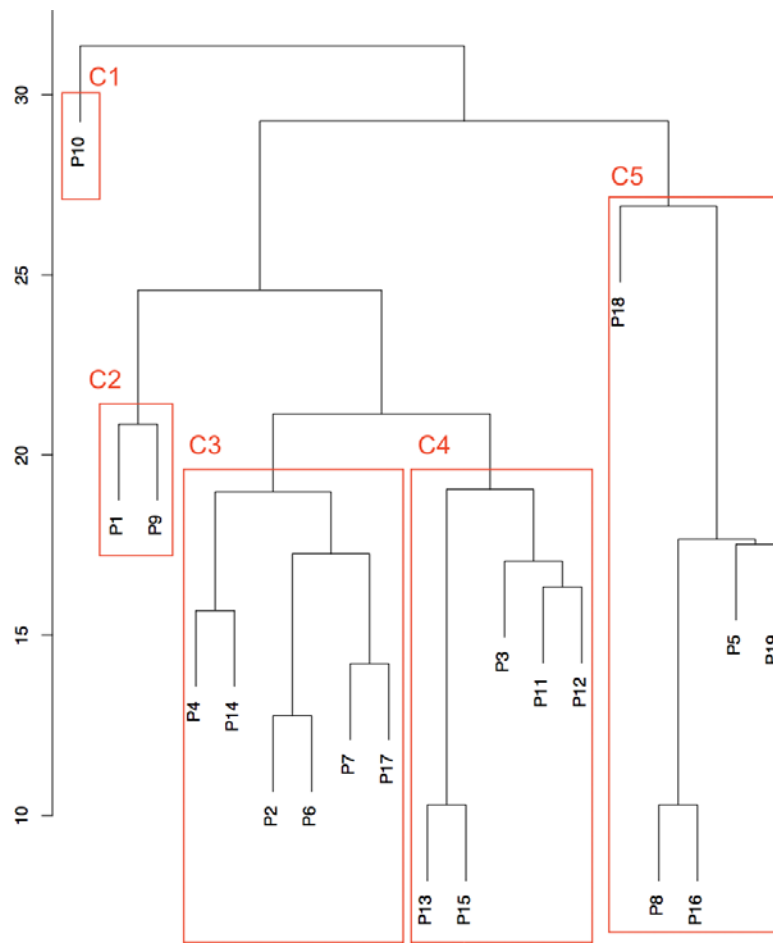


Fig. 2. Cluster analysis to identify clusters of students based on their responses.

Cluster 2 (Novice students with online learning preference): This cluster consisted of only two students. Both students had a positive experience of blended learning and perceived it as enjoyable but found it to be a slightly less helpful approach for teaching compared to other forms. While this was also their first experience with blended learning, they did not experience any challenges with it, thus providing them with an overall favorable experience that rivaled their previous experiences with physical lectures.

Cluster 3 (Novice students with classroom learning preference but who do not oppose blended learning): This cluster was the largest, consisting of six students with almost no previous experience of online or blended learning. The group utilizes online content, e.g., YouTube, for leisure and learning, but they also experienced some technical difficulties during the course. However, unlike Cluster 2, this group of students strictly favored physical lectures compared to online lectures. Despite this view, the students had a positive experience of blended learning on the course.

Cluster 4 (Novice students that enjoy trying blended learning but do not see it as a long-term replacement): This cluster consisted of five students, with similar attributes to Cluster 4. The cluster primarily differs compared to Cluster 3 in terms of their attitudes towards blended learning, as they found it more enjoyable but less helpful. Nonetheless, as with Cluster 3, they had a positive experience.

Cluster 5 (Experienced users, positive to long-term use of the approach): Cluster 5 also consisted of five students with similar attitudes to both Clusters 3 and 4. They considered the approach enjoyable and had a favorable experience of the course. However, unlike Clusters 3 and 4, these students had significantly more previous experience of blended learning. This suggested that they would be positive to longer-term use of the approach.

To provide a more general answer to the study's research question, we looked at three sub-sets of the students' data that regard (1) previous experience of blended learning, (2) motivation to study, and (3) use of online platforms and views on digitalization. These results were then correlated with the students' perceptions of helpfulness of blended learning (Q2) and their experience of blended learning (Q19). Qualitative comments were then used to investigate possible causal relationships.

Experience: For many students the Software Testing course was their first experience of blended or online learning: 16 out of 19 students had only minor or no previous experience. These experiences were elicited in three questions (Q33, Q34 and Q35). Q33 asked whether students had experienced blended learning previously at BTH, Q34 whether they had experienced blended learning at another university in Sweden, and Q35 whether they had experienced blended learning in another university outside Sweden. Correlation of these three questions with Q2 (whether the students perceive blended learning to be helpful or not) and Q19 (in relation to their experiences of blended learning) shows only a minor equivalence with perception of helpfulness of blended learning at BTH (correlation coefficient 0.297), whilst all other coefficients were lower than 0.2. Analysis of the open-ended results provided a few quotes that gave insights into student perceptions; *"Not [had experience with] blended and not live online. Have had some recorded lectures. I prefer the live ones."* and *"This is the first time I've ever had live online lectures. I've quite enjoyed the variance."*

We therefore observe that students' perception of blended learning, which was generally positive, is not correlated to their previous experiences with the approach. One factor that may have influenced this observation was that several students had their first semester at BTH and the Software Testing course was therefore their first course. This means that several students had not yet been introduced to any norm of how education is performed at the institute; therefore, it was easier for them to accept blended learning with online lectures as the prevailing educational norm. This assumption is based on recent research in software engineering that has shown that established norms are very influential in the acceptance of change (Lenberg et al., 2019).

Motivation: Previous research has shown that blended learning can have a positive impact on student learning by fostering more intrinsic motivation (Padilla-Meléndez et al., 2013). In the questionnaire, student motivation was elicited in two questions. First, Q28 asked the students whether they were extrinsically motivated and only sought to pass the course. Q29, in turn, asked whether they were intrinsically motivated and sought to learn as much as possible about software testing. Correlation analysis of these two questions against Q2, perception of helpfulness, and Q19, experience with blended learning, showed only a correlation (coefficient 0.45) between students citing intrinsic motivation and positive experience of blended learning on the course.

It is worth noting that most students that answered the questionnaire perceived themselves as intrinsically motivated (8.22 out of 10, stdev. 2.73). However, this provides no insights into whether blended learning has been influential in the students' motivation. The thematic analysis identified five quotes under the theme *"INTRINSIC/EXTRINSIC"* where two comments were from students with clear extrinsic motivations, e.g., *"I'm doing*

extra courses [in] my fifth year to finish my education. Any course for me has the mindset of 'get the points and move on at the moment,'” and three with intrinsic motivations, e.g., “My primary goal in education is, and always will be, to learn about the subject I study. If I pass without understanding it ain't worth anything. Passing is nice for bureaucratic reasons.”

In summary, we observe that student motivation did not have any explicit connection with student perception of the helpfulness of the approach. However, correlation was found between intrinsic motivation and experience of the approach.

Views on digitalization: To test the assumption that societal digitalization has an impact on perception of blended learning (Duffy, 2008; Kruse & Veblen, 2012; Snelson, 2011), four survey questions were posed: Q36 asked whether the students use online platforms (e.g., YouTube) for self-education, Q37 whether they use online platforms for leisure, Q38 whether they are positive to the digitalization of society and Q39 whether they consider themselves as early technology adopters. Correlation between these questions and perceived helpfulness of blended learning (Q2) and student experiences (Q19) showed some equivalences. Correlation between helpfulness and benefits of digitalization and early adoption showed a lower correlation (coefficients 0.2, Q2 and Q38; and 0.33, Q2 and Q39). Between student experiences with blended learning and digitalization and early adoption there were, however, stronger correlations (coefficients 0.69, Q19 and Q38; and 0.38, Q19 and Q39). No correlation was seen between the use of online platforms for self-learning or leisure and the perceived helpfulness of blended learning (coefficients -0.05, Q2 and Q36; and 0.004, Q2 and Q37). However, students' experiences of blended learning and the use of online platforms were correlated (coefficients 0.424, Q19 and Q36; and 0.69, Q19 and Q37). Thematic analysis provided no explicit insights into causal relationships, but it became evident that students used online platforms frequently for viewing different topics, including gaming, music, nature videos, comedy and more.

In summary, results show that there is a connection between students' experiences of blended learning and their use of online platforms (e.g., YouTube), their perception of digitalization, and whether they consider themselves to be early technology adopters. However, it is worth noting that the students were studying software engineering, which is a driver for much of this new technology. Compared with the previously mentioned study (Keržič et al., 2019) that showed no correlation between the norms among Public Affairs students and the perception of blended learning, the one factor that differs is the nature of the student body. It is therefore possible that the students' reasons for studying this topic are driven by their norms of using software engineering solutions.

Synthesis: By combining the results, we can answer our research question by noting that there are many factors that play a role in the student's perceptions of their experiences and of the helpfulness of blended learning. Whilst experience of the approach plays a minor role, it seems that intrinsic motivation and student norms towards use of online platforms play a larger role. We once more stress that correlation does not imply causality; however, taking the results of the thematic analysis into account, there are several statements that allow for logical inference that support our conclusion. Further, related work has found implicitly similar results, and that habit building, i.e., formulation of norms, is important for the success of blended learning (Zundel, 2013) —although others speak against it (Keržič et al., 2019).

4. Discussion

Results show that students generally have a positive experience of blended learning and find the approach useful when applied in a technical course with interactive online sessions. Additionally, regardless of prior experience, students are positive and remain positive. This result implies that wider adoption of the approach could give better results when blended learning is set as the norm for higher education.

However, whilst these findings are interesting, most of them are already supported by related works (Alaidarous & Madini, 2016; Eradze et al., 2019; Maertens et al., 2016; Rasheed et al., 2020; Van Laer & Elen, 2017; Wong et al., 2019; Wright, 2017). The novelty of this study lies instead in the explicit analysis of students' experience, motivations and views on digitalization. In particular, this analysis concludes that student use of online platforms (e.g., YouTube) and perception of digitalization correlate closely with both perceived usefulness and student experience of blended learning. Additionally, the data, supported by the student archetype analysis, show that students less in favor of digitalization are also less positive towards blended learning. This result is interesting as it differs from results in related works, e.g., the results from Kervzivec et al. (Keržič et al., 2019) who did not observe the same connection we did. This result could also be significant since studies in some cultures have reported that the use of blended learning, or even access to the internet-based applications, are in actual fact barriers for the use of blended or online learning (Alaidarous & Madini, 2016). As such, cultural background and student experiences should be taken into account when deciding to use blended learning with online lecturing as a teaching approach in higher education. Failure to do so could exclude some students from the learning environment, with detrimental effects on their learning. Consequently, teachers must make sure that there are viable alternatives to the online lectures.

From the experiences gained during the study, we identified a few aspects to consider when using this teaching approach. Firstly, avoid static content, such as PowerPoint presentations, in favor of more interactive content to mitigate the risk of students losing focus. Secondly, become familiar with the online platform and experiment with ways of using its features for teaching purposes. Thirdly, record the lectures to avoid students who are experiencing technical difficulties missing out. Fourthly, and perhaps most important, online teaching is not for everyone; some students will reject the approach because of their norms, culture or previous experiences. The teacher should acknowledge this and be prepared to offer the learning materials in alternative ways.

4.1 Related work

Coined in the late 1990s (Newswire, 1999), the debate about what blended learning is and how it should be defined has been ongoing among researchers and practitioners, reaching its peak about a decade ago. In their critical review, Oliver and Trigwell (2005) argue that almost anything can be regarded as blended learning; it only requires two or more different modes of instruction that are mixed (Oliver & Trigwell, 2005). A few years earlier, Driscoll had argued along similar lines that blended learning combines a variety of teaching methods and pedagogical approaches with a range of different instructional and web-based technologies, concluding that blended learning could mean different things to different people (Driscoll, 2002). Others, including Graham (2006) and Garrison and Kanuka (2004), argue for a narrower definition, suggesting that blended learning is a combination of face-to-face

classroom instruction with computer-mediated online instruction (Garrison & Kanuka, 2004; Graham, 2006).

An SLR by Erdaze et al. with 48 empirical papers about Massive Open Online Courses (MOOCs) showed that blended learning can have positive effects but that the approach is also labor intensive (Eradze et al., 2019). Another SLR by Van Laer and Elen sought to find attributes that stimulate self-learning when blended learning is used (Van Laer & Elen, 2017). Seven attributes were acquired from an analysis of 95 empirical studies. These attributes were authenticity, personalization, learner-control, scaffolding, interaction, cues for reflection and cues for calibration. Further, Wong et al. performed a systematic literature review of 35 articles to identify how self-regulated learning (SRL) is supported in online teaching, especially from an individual's perspective (Wong et al., 2019). The study found several factors connected to the individual (i.e., student) to be important for SRL, especially in more constructivist online teaching. The study also found that more research is required in this area. These findings are supported by the literature review by Rasheed et al. that identifies explicit challenges relating to blended learning (Rasheed et al., 2020). In particular, they found that there may be resistance to using online learning tools, that students struggle with SRL, that there are both teaching and institutional challenges, and thus that online learning has barriers relating both to the individual and to technology. The study highlights a need for more research to address the challenges and widen its scope. A literature review by Moore-Adams et al. on the topic of available guidelines for online teaching found that guidelines (1) are based on a small number of studies and little empirical knowledge and (2) only address a subset of knowledge and skills (Moore-Adams et al., 2016). The study concludes that further empirical studies are required to generate more, and more effective, guidelines for online teaching. In another review by Maertens et al., the effectiveness of online learning of surgical training was explored (Maertens et al., 2016). The study reveals that online teaching was as effective as traditional training in the short-term but highlights that the long-term effects have not been studied.

These are only a few of the available SLRs on the topic, showing how rich the knowledge of the topic is. However, as pointed out, there are still gaps in knowledge concerning the field of software testing, including the question whether the observations from other fields apply. This study provides a contribution of such insights.

Furthermore, in a similar way to this study, other studies have explored students' perceptions of blended learning. For instance, Kadijah et al. (Alaidarous & Madini, 2016) studied Saudi Arabian students' perceptions when learning English through blended learning. Results indicate that these students were positive towards the approach. The authors also highlight a lack of comprehensiveness in studies that examine student perception and satisfaction of blended learning in different subjects. A study by Wright (2017) of student perception of blended learning carried out explicitly on a single online lecture compared it to traditional classroom lectures. After collection and analysis, the 118 questionnaire responses showed that students had a high interest and stated the approach to be beneficial for learning. The author stresses that there is a substantial body of knowledge on blended learning but that most studies focus on distance learning.

An investigation of the factors which influence the ways a student perceives the usefulness of an online course in a blended learning environment was performed in a Slovenian higher education institution. The study was based on a questionnaire completed by 539 students and explored the students' attitudes to course topics and technology, learning preferences, and the teacher's role in course design and managing the teaching process.

Results showed that students tend to perceive online learning as positive and useful when the teacher is seen to be deeply engaged in course activities. As well as the lecturer's classroom performance, the study also shows that a student's attitude to the subject matter and his/her acceptance of technology are factors that have a direct impact (Keržič et al., 2019). Contrary to our study, however, analysis revealed no major difference in relation to students' spare-time activities. The difference in results could perhaps pertain to the difference in the student group. The aforementioned study was carried out among undergraduate Public Affairs students.

Studies on blended learning have also been undertaken in the area of software engineering and software testing, in a similar way to this study. For instance, Berkling and Zundel (Zundel, 2013) present a study in which a survey of 59 students analyzed motivational factors and student motivation. The study identified change (i.e., the transition to blended learning) to be a challenge for the students, and that habit building was important. However, the study did not go into any depth regarding student habits outside education, e.g., use of online platforms for leisure.

We can conclude that blended learning is a well-studied approach with ample theoretical frameworks and empirical studies that report on guidelines, best practice and challenges with the approach. The technique has also been studied in a myriad of higher educational contexts and is well grounded in theories such as Bloom's taxonomy for learning (Bloom et al., 1956) and cognitive theory (Sweller, 2011). Results have also highlighted that habits and an individual's norms may influence perception of blended learning, but to the best of our knowledge, few empirical studies have explicitly looked at the connection. The one that we did find (Keržič et al., 2019) showed no influence of student norms on their perception of blended learning. The main contribution of the current study is thereby further evaluation of this connection and the examination of how leisure use of online platforms (e.g., YouTube) may connect to students' perceptions. Additionally, the study provides further support for the well-established theory that blended learning has a positive effect on student learning, even though it also presents challenges.

5. Conclusions

In this study, we have surveyed students' perceptions of blended learning in a technical course on software testing. A questionnaire with 78 questions (Likert- scale and open questions) was sent to 42 students, resulting in 19 responses (response rate of 45 percent). Qualitative and quantitative analysis of the responses found few extreme differences in the data. Instead, most students were positive to blended learning and expressed that it can be a positive approach in higher education. However, the largest contribution of this paper is an analysis of how student usage of online platforms (e.g., YouTube) and discernment of digitalization of society have an impact on the perceived helpfulness and student experience of blended learning.

In conclusion, our study shows that there are multiple factors influencing students' experiences and perception of blended learning, including that of norms, culture, and previous experiences. These factors are important for teachers to consider when deciding to use blended learning as an approach in higher education as they influence the preparations that are required to adequately meet the students on their own level.

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