Agile by technique – The role of technology enhanced learning in higher education

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The use of digital technology in higher education stresses the importance of agility which leads to a massive reshaping of teaching and learning for lecturers, learners, and the educational organization. The changed learning conditions are described by the term technology enhanced learning (TEL). Digital platforms and software that support learning and teaching processes such as massive open online courses (MOOCs), learning management systems (LMS), open educational resources (OER) enable higher agility to the institutional stakeholders (higher education institutions, lecturers and students) that are directly affected. The article aims to create a transparent overview of existing TEL platforms in higher education and their impact. The recent research will be collected in the form of a systematic literature review.
Furthermore, we show the impact on relevant user groups. With the increasing flexibility and availability of content, both groups, students, and teachers become more agile. TEL influences agility in terms of participation, continuous improvement, and faster processes and feedback.

1 Introduction

The digital transformation (DT) affects all areas of working life (Bender, 2016). The benefits of these technologies enable and require more agility at the same time (Bennett, Agostinho & Lockyer, 2015). Agility is defined as the ability to react quickly to sudden changes and to use these changes to gain an advantage (Sharifi & Zhang, 2001). Furthermore, agility is the ability to react efficiently and effectively to emerging opportunities through the use of existing information technology (IT) potentials (Neumann & Fink 2007). In this article, agility in the field of higher education is meant as the capability of *continuous improvement*, *rapid feedback* and *participation* needed to master today's study and life situations. The everyday life of students is increasingly determined by digital technologies (Gottburgsen & Wilige, 2018) which trigger the demand for increasing agility of user groups in higher education institutions. Many technical solutions are available which support the digital transformation and cause agility in higher education institutions, and those technologies are proven to exert decisive impact on teaching style (Bennett, Agostinho & Lockyer, 2015). The changed learning conditions are summarized under the term technology enhanced learning as an expression of the digitalization in the educational context (Kirkwood & Price, 2014). The main goal of this is to increase the quality of teaching and improve learning suc-

cess simultaneously (Janson, Söllner, Bitzer & Leimeister, 2014). In research and practice, many impulses from various disciplines arise which have led to non-transparent results and missing access to adjacent fields of study (Henderson, Selwyn & Aston, 2017).

The article aims to create a transparent overview of existing technology enhanced learning (TEL) systems by concentrating on digital platforms where teaching and learning occur, rather than on single devices or teaching cases. Current research in the field of higher education institutions will be compiled and analysed regarding the directly affected target group, as well as the impact and interaction of the different systems. Moreover, the effect on agility concerning students and teachers will be determined. For this purpose, we offer a brief introduction to clarify the basic terms of agility and the digital transformation in higher education (chapter two). Following a systematic literature review approach (chapter three), we provide an overview about the dominating digital platforms that shape technology enhanced learning (chapter four) to answer the following research question: *What kind of TEL systems are used in higher education?* Further, we will examine their *impact on the stakeholders' agility* (chapter five). In this study, we focus on participants who benefit from these systems and the expected outcome. This article closes with a conclusion that will also provide limitations and a further outlook on future research.

2 Theoretical foundation

2.1 Agility in higher education

Agility in higher education, like the related terms of agile education or lean learning, is a relatively new concept (Parsons & MacCallum, 2019). In the organizational context, the term agility is already widely known and sufficiently defined. Accordingly, agility is a construct that contributes significantly to ensuring the long-term survival and success of a company (Felipe, Roldán & Leal-Rodríguez, 2016). In this field, agility is understood as the ability to react effectively and efficiently to changing environmental influences (Ashrafi et al., 2005). Furthermore, it has been shown that agility as a concept is particularly successful if a sufficient infrastructure of information technology is available. Here, IT is regarded as a decisive factor for the success of the implementation of agility concepts in companies (Park, Sawy & Fiss, 2017). To further subdivide the concept of agility, various subtypes of organizational agility were defined. According to Sambamurthy, Bharadwaj and Grover (2003), organizational agility is divided into three agility dimensions: customer agility, partnering agility, and operational agility. These three subtypes of agility were supplemented almost ten years later by cultural agility (Caligiuri, 2012). The structural changes in higher education through the introduction of agile methods, primarily affect the relationship between students and lecturers (Gottburgsen & Wilige, 2018). For this reason, it is logical to highlight the potential

significance of the specialized agility dimension of customer agility for higher education. Customer agility describes the relationship between an organization and its customers regarding the development or/and continuous improvement of products and services (Sambamurthy et al., 2003). Customer agility, in particular, uses various technical tools that give customers the opportunity for *rapid feedback* and, thus, are considered to *participate* in the *continuous improvement* of products or services (Mukerjee, 2014). Accordingly, we define agility in this paper as the capability of *continuous improvement*, *rapid feedback,* and *participation*. Abundant indications have emerged that adopting the concept of agility is necessary for successfully adapting academic teaching to future conditions and challenges (Mukerjee, 2014). Many changes at the levels of technological development, international competition, and financing are helping to dismantle the long-established structures of universities and enrich them with more agility. This transformation is of utmost importance, regarding the changing working conditions, accompanied by specialized, high-tech professions (Gottburgsen & Wilige, 2018). Agility (enabled by technology use) leads to competitive advantage, which may foster success and long-term survival (Mukerjee, 2014). Teachers and students profit from agility that enables *fast reaction, continuous improvement,* and a higher degree of *participation*. In the following, we will give a brief overview of the technology-driven digital transformation of higher education institutions.

2.2 Digital transformation in higher education

The term digital transformation describes the use of new digital technologies to enable major improvements (Fitzgerald, Kruschwitz, Bonnet & Welch, 2013). Consequently, teaching and learning are massively influenced by digital transformation (Gottburgsen & Wilige, 2018). New communication technologies offer many possibilities for overcoming constraints of entry and time barriers to learning. The so-called open university allows access even for non-traditional students (Zawacki-Richter, von Prümmer & Stöter, 2015). Within this context, the term technology-enhanced learning or synonymously technology mediated learning (Janson et al., 2014) is often used to describe computer supported learning. Still, explicit statements about what the term means or entails are scarce (Kirkwood & Price, 2014). At its core, TEL is a learning environment based on technology use and promises an improved learning or learning management. The term is *"describing the interface between digital technology and higher education teaching"* (Bayne, 2015). The relevant technologies support access to learning material, enable communication and collaboration, offer room for learning through construction, can be used for learners' assessments, and improve digital and multimedia literacy (Goodyear & Retalis, 2010). The term is closely linked to the German expression *Bildungstechnologien* such as learning management systems, Blogs, and Wikis, which distinguishes it from the devices used (Nistor, 2018).

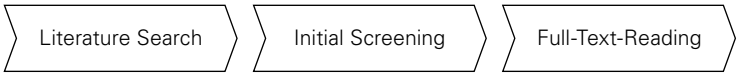
The first stream of research about TEL concentrated on the devices that could be implemented (Gikas & Grant, 2013). Mobile devices, such as smartphones or tablet computers, may support student learning and can be used to participate in traditional (face-to-face), blended learning classes, or pure e-lectures (Rodríguez-Triana et al., 2017). In times of *bring your own device*, recent research often concentrates on the virtual assets (Fischer, Heise, Heinz, Moebius & Koehler, 2015). The term has migrated from the handling of a technical product to the application of the digital resources provided in the foreground. We follow this approach and summarize technology enhanced learning as the digital platforms that make learning possible. We will not examine individual technologies, devices, or applications, such as teaching cases, in detail in this article. Rather, these characteristics are to be viewed as a subgroup of the platforms and are therefore over-specified. Via platforms and software such as massive open online courses (MOOCs) (Burd, Smith & Reisman, 2015), learning management systems (LMS) (Abdel-Maksoud, 2018), and open educational resources (OER) (Bennett et al., 2015) recent learning material can be provided. Furthermore, the relevance of wikis, forums, or other social media systems is increasing, and this eases the communication between the participants (Tess, 2013). The use of the systems leads to four different goals: to motivate people, to enrich learning resources, to implement learning and instructional strategies, and to assess and evaluate learning goals (Wang & Kinuthia, 2004). The influence of TEL in higher education institutions, though often examined, is still not yet described in detail. Many research findings deal with the implications for students (Gikas & Grant, 2013; Henderson et al., 2017) and their learning success (Janson et al., 2014). However, only minimal research focused on the teachers is available (Unal & Unal, 2017) and the institutional impacts are rarely addressed in the research (Schweighofer, Weitlaner, Ebner & Rothe, 2019). Thus this paper concentrates on the impact of TEL on this directly-affected stakeholder group. In the long term, the influence on cultural values and pedagogical issues may come to light. To draw a picture of the transformation, we provide an overview of the current research dealing with the different applications available in higher education and will begin by describing our research method.

3 Method

The base of our work is a literature review which provides an overview of synthesis of the recent trends and gaps related to the aforementioned scope (vom Brocke et al., 2015). We follow a systematic approach to identify, structure, and synthesize the relevant literature (Schryen, 2015). Therefore, our approach provides the methodological benefits of high replicability due to a transparent approach and traceability. In the following section, we provide the most up-to-date definitions of terms, including dominant research trends (chapter four). This groundwork provides a context to analyse

the influence on directly affected stakeholders in chapter five. Figure 1 shows the research process.

Figure: The Research Process



As the first step for our study, we identified a term-defined database for further analysis. To develop the search terms for our review, we firstly scanned and read articles from the field of interest. Since agility is a very new term in relation to higher education and has not yet been very sharpened in the literature (Parsons & MacCallum, 2019), we have excluded this term in the first step of the search because it would reduce the search field inordinately. Through a literature research, we deduced a set of relevant buzzwords. We combined the term *higher education* with recent technologies (see table 1). Using the TEL definition, and a scope that included terms used in both English and German, we deliberately decided to use only digital platforms and software solutions, thereby excluding buzzwords such as flipped classroom. We searched through relevant journals using the database ERIC as it contains most of the journals named by the *Verband für Hochschullehrer* in the specified field. Furthermore, we explored pertinent journals like the *Beiträge für Hochschulforschung*, and chose only to consider peer-reviewed journal articles. The search was conducted from February to March 2019, and due to the amount of material, we decided to limit the searching period to the last five years, as we have focused on recent research outcomes and new developments for TEL in higher education. As a second step, we performed an initial screening, whereby the abstracts of the identified articles were scrutinized to ensure they fulfilled the criterion of relevance. We regarded a paper as relevant if it dealt with the use and application of the technologies in higher education, along agility characteristics, as mentioned in chapter 2.1. Articles describing the consequences of technologies and implications for learners and teachers (Tikkamäki & Mavengere, 2013) were also considered pertinent. However, we dismissed papers that were not directly related to the topic. As the last step, we performed full-text analysis of the remaining papers to gather information about recent research in the fields named herein. We collected and analysed examples of technology use and usage scenarios. Furthermore, we read the papers critically, focusing on characteristics that enable agility within the context as well as characteristics of enhanced learning and the impact on the students. All in all, we identified 330 sources in step one and limited the number in step two to 249 relevant articles. Table 1 presents the results of our literature research:

Table: Results of our literature research

Search Strings	Step 1	Step 2
"OER" OR "Open Educational Resources"	66*	42
"MOOCs" OR "massive open online courses"	175*	132
"Study Assistant" OR "Studienassistenzsystem"	7 **	0
"learning management" OR "course management system" OR "LMS" OR "Lernmangement")	82*	75

* Restrictions: Peer-reviewed only, since 2015, Descriptor: Higher Education.
** Restrictions: Peer-reviewed only, since 2015.

For OER, we dismissed articles without a clear focus on learning (like open research platforms or open production), and it quickly became apparent that there is a great research interest in massive open online courses, which is reflected in a large number of publications found. In the second step, we identified 132 of 175 sources as relevant to the field of investigation. For the learning management system, we identified 82 sources. After an in-depth reading of the texts, we dismissed seven articles, as they did not seem relevant for the field or proved tangential and therefore unspecific (e. g. research about data literacy). Despite the fact that the literature research produced only a few sources on the topic of a digital study assistant (see table 1), the term nevertheless will be introduced as a subcategory of the LMS. The findings presented here will be elaborated in the next chapter and enriched by further descriptions of characteristics. In the following section, we will describe the fields of research for each major technology category and show actual trends and essential findings for the last five years. Also, important definitions of terms are given, and historical developments from current sources are included.

4 Results

4.1 Open educational resources

The growing agility in higher education is mainly explained by the use and support of digital educational resources, such as open educational resources (OER) and other technologies which have a decisive impact on the type of teaching (Bennett et al., 2015). UNESCO defines OER as resources for teaching, learning, and research in any medium. One important characteristic is the free access and use, adaptation, and redistribution by others without or with minor restrictions (Butcher, Malina & Neumann, 2013). The origin of the OER movement dates back to 2001 and is based on the OpenCourseWare initiative of MIT (Kopp, Gröblinger & Zimmermann, 2017). MIT's goal was to make all the learning materials used by their 1800 courses available via the Internet, where the resources could be used and repurposed as desired by others, without charge (Weller, 2014). "*This concept must be perceived as innovative because it describes a general economic and social paradigm shift: Education, which formerly*

was limited to a specific group of learners, now, is promoted as a public good." (Richter & Veith, 2014, p. 205). Since then, the use of OERs has steadily increased, and in relation to that, the Creative Commons states in 2017 that nearly 1.5 billion OER objects were licensed ("A Transformative Year," 2018). In Fact, the European Commission has funded several OER related projects, like *Open Science Resources*, *OrganicEdunet*, *Ariadne* and many more which dealt with the collection, production presentation, quality, and management of OERs and focused on improving education. This research highlighted two journals which predominantly deal with OER-related themes (*Open Praxis* with nine articles and *The International Review of Research in Open and Distributed Learning* with 19 publications). Beside case descriptions (Kaatrakoski, Littlejohn & Hood, 2017) and examinations of perceptions (Hilton, 2016), some authors search for business models of OERs (Wang & Wang, 2017) or describe country-specific applications (Shigeta et al., 2017). Despite the advantages, only a small number of universities have turned to an open resource approach in education (Doan, 2017). This finding reveals a clear research gap in the form of the following research question: Why is the adoption of OERs still limited and why have many universities not joined this trend yet?

4.2 Massive open online courses

Massive open online courses represent an important element within TEL systems (Yousef, Chatti, Schroeder & Wosnitza, 2015). The interest in MOOCs has risen strongly in recent years, and it is therefore not surprising that the number of professional publications focused on it has increased enormously (Zawacki-Richter, Bozkurt, Alturki & Aldraiweesh, 2018). MOOCs were launched in 2008 by Siemens and Downes when they opened a course at the University of Manitoba for an original number of 25 university students worldwide but ended up with over 2000 people enrolled (Mohamed & Hammond, 2018). However, it was Dave Cormier who characterized the term MOOC to describe this kind of course (Mohamed & Hammond, 2018). The name already contains the definition, since this is essentially a large, open online course. Massive means that the course can theoretically be used by a very large number of learners (Armellini, 2016), while the word open refers to the openness or usability of the course without further restrictions. Despite being conceived as purely online courses, MOOCs, in practice, are often held in classroom settings (Blackmon & Major, 2017). This does not necessarily imply a fixed start and end time, but refers to a specific topic and provides meaningful organization of the individual topics (Blackmon, 2016; Blackmon & Major, 2017). MOOCs can differ greatly in size and degree of openness (Lowenthal & Hodges, 2015). A common subdivision of MOOCs is the pedagogical distinction between connectivist MOOCs (cMOOCs) and extended MOOCs (xMOOCs) (Mohamed & Hammond, 2018). The trend is heading towards a more distinct classification like synchMOOCs, asynchMOOCs, or madeMOOCs (Blackmon, 2016; Blackmon & Major,

2017). This broad differentiation accounts for the countercurrent against a one-size-fits-all model of the past as postulated by LeBlanc (2018) and thus addresses the respective differences in circumstances, like disparate and varied course content and learning goals. The hopes assigned to MOOCs in the future particularly lie in improving education in countries with low educational opportunities (Blackmon, 2016). It can be observed that MOOCs are moving towards certification of their courses although they are still primarily independent of payment (Blackmon & Major, 2017; Shigeta et al., 2017). Moreover, the initial euphoria seems to have already subsided, giving way to a realistic assessment of the performance of MOOCs in terms of, for example, access to higher education (Baker & Passmore, 2016; Fischer et al., 2015). Here, research should focus on harnessing the great potential of MOOCs for free access to education and training (Alzahrani, 2018).

4.3 Learning management systems

Learning management systems are online learning environments or platforms with functionalities for flexible and active learning (Cabero-Almenara, Arancibia & Del Prete, 2019). They are used to publish materials, upload course syllabi, deliver notes, request and collect student works, etc. The term course management system (CMS) is used synonymously (Management Association, 2018). In practice, several different platform systems are used, such as Stud.IP, Blackboard, Canvas, e-College, Moodle, and Sakai (Borboa, Joseph, Spake & Yazdanparast, 2017). Additionally, many social media activities, like wikis, chat, and assessments can be integrated within the LMS (Son, Kim, Na & Baik, 2016). The majority of articles was published in *Education and Information Technologies,* followed by the *International Review of Research in Open and Distributed Learning*. Several researchers focus on perceptions of the students (Borboa, 2017) and teachers (Basal, 2015) using an LMS. In some studies, the role of faculties is examined (Rhode, Richter, Gowen, Miller & Wills, 2017), while others focus on reasons for use (Abdel-Maksoud, 2018). Because just about every action in an LMS can be observed and stored, insights based on this data can be gained for the purposes of learning analytics (Kuhnel, Seiler, Honal & Ifenthaler, 2018). The knowledge about the student's behaviour can be used to adjust learning and teaching methods (Joo, Kim & Kim, 2016). Further research in this field deals with the use of specific platforms for didactic purposes (Cabero-Almenara et al., 2019), and researchers consistently examine ways to raise interaction (Holmes & Prieto-Rodriguez, 2018). This could explain why one of the largest research streams in e-learning is taking up a currently dynamic sub-topic of LMS: gamification (Chen, Huang, Gribbins & Swan, 2018). A study assistance system is an instrument of electronic study information, monitoring, and control that can also be used for further training courses. With appropriate expansion and differentiation (e.g. by creating interfaces) it can enhance the LMS. Besides the information from the LMS, students get information about their assignment related to

the European credit transfer system (ECTS), as well as their level of achievement within the framework of the curriculum. At the same time, information on the progress of studies are available, which can also be related to certain institutions, study programs, modules, or module connections. In this way, undesirable individual developments of students or even of institutions can be identified quickly.

5 Discussion

5.1 Implications for higher education institutions

Although the direct stakeholders of the technology enhanced learning environments are students and lecturers, the higher education institution (HEI) as a major arena of learning plays a crucial role. It is the task of the institutions to integrate the systems and to ensure their smooth interaction (Fischer et al., 2015; Kirkwood & Price, 2016). HEI expect success and long-term survival by becoming agile and enabling agile processes (Twidale & Nichols, 2013). The digital transformation fosters agile structures in this field (Mukerjee, 2014) and moreover knowledge transfer is a core process in this context. Directing a process towards agility by using technology enhanced learning prepares participating institutions for the future. Further market models may arise (Baker& Passmore, 2016; Gordon, 2014), thereby providing more content with a higher range of coverage (Burd, Smith & Reisman, 2015). Still, research in this field is siloed and mainly concentrates on single technologies. We identified only a few articles that tackle more than one of our examined technologies (Kopp, Gröblinger & Zimmermann, 2017; Shigeta et al., 2017). Thus we conclude that an overview of existing systems and their interplay is still missing. Some authors provide lists of tools and applications (Fischer et al., 2015;), but the interplay seems to be rarely examined (Kirkwood & Price, 2016). OER provide access to online courses that are available for large groups such as MOOCs. LMS can help to control the composition of these courses and provide central access to the relevant materials. Communication within the courses can also be handled via the social media functionalities of the LMS, and study assistants can collect data and compress it into so-called study dashboards. On the basis of those data made available within the course platform, learning analytics systems evaluate the students' performance. Still, higher education institutions struggle with the integration of TEL systems. They require clear guidelines for adoption and technological integration (Feldman-Maggor, Rom & Tuvi-Arad, 2016). Researchers claim that providing institutions with tools and devices is insufficient, and some opine that general standards for the quality of content and data security among OERs and MOOCs are still missing (Ochoa & Ternier, 2017). Furthermore, we miss the consideration of the strategic impact of TEL; for example, digital transformation is known to have a significant influence on the strategies of enterprises (Hess, Matt, Benlian & Wiesböck, 2016). It stands to reason that the same should be true for higher education institutions.

5.2 Impact on students' outcomes

The majority of today's students is labeled as the generation of the so-called "digital natives". For them, who are raised with new technologies, the classic style of teaching is often seen as a contrast to their normal lives, which in many cases leads to deep conflicts (Loeckx, 2016). The introduction of TEL systems in higher education can have positive impacts on everyday learning and affect them in different ways (Kirkwood & Price, 2014). Cognitive, reflective, analytical, synthetic, dialogical, technical, and socio-cultural benefits for participants using TEL have been proven (Al-Khatib, 2011). *Participation:* In this context, the targeted use of OERs also makes sense to consider the individual interests and learning types within the heterogeneous body of students. It has already been postulated that one of the greatest challenges of the next ten years is to transform the current study system which is like a one-size-fits-all model to a free system which can be highly customized to the needs of students (LeBlanc, 2018). *Continuous improvement*: Changes in the heterogeneity of learners include socio-cultural and educational backgrounds. Here, MOOCs are an obvious choice with which learners are no longer bound to these components, but can nevertheless pursue their study goals (Rohs & Ganz, 2015). Also, digital study assistance systems can help students to adjust their combination of modules and lectures to be personally manageable. For example, they enable individual planning of semesters or modules and can provide important information for students wishing to choose an individual way of studying. Initial approaches of this kind of a digital study assistance system already exist (SID-DATA, 2019). Students seem to have a positive perception of their ability to use new learning technologies (Nami & Vaezi, 2018). Also, there is another benefit, especially for OERs, as it has been proven that they have a positive impact on the perception and attitude of students towards learning. Furthermore, there is no evidence shown that OERs have a negative impact on students' performance (Weller, De los Arcos, Farrow, Pitt & McAndrew, 2015). In addition, research has pointed out that the intention of students to use MOOCs in an academic context is raised by the perceived ease of use and in their attitude positive towards them (Tahiru & Kamalludeen, 2018). For the most part, students would like to use more technologies for efficient and convenient access to content and are eager to use these for academic purposes (Mirriahi & Alonzo, 2015). The learning management system has also shown higher performance impacts for lecturers and learners than traditional face-to-face classroom settings (Bere, Deng & Tay, 2018) which underlines the increment of learners' success by using TEL.

5.3 Impact on lecturers

Participation: One of the main motivations to use a MOOC from a teacher's perspective can be categorized as altruistic (Lowenthal, Snelson & Perkins, 2018). An example, in this case, is the desire to deliver academic content in areas where students have

no or little access to such content (Blackmon, 2018). By providing content to a large group of students, the level of awareness increases. In a competitive academic world, this may lead to advantages for the lecturers, as their expertise can be leveraged (Blackmon, 2018). *Rapid feedback:* Furthermore, the use of TEL enhances the feedback possibilities, e. g., via LMS (Basal, 2015), as learners are enabled to react rapidly (Bennett, Agostinho & Lockyer, 2015). The direct responses may lead to commonly improved design and content (Bonafini, 2017). These data are also important for formative evaluations and assessments (Riedel & Möbius, 2018). The construction of MOOCs makes professors reflect on their teaching because they receive feedback from forums (Loeckx, 2016). Another motive named in the literature was the opportunity to experiment with new technologies (Blackmon, 2018), which may lead to higher intrinsic motivation and increased capabilities of the lecturers (Buhl, Andreasen & Pushpanadham, 2018). Furthermore, the lecturers profit from more flexible working conditions (Gordon, 2014). C*ontinuous improvement:* The role of teachers changes from a knowledge-transmitter to a learning-coach (Loeckx, 2016). The ubiquitous availability of content must lead to the *continuous improvement* of the lectures to differentiate them from the masses. Despite the obvious value of technology-enhanced learning, there are also some negative points to mention. Teachers perceive disadvantages, especially of MOOCs, as compared to face-to-face courses regarding the individualized assessment and the group size (Lowenthal et al., 2018). Still, homogenous training to provide adequate professional development, to support teachers and to increase their awareness of the complex interaction between technology, pedagogy and cognitive content in their different disciplines is missing (Cabero-Almenara et al., 2019). Researchers have also proven the correlation between perceived ease of use and perceptions of usefulness of LMS (Wichadee, 2015). A standardized proceeding for TEL integration could help to assure a level of quality (Kirkwood & Price, 2016; Weller et al., 2015). The same applies to standards regarding the quality of the content of MOOCs and OER (Richter & Veith, 2014).

6 Conclusion

In this article, we examined recent research about TEL systems. Our findings present a broad picture of the digital platform capabilities and their role among HEIs. Our work contributes to practitioners as we detected recent trends in that field and describe the interaction of the systems and the implications for the stakeholders. We also see some contribution for researchers as we neatly described the actual state of the art. Our research shows: several systems with different goals do exist. As most systems seem to improve the learning and the learning outcomes, a tuned interaction may lead to further improvements for the stakeholders as well as for the HEI. TEL systems support agility in the way of fast feedback, participation, and continuous improvement. Agile processes are not limited to one stakeholder group; rather, all groups can mutually

foster agility. Students *participate* in the design and improvement of study units through technical tools. *Rapid feedback* improves the lectures which can be enabled by technologies, such as online forums. In return, students receive much faster feedback on their achievements and questions, either from the systems or directly from the lecturers. *Continuous improvement* is the aspired result of the feedback processes. In this context, the targeted use of OERs also makes sense when considering individual interests and learning types within the heterogeneous body of students. Our literature research detected most findings in the field of MOOCs which may lead to the assumption that the field is the most demanding. As we detected only a few findings regarding study assistance systems, we assume, that this field has further need for research focusing on enhancements like chatbots or conversation agents (Hobert & Meyer von Wolff, 2019), dashboards for learning analytics (Kuhnel et al., 2018) and data security (Zimmermann, Lackner & Ebner, 2016). Despite our careful review and synthesis, the work is not without limitations. We concentrated on the platforms and systems, and we did not pursue usability, which would be part of "device research". Moreover, stakeholders beyond the directly affected target group, such as politicians, are an interesting topic for further research but did not fall within the scope of this study. Furthermore, we described the research process as detailed as possible to assure the traceability of the process and findings. Although we carefully prepared our literature research, researchers choosing different limitations and databases may come to divergent conclusions.

References

A Transformative Year: State of the Commons 2017. (2018, May 8). Retrieved March 12, 2019, from https://creativecommons.org/2018/05/08/state-of-the-commons-2017/

Abdel-Maksoud, N. F. (2018). The Relationship between Students' Satisfaction in the LMS „Acadox" and Their Perceptions of Its Usefulness, and Ease of Use. Journal of Education and Learning, 7(2), 184–190.

Al-Khatib, H. (2011). Technology Enhanced Learning: Virtual Realities; Concrete Results – Case Study on the Impact of TEL on Learning. European Journal of Open, Distance and E-Learning, 1.

Alzahrani, A. (2018). The Changes in Massive Open Online Courses (MOOCs) Studies between 2012 and 2017- A Review of Literature. World Journal of Education, 8(4), 59.

Armellini, P. R. (2016). Are Massive Open Online Courses (MOOCs) pedagogically innovative?, 12.

Ashrafi, N., Xu, P., Sathasivam, M., Kuilboer, J.-P., Koelher, W., Heimann, D., Waage, F. (2005). A framework for implementing business agility through knowledge management systems. In Seventh IEEE International Conference on E-Commerce Technology Workshops (S. 116–121).

Baker, R. & Passmore, D. (2016). Value and Pricing of MOOCs. Education Sciences, 6(4), 14.

Bayne, S. (2015). What's the matter with 'technology-enhanced learning'? Learning, Media and Technology, 40, 5–20.

Basal, A. (2015). Perceptions of Pre-Service English Teachers towards the Integration of an LMS into English Language Teacher Education. Journal of Technology and Teacher Education, 23(4), 485–507.

Bender, C. (2016). Die Vorlesung. Ein Auslaufmodell? Forschung und Lehre, Heft 8, 692–694.

Bennett, S., Agostinho, S. & Lockyer, L. (2015). Technology tools to support learning design: Implications derived from an investigation of university teachers' design practices. Computers & Education, 81, 211–220.

Bere, A., Deng, H. & Tay, R. (2018). Investigating the Impact of eLearning Using LMS on the Performance of Teaching and Learning in Higher Education. In 2018 IEEE Conference on e-Learning, e-Management and e-Services (IC3e) (S. 6–10). Langkawi Island, Malaysia: IEEE.

Blackmon, S. (2018). MOOC Makers: Professors' Experiences With Developing and Delivering MOOCs. The International Review of Research in Open and Distributed Learning, 19(4).

Blackmon, S. J. (2016). Through the MOOCing Glass: Professors' Perspectives on the Future of MOOCs in Higher Education. New Directions for Institutional Research, 2015(167), 87–101.

Blackmon, S. J. & Major, C. H. (2017). Wherefore Art Thou MOOC: Defining Massive Open Online Courses. Online Learning, 21(4).

Bonafini, F. C. (2017). The effects of participants' engagement with videos and forums in a MOOC for teachers' professional development. Open Praxis, 9(4), 433.

Borboa, D., Joseph, M., Spake, D. & Yazdanparast, A. (2017). Perceptions and Use of Learning Management System Tools and Other Technologies in Higher Education: A Preliminary Analysis. Journal of Learning in Higher Education, 10(2), 17–23.

Buhl, M., Andreasen, L. B. & Pushpanadham, K. (2018). Upscaling the number of learners, fragmenting the role of teachers: How do massive open online courses (MOOCs) form new conditions for learning design? International Review of Education, 64(2), 179–195.

Burd, E. L., Smith, S. P. & Reisman, S. (2015). Exploring Business Models for MOOCs in Higher Education. Innovative Higher Education, 40(1), 37–49.

Butcher, N., Malina, B. & Neumann, J. (2013). Was sind Open Educational Resources? und andere häufig gestellte Fragen zu OER. Bonn: UNESCO.

Cabero-Almenara, J., Arancibia, M. L. & Del Prete, A. (2019). Technical and Didactic Knowledge of the Moodle LMS in Higher Education. Beyond Functional Use. Journal of New Approaches in Educational Research, 8(1), 25–33.

Caligiuri, P. (2012). Cultural Agility: Building a Pipeline of Successful Global Professionals. John Wiley & Sons.

Chen, C.-C., Huang, C., Gribbins, M. & Swan, K. (2018). Gamify Online Courses with Tools Built into Your Learning Management System (LMS) to Enhance Self-Determined and Active Learning. Online Learning, 22(3), 41–54.

Doan, T. (2017). Why Not OER? Portal: Libraries and the Academy, 17(4), 665–669.

Feldman-Maggor, Y., Rom, A. & Tuvi-Arad, I. (2016). Integration of Open Educational Resources in Undergraduate Chemistry Teaching--A Mapping Tool and Lecturers' Considerations. Chemistry Education Research and Practice, 17(2), 283–295.

Felipe, C. M., Roldán, J. L. & Leal-Rodríguez, A. L. (2016). An explanatory and predictive model for organizational agility. Journal of Business Research, 69(10), 4624–4631.

Fischer, H., Heise, L., Heinz, M., Moebius, K. & Koehler, T. (2015). How to Identify E-Learning Trends in Academic Teaching: Methodological Approaches and the Analysis of Scientific Discourses. Interactive Technology and Smart Education, 12(1), 31–43.

Fitzgerald, M., Kruschwitz, N., Bonnet, D. & Welch, M. (2013). Embracing digital technology: A new strategic imperative. MIT Sloan Management Review, 55(2), 1–12.

Gikas, J. & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. The Internet and Higher Education, 19, 18–26.

Goodyear, P. & Retalis, S. (2010). Technology-enhanced learning. Rotterdam: Sense Publishers.

Gordon, N. (2014, Januar). Flexible Pedagogies: technology-enhanced learning, 25.

Gottburgsen, A. & Wilige, J. (2018). Mehr Mobilitätserfahrungen durch digitale Medien? Zu den Effekten von studentischer Diversität und Lernumweltsmerkmalen auf die internationale Mobilität. Beiträge zur Hochschulforschung, 4/2018, 30–50.

Henderson, M., Selwyn, N. & Aston, R. (2017). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. Studies in Higher Education, 42(8), 1567–1579.

Hess, T., Matt, C., Benlian, A. & Wiesböck, F. (2016). Options for formulating a digital transformation strategy. MIS Quarterly Executive, 15(2), 123–139.

Hilton, J. (2016). Open Educational Resources and College Textbook Choices: A Review of Research on Efficacy and Perceptions. Educational Technology Research and Development, 64(4), 573–590.

Hobert, S. & Meyer von Wolff, R. (2019). Say Hello to Your New Automated Tutor – A Structured Literature Review on Pedagogical Conversational Agents. In Proceedings of the 14th International Conference on Wirtschaftsinformatik (S. 301–315). Siegen.

Holmes, K. A. & Prieto-Rodriguez, E. (2018). Student and Staff Perceptions of a Learning Management System for Blended Learning in Teacher Education. Australian Journal of Teacher Education, 43(3), 15.

Janson, A., Söllner, M., Bitzer, P. & Leimeister, J. M. (2014). Examining the effect of different measurements of learning success in technology-mediated learning research. International Conference on Information Systems (ICIS).

Joo, Y. J., Kim, N. & Kim, N. H. (2016). Factors Predicting Online University Students' Use of a Mobile Learning Management System (m-LMS). Educational Technology Research and Development, 64(4), 611–630.

Kaatrakoski, H., Littlejohn, A. & Hood, N. (2017). Learning Challenges in Higher Education: An Analysis of Contradictions within Open Educational Practice. Higher Education: The International Journal of Higher Education Research, 74(4), 599–615.

Kirkwood, A. & Price, L. (2014). Technology-enhanced learning and teaching in higher education: what is 'enhanced' and how do we know? A critical literature review. Learning, Media and Technology, 39(1), 6–36.

Kirkwood, A. & Price, L. (2016). Technology-Enabled Learning Implementation Handbook. Commonwealth of Learning (COL).

Kopp, M., Gröblinger, O. & Zimmermann, C. (2017). Increasing Educational Value: The Transformation of MOOCs into Open Educational Resources. In C. Delgado Kloos, P. Jermann, M. Pérez-Sanagustín, D. T. Seaton & S. White (Hrsg.), Digital Education: Out to the World and Back to the Campus (S. 223–232). Springer International Publishing.

Kuhnel, M., Seiler, L., Honal, A. & Ifenthaler, D. (2018). Mobile learning analytics in higher education: Usability testing and evaluation of an app prototype. Interactive Technology and Smart Education, 15(4), 332–347.

LeBlanc, P. J. (2018). Higher Education in a VUCA World. Change: The Magazine of Higher Learning, 50(3–4), 23–26.

Loeckx, J. (2016). Blurring Boundaries in Education: Context and Impact of MOOCs. The International Review of Research in Open and Distributed Learning, 17(3). h

Lowenthal, P. & Hodges, C. (2015). In Search of Quality: Using Quality Matters to Analyze the Quality of Massive, Open, Online Courses (MOOCs). The International Review of Research in Open and Distributed Learning, 16(5).

Lowenthal, P., Snelson, C. & Perkins, R. (2018). Teaching Massive, Open, Online, Courses (MOOCs): Tales from the Front Line. The International Review of Research in Open and Distributed Learning, 19(3).

Management Association, I. R. (Hrsg.). (2018). Online Course Management: Concepts, Methodologies, Tools, and Applications. IGI Global.

Mirriahi, N. & Alonzo, D. (2015). Shedding Light on Students' Technology Preferences: Implications for Academic Development. Journal of University Teaching and Learning Practice, 12(1).

Mohamed, M. H. & Hammond, M. (2018). MOOCs: a differentiation by pedagogy, content and assessment. International Journal of Information and Learning Technology, 35(1), 2–11.

Mukerjee, S. (2014). Agility: a crucial capability for universities in times of disruptive change and innovation, 56(1), 5.

Nami, F. & Vaezi, S. (2018). How ready are our students for technology-enhanced learning? Students at a university of technology respond. Journal of Computing in Higher Education, 30(3), 510–529.

Neumann, S. & Fink, L. (2007). Gaining agility through IT personnel capabilities: The mediating role of IT infrastructure capabilities. Journal of the Association for Information Systems, 8(8), 25.

Nistor, N. (2018). Akzeptanz von Bildungstechnologien. Lernen Mit Bildungstechnologien: Praxisorientiertes Handbuch Zum Intelligenten Umgang Mit Digitalen Medien, 1–11.

Ochoa, X. & Ternier, S. (2017). Technical Learning Infrastructure, Interoperability and Standards. In E. Duval, M. Sharples & R. Sutherland (Hrsg.), Technology Enhanced Learning: Research Themes (S. 145–155). Cham: Springer International Publishing.

Parsons, D. & MacCallum, K. (2019). Agile and Lean Concepts for Teaching and Learning: Bringing Methodologies from Industry to the Classroom. Springer.

Park, Y., Sawy, O. & Fiss, P. (2017). The Role of Business Intelligence and Communication Technologies in Organizational Agility: A Configurational Approach. Journal of the Association for Information Systems, 18(9), 648–686.

Rhode, J., Richter, S., Gowen, P., Miller, T. & Wills, C. (2017). Understanding Faculty Use of the Learning Management System. Online Learning, 21(3), 68–86.

Richter, T. & Veith, P. (2014). Fostering the Exploitation of Open Educational Resources. Open Praxis, 6(3).

Riedel, J. & Möbius, K. (2018). Bestandsaufnahme, Hindernisse und Möglichkeiten des Einsatzes von E-Assessment an sächsischen Hochschulen. Beiträge zur Hochschulforschung, (04/2018).

Rodríguez-Triana, M. J., Prieto, L. P., Vozniuk, A., Boroujeni, M. S., Schwendimann, B. A., Holzer, A. & Gillet, D. (2017). Monitoring, awareness and reflection in blen ded technology enhanced learning: a systematic review. International Journal of Technology Enhanced Learning, 9(2–3), 126–150.

Rohs, M. & Ganz, M. (2015). MOOCs and the claim of education for all: A disillusion by empirical data. The International Review of Research in Open and Distributed Learning, 16(6).

Sambamurthy, V., Bharadwaj, A. & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. MIS quarterly, 237–263.

Schryen, G. (2015). Writing Qualitative IS Literature Reviews—Guidelines for Synthesis, Interpretation, and Guidance of Research. Communications of the Association for Information Systems, 37(1).

Schweighofer, P., Weitlaner, D., Ebner, M. & Rothe, H. (2019). Influential factors for technology-enhanced learning: professionals' views. Journal of Research in Innovative Teaching & Learning.

Sharifi, H. & Zhang, Z. (2001). Agile manufacturing in practice-Application of a methodology. International Journal of Operations & Production Management, 21(5/6), 772–794.

Shigeta, K., Koizumi, M., Sakai, H., Tsuji, Y., Inaba, R. & Hiraoka, N. (2017). A survey of the awareness, offering, and adoption of OERs and MOOCs in Japan. Open Praxis, 9(2), 195.

SIDDATA – Verbundprojekt zur Studienindividualisierung durch digitale, datengestützte Assistenten. (2019). Abgerufen 8. März 2019, von https://www.siddata.de/

Son, J., Kim, J.-D., Na, H.-S. & Baik, D.-K. (2016). A Social Learning Management System Supporting Feedback for Incorrect Answers Based on Social Network Services. Educational Technology & Society, 19(2), 245–257.

Tahiru, M. & Kamalludeen, R. (2018). Indicators of Students' Intention to Use Massive Open Online Courses for Academic Purposes. Malaysian Online Journal of Educational Technology, 6(3), 52–62.

Tess, P. A. (2013). The role of social media in higher education classes (real and virtual)–A literature review. Computers in Human Behavior, 29(5), A60–A68.

Tikkamäki, K. & Mavengere, N. (2013). Organizational Learning, Agility and Social Technologies in Contemporary Workplaces. In T. Ley, M. Ruohonen, M. Laanpere & A. Tatnall (Eds.), Open and Social Technologies for Networked Learning (pp. 205–209). Springer Berlin Heidelberg.

Twidale, M. B. & Nichols, D. M. (2013). Agile Methods for Agile Universities. In T. Besley & M. A. Peters (Hrsg.), Re-imagining the Creative University for the 21st Century (S. 27–48). Rotterdam: SensePublishers.

Unal, Z. & Unal, A. (2017). Comparison of Student Performance, Student Perception, and Teacher Satisfaction with Traditional versus Flipped Classroom Models. International Journal of Instruction, 10(4), 145–164.

vom Brocke, J., Simons, A., Riemer, K., Niehaves, B., Plattfault, R. & Cleven, A. (2015). Standing on the shoulders of giants: Challenges and recommendations of literature search in information systems research. Communications of the Association for Information Systems, 37(1), 205–224.

Wang, S. & Wang, H. (2017). Business Models Associated with Distance Learning in Higher Education. Online Journal of Distance Learning Administration, 20(3).

Weller, M. (2014). Battle for Open: How openness won and why it doesn't feel like victory. Ubiquity Press.

Weller, M., De los Arcos, B., Farrow, R., Pitt, B. & McAndrew, P. (2015). The Impact of OER on Teaching and Learning Practice. Open Praxis, 7(4).

Wichadee, S. (2015). Factors Related to Faculty Members' Attitude and Adoption of a Learning Management System. Turkish Online Journal of Educational Technology - TOJET, 14(4), 53–61.

Yousef, A. M. F., Chatti, M. A., Schroeder, U. & Wosnitza, M. (2015). A usability evaluation of a blended MOOC environment: An experimental case study. The International Review of Research in Open and Distributed Learning, 16(2).

Zawacki-Richter, O., Bozkurt, A., Alturki, U. & Aldraiweesh, A. (2018). What Research Says About MOOCs – An Explorative Content Analysis. The International Review of Research in Open and Distributed Learning, 19(1).

Zawacki-Richter, O., von Prümmer, C. & Stöter, J. (2015). Open Universities: Offener Zugang zur Hochschule in nationaler und internationaler Perspektive. Beiträge zur Hochschulforschung, 36(2015), 1.

Zimmermann, C., Lackner, E. & Ebner, M. (2016). FACETS OF OPENNESS IN MOOCS–A REVIEW. In DisCO 2016–Towards open education an information society.

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