Open Online Learning for Professional Development

Integrating Design and Research Perspectives

Inaugural Dissertation
to Obtain the Academic Degree
of a Doctor in Business Administration
at the University of Mannheim

submitted by
Marc Egloffstein

Mannheim

Dean: Joachim Lutz
Referent: Prof. Dr. Dirk Ifenthaler, University of Mannheim
Correferent: Prof. Dr. Jürgen Seifried, University of Mannheim
Correferent: Prof. Dr. Sabine Seufert, University of St. Gallen

Day of oral examination: 24.04.24

Abstract

With the growing importance of digital education, this thesis aims to investigate open online learning for professional development with Massive Open Online Courses (MOOCs). The overarching research question, *How can MOOCs for professional learning and development be advanced and meaningfully designed?* is addressed with four empirical studies. MOOCs for professional learning and development were investigated with a focus on employee perspectives, instructional quality, learner participation and achievement, and patterns of learner behavior.

The thesis consists of seven chapters and integrates four distinct research papers. The first chapter outlines the motivation for exploring open online learning for professional development from a design perspective. By integrating the concepts of *learning at scale* and *open learning*, it traces the trajectory of MOOCs from their early academic implementations to the current shift towards professional development. Additionally, the chapter lays out the research objectives, scope, research questions, and the overall structure of the thesis. Chapter 2 delves into the conceptual foundations of the thesis. It introduces defining aspects of MOOCs, their technological underpinnings, and design considerations. Furthermore, it explores MOOCs in professional learning and development, highlighting use cases and corporate implementations. The subsequent four chapters focus on the four research studies. Chapter 3 discusses employee perspectives on MOOCs for workplace learning, revealing motives and areas of interest. Chapter 4 examines the instructional quality of business MOOCs and identifies strengths and opportunities for improvement. Providing first insights into an emerging field, the fifth chapter analyzes participation and achievement in Enterprise MOOCs for professional learning. In order to derive evidence-informed design recommendations, Chapter 6 investigates course design approaches and behavioral patterns in MOOCs for professional learning. Chapter 7 discusses the findings of the four studies, along with implications and design recommendations within and beyond the current MOOC format. Following additional remarks on limitations, potential avenues for future research are outlined. These include an updated stakeholder perspective on open online learning, the development of feasible outcome measures, and contextualized design-oriented research. Additionally, a framework to integrate various research perspectives into instructional quality assessment was introduced. The thesis concludes with an outlook on the perspectives of open online learning for professional development between modularization and AI enrichment.

Zusammenfassung

Vor dem Hintergrund der wachsenden Bedeutung digitaler Bildung nimmt diese Arbeit offenes Online-Lernen für die berufliche Weiterbildung mit Massive Open Online Courses (MOOCs) in den Blick. Die übergeordnete Fragestellung lautet: *Wie können MOOCs für die berufliche Weiterbildung sinnvoll gestaltet und verbessert werden?* In vier empirischen Studien werden die Perspektiven der Mitarbeitenden, die didaktische Qualität, Partizipation und Lernerfolg sowie Verhaltensmuster von Lernenden analysiert.

Die vorliegende Arbeit besteht aus sieben Kapiteln und umfasst dabei vier separate Teilstudien. Im ersten Kapitel wird die Motivation zur Untersuchung offenen Online-Lernens im Kontext beruflicher Weiterbildung aus einer designorientierten Perspektive heraus erläutert. Durch die Integration der Konzepte *learning at scale* und *open learning* wird der Entwicklungspfad von MOOCs von ihren frühen akademischen Implementierungen bis zur gegenwärtigen Transformation hin zur beruflichen Weiterbildung nachgezeichnet. Im ersten Kapitel werden darüber hinaus die Forschungsziele, die Forschungsfragen, die inhaltliche Einordnung und die Gesamtstruktur der Arbeit vorgestellt. Das zweite Kapitel widmet sich dann den konzeptionellen Grundlagen der Arbeit. Es behandelt definitorische Aspekte von MOOCs, ihre technologischen Grundlagen sowie Überlegungen zum Instruktionsdesign. Außerdem wird der Anwendungskontext der beruflichen Weiterbildung noch einmal im Speziellen betrachtet. In den folgenden vier Kapiteln liegt der Fokus dann auf den vier Teilstudien. Das dritte Kapitel erörtert die Perspektive von Mitarbeitenden auf MOOCs für arbeitsbezogenes Lernen und stellt dabei insbesondere deren Motive und inhaltliche Interessen heraus. Kapitel 4 untersucht die didaktische Qualität von Weiterbildungs-MOOCs und beleuchtet Stärken sowie mögliche Verbesserungsbereiche. Kapitel 5 nimmt die Lernenden einer MOOC-basierten Weiterbildungsplattform und insbesondere deren Partizipation und Lernerfolg in den Blick. Um evidenzgestützte Gestaltungsempfehlungen ableiten zu können, werden im sechsten Kapitel Verhaltensmuster von Lernenden unter besonderer Berücksichtigung der Kursgestaltung analysiert. Abschließend werden im siebten Kapitel die Ergebnisse der vier Studien sowie Implikationen und Gestaltungsempfehlungen innerhalb und über das gegenwärtige MOOC-Format hinaus diskutiert. Nach einer Darlegung der Limitationen der Arbeit werden Anknüpfungspunkte für die weitere Forschung vorgestellt. Diese beziehen sich auf die Aktualisierung der Studie zu den Mitarbeiterperspektiven, die Entwicklung praktikabler Erfolgsmaße für Weiterbildungs-MOOCs sowie die Notwendigkeit einer kontextbezogenen, designorientierten Forschung. Darüber hinaus wird ein Rahmenmodell zur Integration verschiedener Forschungsperspektiven hinsichtlich der Erfassung der didaktischen Qualität von MOOCs vorgestellt. Die Arbeit schließt mit einem Ausblick auf die mögliche Weiterentwicklung des offenen Online-Lernens zwischen Modularisierung und der Einbettung Künstlicher Intelligenz.

Acknowledgements

I extend my heartfelt appreciation to all those who have supported me throughout the journey of this dissertation project.

First and foremost, I would like to thank my supervisor, Prof. Dr. Dirk Ifenthaler, for his patience and unwavering support throughout a process that presented its share of challenges. I am deeply grateful for the freedom and all the opportunities he provided to explore new perspectives in international educational technology research. Without his guidance, this thesis would not exist.

Likewise, I would like to extend my gratitude to Prof. Dr. Jürgen Seifried and Prof. Dr. Sabine Seufert for their time and willingness to review this thesis.

Special thanks are extended to Prof. Dr. Kristina Kögler, who was involved in parts of this project and consistently supported me and my work. Friendship is irreplaceable.

I would also like to express my gratitude to Muhittin Şahin, Ph.D., and the teams at openSAP and openHPI, whose contributions have supported this dissertation. A special acknowledgment goes to Florian Schwerer, without whom the research cooperation would not have been possible.

Then, of course, there are the current and former colleagues at the Learning, Design and Technology group in Mannheim: Dr. Jan Delcker, Dr. Clara Schumacher, Dr. Michael Roll, Dr. Li Chen, Joana Heil, Yvonne Hemmler, Floris Scherb, and Nicolai Plintz. Thank you for the insightful discussions, your support, and friendship.

Finally, I would also like to mention the other former colleagues from the Bamberg group, who have had a decisive influence on my scientific career. Without them, I would not be who I am today. Thank you for your friendship and many years of gracious support: Prof. Dr. Andreas Rausch, Prof. Dr. Julia Warwas, Prof. Dr. Tobias Kärner, Prof. Dr. Susanne Scheja, Prof. Dr. Karsten D. Wolf, and Prof. Dr. Detlef Sembill.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Motivation

Apart from time and location-independent learning, an ongoing aim in deploying educational technologies has been to enhance outreach to a broader participant audience (Dousay & Janak, 2018; Molenda, 2023; Reiser, 2001). After the internet's breakthrough in the second half of the 1990s, it was primarily the technological advancements since around 2005, characterized by higher bandwidths and the ubiquity of devices such as mobile computers and smartphones, along with the rise of social media and video-based platforms, that facilitated new technology-based forms of learning (Ifenthaler, 2010; Ramsey & West, 2023; Weller, 2018). At the same time, there has been a notable surge in the demand for education. As a case in point, the global number of students pursuing tertiary education has more than doubled in the last two decades, from 100 million students enrolled in 2000 to over 235 million in 2020 (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2022). As educational systems and their institutions needed to adjust, the demand for technology-driven learning methods designed for large participant groups increased.

Therefore, learning at scale—the design, implementation, and evaluation of technology-based learning environments with many learners and few experts to guide them (Reich, 2022)—has gained significance since the late 2000s and 2010s (Reich, 2020b). Based on the origin of the learner activity sequence, large-scale learning environments can be classified into three genres (Reich, 2020a): instructor-guided, peer-guided, and algorithm-guided learning at scale. Contrary to this designation, learning at scale does not operate on the principles of economies of scale, where cost advantages can be obtained by minimizing marginal costs due to increased sizes (Kasch et al., 2017). Educational scalability, instead, has to include "quantitative aspects of education (delivery at low cost) but also qualitative aspects regarding the complexity of educational processes and instructional design choices" (Kasch et al., 2017, p. 846). Educational scalability can be operationalized within the "iron triangle" of scale, cost, and quality (Kasch et al., 2017, p. 849). While in traditional educational settings, those three elements cannot all be optimized simultaneously, technologies for learning at scale aim at stretching the triangle.

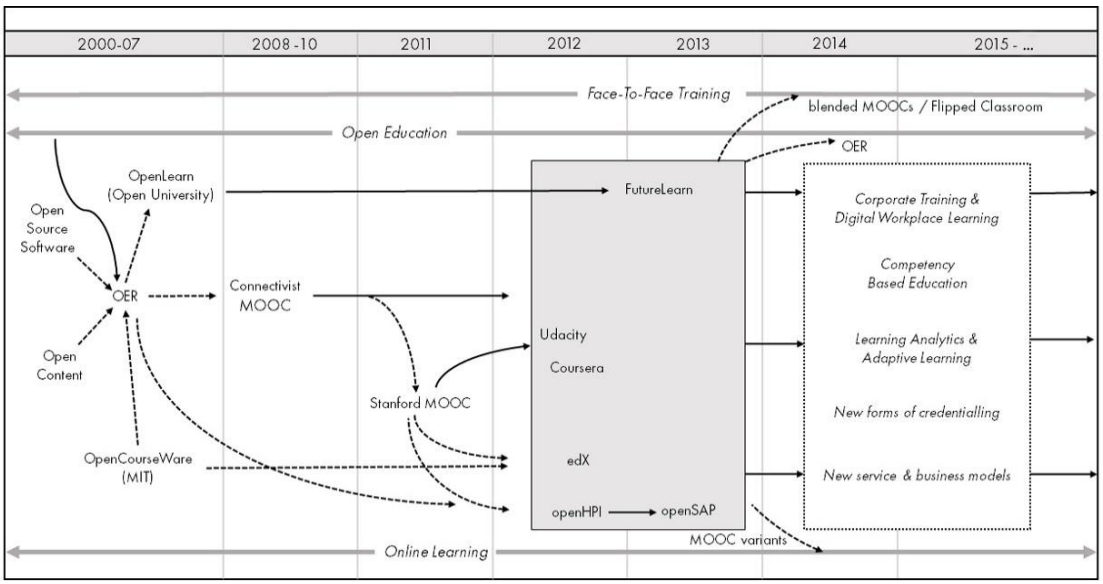
From a pedagogical standpoint, learning at scale has been closely associated with openness (Zawacki-Richter & Jung, 2023), resulting in various approaches to open online learning. In education, openness describes an evolving and multifaceted concept (Baker, 2017) linked to access, flexibility, equity, collaboration, agency, democratization, social justice, transparency, and removing barriers (Zawacki-Richter et al., 2020). The extent to which these elements are addressed, however, remains highly specific, given that open online learning does not consistently adhere to a uniform notion of openness (Kögler et al., 2020). In most cases, the two distinct ideas of open distance learning (ODL) are addressed (Gaskell, 2017), namely time and location-independent learning and distance learning as for the separation between teachers and learners. Open access (OA), with its distinct interpretations of open admission (concerning formal entry requirements or necessary prior knowledge) and open as free (concerning monetary costs), is being implemented very specifically (Cronin, 2017). The pedagogically oriented principles of Open Educational Resources (OER), which enable the open distribution of learning resources through the 5R activities (retain, reuse, revise, remix, redistribute), are, if at all, implemented at most by non-commercial education providers (Wiley, 2015). The principles of Open Educational Practices (OEP), describing open, collaborative pedagogical approaches in working with OER (Ehlers, 2011), may be implemented in open online learning (Czerniewicz et al., 2017), leading to open learning innovations (Stracke et al., 2019). However, these principles come into play even less.

Massive Open Online Courses (MOOCs), as the most influential implementation of open online learning in the past 15 years (Despujol et al., 2022), combine the ideas of learning at scale with a notion of openness. The origins of the MOOC concept are closely related to the open education movement, which introduced OER in a manner similar to the principles of open content and open-source software (Storme et al., 2016; Yuan & Powell, 2015). The MOOC acronym came to use around the ‘Connectivism and Connective Knowledge’ (CCK08) course in 2008 (Martindale, 2015). CCK08 pioneered the field, presenting a substantial approach to implement collaborative, connected, and open learning—the prime example of peer-guided learning at scale. Building on the acronym but not on the underlying pedagogical concepts (Deimann, 2017), the *Stanford MOOC* achieved significant success in 2011 with an online, video-based version of the lecture ‘Introduction to Artificial Intelligence,’ attracting hundreds of thousands of

participants globally. This online transformation of a university course provides an essential example of instructor-led learning at scale.

The trajectory of MOOCs can be described through (1) an initial phase of experimentation, (2) the emergence of mainstream platforms, and (3) an ongoing phase of redesign and consolidation aimed at sustainability (Knox, 2017). During the first phase, pedagogical innovations from the peer-guided genre were introduced from 2008 onwards. The second phase focused on instructor-guided MOOCs and witnessed the entry of mainstream MOOC platforms like edX, Coursera, Udacity, or FutureLearn as academic spin-offs distributing those courses into the global education market (Ebben & Murphy, 2014). As the initial expectations from the peak of the hype phase from around 2012—the so-called 'Year of the MOOC' (Pappano, 2012; D. Shah, 2020)—have evolved, a more realistic perspective on MOOCs has emerged (Jordan & Goshtasbpour, 2022). Practical use cases have since been developed, backed by extensive research efforts. These scenarios include a shift from academic education to corporate training and digital workplace learning, a focus on competency-based education for professional development, and implementation of learning analytics, new credentialing approaches, and innovative service and business models (Egloffstein, 2018). Figure 1.1 illustrates the evolution of the MOOC concept, from its historical roots to the current topics and challenges in the context of professional learning and development (Egloffstein, 2018; Yuan & Powell, 2015).

Figure 1-1
Trajectory for MOOCs in Professional Learning and Development



In terms of their rapid growth and current dissemination, MOOCs can be regarded as a success model. According to the ten-year roundup from the MOOC aggregator Class Central, the number of learners in MOOCs has grown from around 300,000 in the initial three Stanford courses from 2011 to over 220 million in just one decade. In 2021, more than 19,400 courses, 1,670 micro-credentials, and 70 MOOC-based degree programs were offered by 950 universities (D. Shah, 2021). Notably, these statistics focus on the 'Western world' and do not take the significant growth in China (King & Lee, 2023) and other parts of the globe (Lee & Chung, 2019; Ruipérez-Valiente et al., 2022; Semenova et al., 2018) into account.

However, when it comes to the common MOOC narratives particularly emphasized when the mainstream platforms entered the market, the assessment must be more nuanced. The predicted disruptive transformation of postsecondary education has not happened (Reich & Ruipérez-Valiente, 2019). Rather than replacing traditional formats such as lectures and opening up academic education, MOOCs have become an additional offering as the technology has been 'domesticated' by the existing system (Reich, 2020a). Moreover, MOOCs may not necessarily contribute to the democratization of education since the participants primarily consist of learners with a higher socioeconomic status (Hansen & Reich, 2015) and a higher level of education (Rohs & Ganz, 2015), while the data on learning success of individuals considered underrepresented appear inconsistent (Goglio & Parisi, 2020; Meany & Fikes, 2023; Stich & Reeves, 2017). Likewise, MOOCs do not contribute automatically to equity across countries, as evidenced by global achievement gaps that can be traced back to technological, economic, skill-related, and psychological barriers. (Cagiltay et al., 2023; Gameel & Wilkins, 2019; Kizilcec et al., 2017). With that said, MOOCs still create opportunities by reaching a significant number of underprivileged learners who might not otherwise engage in formal academic education (Lamberg, 2020; Van de Oudeweetering & Agirdag, 2018).

Since MOOCs may not significantly reshape higher education and might not be particularly suitable for less affluent and inexperienced students, an alternative business model has gained attention: outsourcing universities' master's programs for professional learners (Reich & Ruipérez-Valiente, 2019). At the same time, MOOC

providers are increasingly emphasizing non-academic courses (D. Shah, 2021) and forming partnerships with corporations (Park, 2021) while diverging from their academic origins (Cortes Mendez, 2020). Of the four Anglo-American mainstream platforms, only Coursera still operates independently, while its closest competitors have been integrated into commercial online learning ecosystems whose offerings include much more than just MOOCs (D. Shah, 2023). In the German-speaking sphere, the established MOOC platforms iMooX and mooin/OnCampus (Ebner et al., 2017) extend their portfolio beyond academic education. Furthermore, there are several topic-specific MOOC providers like the AI Campus (courses on Artificial Intelligence; Rampelt & Bernd, 2021), eGov-Campus (centered on digital transformation in administration; Egloffstein & Ifenthaler, 2023), and openSAP (addressing technology and business-related subjects; Renz et al., 2016) focusing more on professional development. Most of these platforms can be classified as regional providers due to their emphasis on the German language, except for openSAP, which has maintained a global perspective from the outset. All in all, a clear shift towards professional learning and development has become evident in the evolution of MOOCs (Bonk, Lee, et al., 2018; Egloffstein, 2018).

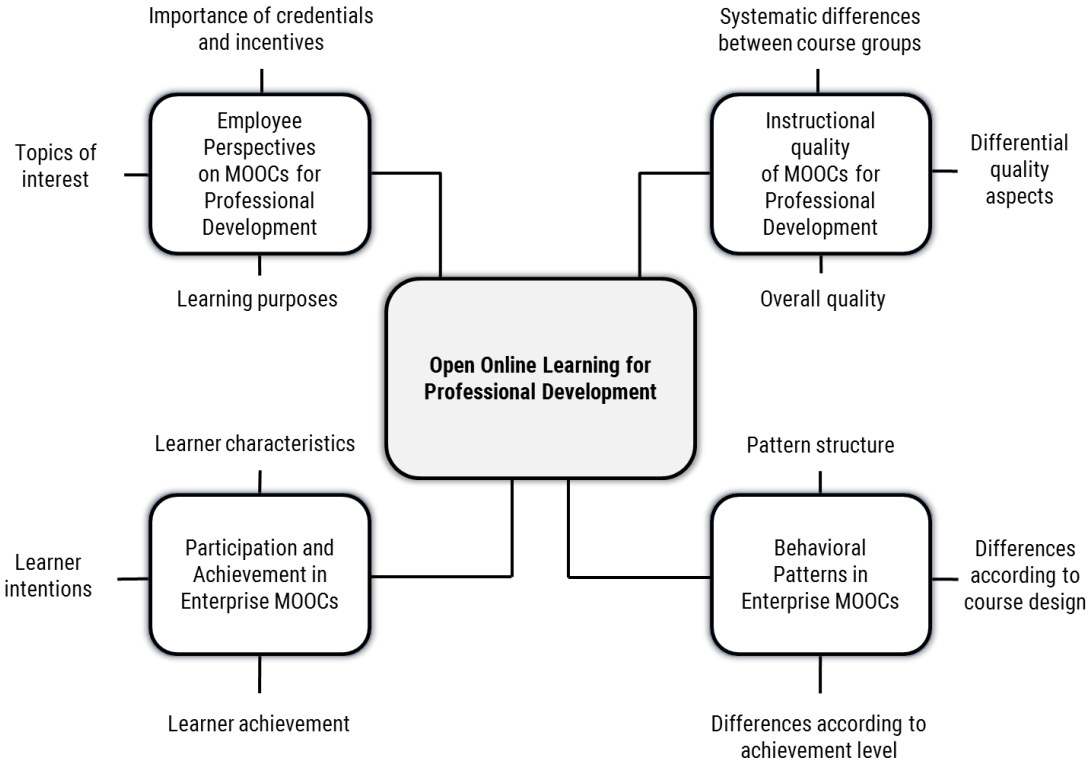
1.2 Research Objective and Scope

This transition towards professional development is not yet reflected in the existing body of MOOC research, which has traditionally focused on academic MOOCs (Zawacki-Richter et al., 2018), while other contexts, such as K-12 education (Guggemos et al., 2022) or vocational education and professional development (Paton et al., 2018) remained comparatively under-researched. While various review studies highlight that instructional design and its implications play a central role in MOOC research (Alemayehu & Chen, 2023; Babori, 2020; Despujol et al., 2022; R. Moore & Blackmon, 2022; Paton et al., 2018; Zawacki-Richter et al., 2018; Zhu et al., 2020), little is known about design specifics for MOOCs in professional learning and development.

Hence, this thesis aims to investigate open online learning for professional development with Massive Open Online Courses from a design perspective. Four empirical studies address the overarching research question: *How can MOOCs for professional learning and development be advanced and meaningfully designed?* Two of

these studies focus on general aspects, and two relate to the implementation of Enterprise MOOCs on a specific platform. MOOCs for professional learning and development were investigated with a focus on (1) employee perspectives, (2) instructional quality, (3) learner participation and achievement, and (4) patterns of learner behavior. Figure 1-2 provides an overview of the research foci and the related studies.

Figure 1-2
Research Objective and Foci



Following Reeves and Oh (2017), the research approach of this thesis can be categorized as design-oriented research. However, this does not involve the actual implementation of educational design research (McKenney & Reeves, 2021) in the sense of design-based research (Hoadley & Campos, 2022), as there was no direct influence on course implementation in the context of the project. Considering that MOOCs for professional development are in a developmental phase rather than a mature stage, this research can be further characterized as explorative 'research to improve' (Honebein & Reigeluth, 2021), oscillating between pure applied research and use-inspired basic research in the Pasteur's Quadrant model (Klahr, 2019; Stokes, 1997). With respect to common multilevel models of educational research and management (Seifried et al.,

2005; Seufert, 2013) and their adaptation to open and digital education (Zawacki-Richter & Jung, 2023), Study 1 (integration into institutional contexts) and Study 2 (comparing platforms and institutions) can be located at the meso-level, and Study 3 and 4 primarily at the micro-level (teaching and learning on one platform). Table 1-1 provides an overview of the research studies included and the respective research papers.

Table 1-1

Overview of the Research Studies Included

Study Chapter	Study 1 Chapter 3	Study 2 Chapter 4	Study 3 Chapter 5	Study 4 Chapter 6
Reference	Egloffstein, M., & Ifenthaler, D. (2017). Employee perspectives on MOOCs for workplace learning. *TechTrends, 61*(1), 65–70.	Egloffstein, M., Kögler, K. & Ifenthaler, D. (2019). Instructional quality of business MOOCs: Indicators and initial findings. *Online Learning Journal, 23*(4), 85–105.	Egloffstein, M., & Schwerer, F. (2019). Participation and achievement in enterprise MOOCs for professional development: Initial findings from the openSAP university. In D. G. Sampson et al. (Eds.), *Learning technologies for transforming large-scale teaching, learning, and assessment* (pp. 91–103). Springer.	Egloffstein, M., Şahin, M. & Ifenthaler, D. (2023). Course design approaches and behavioral patterns in massive open online courses for professional learning. *Online Learning Journal, 27*(4), 48–68.
Research design	Quantitative approach; survey study	Qualitative approach; rating study	Quantitative approach; survey study	Quantitative approach; Learning Analytics study
Methods	Descriptive and inferential statistics	Expert rating; descriptive and inferential statistics	Descriptive statistics	Lag Sequential Analysis
Sample	N = 119 employees	N = 101 courses	N = 9,994 learners	N_A = 10,454,430 activities from N_L = 72,668 learners
Research foci	Explore the acceptance of MOOCs for professional development	Analyze the instructional quality of MOOCs for professional development	Explore learner characteristics, participation, and achievement in Enterprise MOOCS	Explore behavioral patterns in Enterprise MOOCs with regard to course design

1.3 Research Questions

The overarching research objective is reflected in the diverse research questions of the four distinct studies, which are presented subsequently.

1.3.1 Employee Perspectives on MOOCs for Workplace Learning (Study 1)

In response to evident research gaps, the primary objective of the first study (Chapter 3) is to explore the acceptance of MOOCs for workplace learning among (potential) learners. This survey, involving $N = 119$ employees, specifically delves into their perspectives on motivation, credentials, and incentives linked to participation in corporate MOOCs. The following research questions have been examined:

- For which learning purposes would employees use MOOCs?
- Which MOOC topics are of interest to employees?
- How important are credentials and incentives for employees when participating in MOOCs?

1.3.2 Instructional Quality of Business MOOCs (Study 2)

Building on earlier research examining the instructional quality of MOOCs, the second study (Chapter 4) presents an analysis of the instructional quality of business MOOCs, employing a domain-specific approach. For this exploratory study, a rating instrument was adapted, and $N = 101$ courses were assessed. The following research questions have provided the framework for the investigation:

- How can the instructional quality of MOOCs in the field of business and management be described in terms of structuredness and fit with existing instructional design principles?
- Which categories point toward high instructional quality of business MOOCs, and which categories indicate room for improvement?
- Are there systematic differences concerning instructional quality based on distinctive features of business MOOCs, such as provider/platform, geographic region, and authoring institution?

1.3.3 Participation and Achievement in Enterprise MOOCs (Study 3)

The aim of Study 3 (Chapter 5) was to shed light on corporate MOOCs and their learners. Using openSAP as a significant Enterprise MOOC platform, characteristics of N = 9,994 learners and their intentions for using MOOCs have been analyzed in relation to actual achievement. This analysis provides initial insights into how MOOCs are currently utilized for professional learning. The following research questions have been addressed:

- Who is participating in Enterprise MOOCs at openSAP?
- What are participants' MOOC-related experiences, intended usage contexts, and learning objectives for Enterprise MOOCs at openSAP?
- What are participants' achievements in Enterprise MOOCs at openSAP?

1.3.4 Behavioral Patterns in Enterprise MOOCs (Study 4)

Study 4 (Chapter 6) focuses on learner behavior in different openSAP courses. The study seeks to identify behavioral patterns in Enterprise MOOCs and determine differences according to course design as well as learner achievement to derive evidence-based design recommendations. N_A = 10,454,430 activities from N_L = 72,668 learners have been analyzed. The study illustrates how learning analytics can inform course design and facilitation. The guiding research questions have been:

- Are there behavior patterns in enterprise MOOCs for professional learning?
- Do interaction sequences differ according to the underlying course design approach?
- Are there interaction sequences for high-achieving learners?

1.4 Structure of the Thesis

This thesis comprises seven chapters and integrates four distinct research papers. The first chapter outlines the motivation for exploring open online learning for professional development from a design perspective. Integrating the concepts of learning at scale and open learning, it traces the trajectory of MOOCs from their early academic implementations to the current shift toward professional development. Additionally, the

chapter lays out the research objectives, scope, research questions, and the overall structure of the thesis.

Chapter 2 delves into the conceptual foundations of the thesis. It introduces defining aspects of Massive Open Online Courses, their technological underpinnings, and design considerations. Furthermore, it explores MOOCs in professional learning and development, highlighting use cases and corporate implementations.

The subsequent four chapters focus on the four research studies. Chapter 3 discusses employee perspectives on MOOCs for workplace learning (Study 1). Chapter 4 examines the instructional quality of business MOOCs (Study 2). The fifth chapter (Study 3) analyzes participation and achievement in Enterprise MOOCs for professional learning. Chapter 6 (Study 4) investigates course design approaches and behavioral patterns in MOOCs for professional learning.

Chapter 7 summarizes the findings of the four studies, along with practical implications and design recommendations. Following additional remarks on limitations and potential directions for future research, the thesis concludes with an outlook on the perspectives of open online learning for professional development.

References

Alemayehu, L., & Chen, H.-L. (2023). Learner and instructor-related challenges for learners' engagement in MOOCs: A review of 2014–2020 publications in selected SSCI indexed journals. *Interactive Learning Environments, 31*(5), 3172–3194. https://doi.org/10.1080/10494820.2021.1920430

Babori, A. (2020). Trends in MOOCs Research: Analysis of Educational Technology Journals. *International Journal of Emerging Technologies in Learning, 15*(17), pp. 47–68. https://doi.org/10.3991/ijet.v15i17.14637

Baker, F. W. (2017). An alternative approach: Openness in education over the last 100 years. *TechTrends, 61*, 130–140. https://doi.org/10.1007/s11528-016-0095-7.

Bonk, C. J., Lee M. M., Reeves, T. C., & Reynolds, T. H. (2018). The emergence and design of massive open online courses. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design & technology* (4th Ed., pp. 250–258). Pearson.

Cagiltay, N. E., Toker, S., & Cagiltay, K. (2023). Exploring the Influence of Countries' Economic Conditions on Massive Open Online Course (MOOC) Participation: A Study of 3.5 Million MITx Learners. *The International Review of Research in Open and Distributed Learning, 24*(2), 1–17. https://doi.org/10.19173/irrodl.v24i2.7123

Cortes Mendez, M. (2020, September 15). *Georgia Tech's Computer Science Online Master's Leaves Udacity*. Class Central. https://www.classcentral.com/report/georgia-tech-omscs-leaves-udacity/

Czerniewicz L., Deacon A., Glover M., Walji S. (2017). MOOC—making and open educational practices. *Journal of Computing in Higher Education, 29*(1), 81–97. https://doi.org/10.1007/s12528-016-9128-7

Deimann, M. (2017). Open Education, An Overview of. In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1696–1700). Springer. https://doi.org/10.1007/978-981-287-588-4_213

Despujol, I., Castañeda, L., Marín, V. I., & Turró, C. (2022). What do we want to know about MOOCs? Results from a machine learning approach to a systematic literature mapping review. *International Journal of Educational Technology in Higher Education*, *19*(53). https://doi.org/10.1186/s41239-022-00359-1

Dousay, T. A., & Janak, E. (2018). All things considered: Educational radio as the first MOOCs. *TechTrends, 62*(6), 555–562. https://doi.org/10.1007/s11528-018-0257-x

Ebben, M., & Murphy, J. S. (2014). Unpacking MOOC scholarly discourse: A review of nascent MOOC scholarship. *Learning, Media and Technology, 39*(3), 328–345. https://doi.org/10.1080/17439884.2013.878352

Ebner, M., Lorenz, A., Lackner, E., Kopp, M., Kumar, S., Schön, S., & Wittke, A. (2017). How OER Enhances MOOCs—A Perspective from German-Speaking Europe. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open Education: from OERs to MOOCs* (pp. 205–220). Springer. https://doi.org/10.1007/978-3-662-52925-6_11

Egloffstein, M. (2018). Massive open online courses in digital workplace learning: Current state and future perspectives. In D. Ifenthaler (Ed.), *Digital workplace learning: Bridging formal and informal learning with digital technologies* (pp. 149–166). Springer. https://doi.org/10.1007/978-3-319-46215-8_

Egloffstein, M., & Ifenthaler, D. (2023). Modularizing MOOCs for Professional Learning: Prospects and Challenges for Instructional Design. *Proceedings 2023 IEEE Learning with MOOCS* (pp. 1–4). https://doi.org/10.1109/LWMOOCS58322.2023.10305982.

Gameel, B. G., & Wilkins, K. G. (2019). When it comes to MOOCs, where you are from makes a difference. *Computers & Education, 136*, 49–60. https://doi.org/10.1016/j.compedu.2019.02.014

Gaskell, A. (2017). Open Distance Learning. In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1688–1693). Springer. https://doi.org/10.1007/978-981-287-588-4_215

Goglio, V., & Parigi, P. (2020). The Social Dimension of Participation and Completion in MOOCs. *Educational Technology & Society, 23*(4), 106–123. https://doi.org/10.30191/ETS.202010_23(4).0008

Guggemos, J., Moser, L., & Seufert, S. (2022). Learners don't know best: Shedding light on the phenomenon of the K-12 MOOC in the context of information literacy. *Computers & Education*, *188*, 104552. https://doi.org/10.1016/j.compedu.2022.104552

Hansen, J. D., & Reich, J. (2015). Democratizing education? Examining access and usage patterns in massive open online courses. *Science, 350*(6265), 1245–1248. https://doi.org/10.1126/science.aab3782

Hoadley, C., & Campos. F. C. (2022). Design-based research: What it is and why it matters to studying online learning, *Educational Psychologist, 57*(3), 207–220, https://doi.org/10.1080/00461520.2022.2079128

Honebein, P. C., Reigeluth, C. M. (2021). To prove or improve, that is the question: The resurgence of comparative, confounded research between 2010 and 2019. *Educational Technology Research and Development, 69*, 465–496. https://doi.org/10.1007/s11423-021-09988-1

Ifenthaler, D. (2010). Learning and Instruction in the Digital Age. In J. M. Spector, D. Ifenthaler, P. Isaias, Kinshuk, & D. G. Sampson (Eds.), *Learning and Instruction in the Digital Age* (pp. 3–10). Springer. https://doi.org/10.1007/978-1-4419-1551-1_1

Jordan, K., & Goshtasbpour, F. (2022). JIME Virtual Special Collection – 2012 to 2022: The Decade of the MOOC. *Journal of Interactive Media in Education, 2022*(1), 1. https://doi.org/10.5334/jime.757

Kasch, J., van Rosmalen, P., & Kalz, M. (2017). A Framework towards Educational Scalability of Open Online Courses. *Journal of Universal Computer Science*, *23*(9), 845–867. https://doi.org/10.3217/JUCS-023-09-0845

Kasch, J., Van Rosmalen, P., & Kalz, M. (2021). Educational scalability in MOOCs: Analysing instructional designs to find best practices. *Computers & Education, 161, 104054*,1–12. https://doi.org/10.1016/j.compedu.2020.104054

King, I., & Lee, W. I. (2023). *A Decade of MOOCs and Beyond: Platforms, Policies, Pedagogy, Technology, and Ecosystems with an Emphasis on Greater China*. Springer. https://doi.org/10.1007/978-3-031-15241-2

Kizilcec, R. F., Saltarelli, A. J., Reich, J., & Cohen, G. L. (2017). Closing global achievement gaps in MOOCs: Brief interventions address social identity threat at scale. *Science, 355*(6322), 251–252. https://doi.org/10.1126/science.aag2063

Klahr, D. (2019). Learning Sciences Research and Pasteur's Quadrant. *Journal of the Learning Sciences, 28*(2), 153–159. https://doi.org/10.1080/10508406.2019.1570517

Knox, J. (2017). Massive Open Online Courses (MOOCs). In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1372–1378). Springer. https://doi.org/10.1007/978-981-287-588-4_219

Kögler, K., Egloffstein, M., & Schönberger, B. (2020). Openness in MOOCs for training and professional development – An exploration of entry and participation barriers. In E. Wuttke, J. Seifried, & H. M. Niegemann (Eds.), *Vocational education and training in the age of digitization: Challenges and opportunities* (pp. 205–223). Barbara Budrich. https://doi.org/10.3224/84742432

Lambert, S. R. (2020). Do MOOCs contribute to student equity and social inclusion? A systematic review 2014–18. *Computers & Education, 145*, 103693. https://doi.org/10.1016/j.compedu.2019.103693

Lee, S., & Chung, J. Y. (2019). Lessons learned from two years of K-MOOC experience. *Educational Media International, 56*(2), 134–148. https://doi.org/10.1080/09523987.2019.1614245

Martindale, T. (2015). Massive Open Online Courses. In J. M. Spector (Ed.), *Encyclopedia of Educational Technology* (pp. 486–488). SAGE. https://doi.org/10.4135/9781483346397

McKenney, S., & Reeves, T. C. (2021). Educational design research: Portraying, conducting, and enhancing productive scholarship. *Medical Education, 55*(1), 82–92. https://doi.org/10.1111/medu.14280

Meaney, M., & Fikes, T. (2023). The Promise of MOOCs Revisited? Demographics of Learners Preparing for University. *Journal of Learning Analytics, 10*(1), 113–132. https://doi.org/10.18608/jla.2023.7807

Molenda, M. H. (2023). History and Development of Instructional Design and Technology. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 57–74). Springer. https://doi.org/10.1007/978-981-19-2080-6_4

Moore, R. L., & Blackmon, S. J. (2022). From the learner's perspective: A systematic review of MOOC learner experiences (2008–2021). *Computers & Education 190*, 104596. https://doi.org/10.1016/j.compedu.2022.104596

Pappano, L. (2012, November 13). *The Year of the MOOC*. The New York Times.

Park, S. (2021). MOOCs in the workplace: An intervention for strategic human resource development. *Human Resource Development International, 24*(3), 329. https://doi.org/10.1080/13678868.2018.1516062

Paton, R. M., Fluck, A. E., & Scanlan, J. D. (2018). Engagement and retention in VET MOOCs and online courses: A systematic review of literature from 2013 to 2017. *Computers & Education, 125*, 191–201. https://doi.org/10.1016/j.compedu.2018.06.013

Rampelt, F., & Bernd, M. (2021). AI Campus – Co-Creating Instructional Design Standards for an Open AI Learning Ecosystem. *Proceedings EDULEARN21*, 8373. https://doi.org/10.21125/edulearn.2021.1693

Ramsey, J. L., & West, R. E. (2023). A recent history of learning design and technology. *TechTrends, 67*(11), 781–791. https://doi.org/10.1007/s11528-023-00883-5

Reeves, T. C., & Oh, E. G. (2017). The goals and methods of educational technology research over a quarter century (1989–2014). *Educational Technology Research and Development, 65*, 325–339. https://doi.org/10.1007/s11423-016-9474-1

Reich, J. (2020a). *Failure to disrupt. Why technology alone can't transform education*. Harvard University Press.

Reich, J. (2020b). Two Stances, Three Genres, and Four Intractable Dilemmas for the Future of Learning at Scale. *Proceedings of the Seventh ACM Conference on Learning @ Scale (L@S '20)* (pp. 3–13). Association for Computing Machinery. https://doi.org/10.1145/3386527.3405929

Reich, J. (2022). Learning Analytics and Learning at Scale. In C. Lang, A. F. Wise, A. Merceron, D. Gašević, & G. Siemens (Eds.), *Handbook of Learning Analytics* (2nd ed., pp. 188–195). Society for Learning Analytics Research. https://doi.org/10.18608/hla22.018

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science, 363*(6423), 130–131. https://doi.org/10.1126/science.aav7958

Reiser, R. A. (2001). A history of instructional design and technology: Part I: A history of instructional media. *Educational Technology Research and Development, 49*(1), 53–64. https://doi.org/10.1007/BF02504506

Renz, J., Schwerer, F., & Meinel, C. (2016). openSAP: Evaluating xMOOC Usage and Challenges for Scalable and Open Enterprise Education. *International Journal of Advanced Corporate Learning, 9*(2), 34–39. https://doi.org/10.3991/ijac.v9i2.6008

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). https://doi.org/10.19173/irrodl.v16i6.2033

Ruipérez-Valiente, J. A., Staubitz, T., Jenner, M., Halawa, S., Zhang, J., Despujol, I., Maldonado-Mahauad, J., Montoro, G., Peffer, M., Rohloff, T., Lane, J., Turro, C., Li, X., Pérez-Sanagustín, M., & Reich, J. (2022). Large-scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions. *Computers & Education, 180*, 104426. https://doi.org/10.1016/j.compedu.2021.104426

Semenova, T., Vilkova, K., & Shcheglova, I. (2018). The MOOC market: Prospects for Russia. *Educational Studies Moscow, 2018*(2), 173–197. https://doi.org/10.17323/1814-9545-2018-2-173-197

Seifried, J., Sembill, D., Nickolaus, R., & Schelten, A. (2005). Analysen systemischer Wechselwirkungen beruflicher Bildungsprozesse: Forschungsstand und Forschungsperspektiven beruflicher Bildung. [Analyses of systemic interactions in vocational education processes: State of research and research perspectives in vocational education]. *Zeitschrift für Berufs- und Wirtschaftspädagogik, 101*(4), 229–245.

Seufert, S. (2013). *Bildungsmanagement* [Educational Management]. Schäffer-Poeschel.

Shah, D. (2020, February 4). *Capturing the Hype: Year of the MOOC Timeline Explained*. Class Central. https://www.classcentral.com/report/mooc-hype-year-1/

Shah, D. (2021, December 14). *A Decade of MOOCs: A Review of MOOC Stats and Trends in 2021*. Class Central. https://www.classcentral.com/report/moocs-stats-and-trends-2021

Shah, D. (2023, January 2). *2022 Year in Review: The "New Normal" that Wasn't.* Class Central. https://www.classcentral.com/report/2022-year-in-review/

Stich, A. E., & Reeves, T. D. (2017). Massive open online courses and underserved students in the United States. *The Internet and Higher Education, 32*, 58–71. https://doi.org/10.1016/j.iheduc.2016.09.001

Stokes, D. E. (1997). *Pasteur's quadrant: Basic science and technological innovation.* Brookings Institution Press.

Storme, T., Vansieleghem, N., Devleminck, S., Masschelein, J., & Simons, M. (2016). The emerging pedagogy of MOOCs, the educational design of technology and practices of study. *Journal of Computers in Education, 3*(3), 309–328. https://doi.org/10.1007/s40692-016-0070-5

Stracke, C. M., Downes, S., Conole, G., & Burgos, D. (2019). Are MOOCs Open Educational Resources? A literature review on history, definitions, and typologies of OER and MOOCs. *Open Praxis, 11*(4), 331–341. https://doi.org/10.5944/openpraxis.11.4.1010

United Nations Educational, Scientific and Cultural Organization. (2022, May). *Higher education global data report (Working Document).* A contribution to the 3rd UNESCO World Higher Education Conference. https://unesdoc.unesco.org/ark:/48223/pf0000389859

Van de Oudeweetering, K., & Agirdag, O. (2018). MOOCs as Accelerators of Social Mobility? A Systematic Review. *Educational Technology & Society, 21*(1), 1–11. https://doi.org/10.30191/ETS.201801_21(1).0001

Weller, M. (2018). Twenty Years of EdTech. *Educause Review, 53*(4), 34–48.

Wiley, D. (2015). The MOOC Misstep and the Open Education Infrastructure. In C. J. Bonk, M. M. Lee, T. C. Reeves, & T. H. Reynolds (Eds.), *MOOCs and Open Education Around the World* (pp. 3–11). Routledge.

Yuan, L., & Powell, S. (2015). Partnership Model for Entrepreneurial Innovation in Open Online Learning. *eLearning Papers, 41*, 1–9.

Zawacki-Richter, O., & Jung, I. (2023). Shaping the Field of Open, Distance, and Digital Education. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 3–12). Springer. https://doi.org/10.1007/978-981-19-2080-6_94

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), 242–259. https://doi.org/10.19173/irrodl.v19i1.3356

Zawacki-Richter, O., Conrad, D., Bozkurt, A., Aydin, C. H., Bedenlier, S., Jung, I., Stöter, J., Veletsianos, G., Blaschke, L. M., Bond, M., Broens, A., Bruhn, E., Dolch, C., Kalz, M., Kerres, M., Kondakci, Y, Marin, V., Mayrberger, K., Müskens, W., … , Xiao, J. (2020). Elements of Open Education: An Invitation to Future Research. *The International Review of Research in Open and Distributed Learning, 21*(3), 319–334. https://doi.org/10.19173/irrodl.v21i3.4659

Zhu M., Sari A. R., Lee M. M. (2020). A comprehensive systematic review of MOOC research: Research techniques, topics, and trends from 2009 to 2019. *Educational Technology Research and Development*, 68(4), 1685–1710. https://doi.org/10.1007/s11423-020-09798-x

2 Conceptual Foundations

2.1 Massive Open Online Courses

2.1.1 Characteristics and Variations

Massive Open Online Courses (MOOCs) are online courses with free and open registration that allow for large participant groups over the Internet (Daniel, 2012; Ifenthaler et al., 2015; Knox, 2017; Martindale, 2015; Tu & Sujo-Montes, 2015). While capturing the essential elements, this brief definition reflects only a narrow conceptual consensus, as MOOCs show significant diversity in terms of content and format (Bonk, Lee, et al., 2018). The acronym MOOC can be interpreted as follows (Blackmon & Major, 2017):

Massive: denotes the scale of student participation, with enrollment figures varying from several hundred (where 1000 enrollments often serve as a typical 'key performance indicator' in corporate settings) to hundreds of thousands of participants. Against this backdrop, MOOCs are regarded as one of the most prominent ways to facilitate learning at scale (Joksimović et al., 2018; Kasch et al., 2017). On the flip side, there have been contrary developments in the form of Small Private Online Courses (SPOCs), which characterize smaller online courses involving more online interaction, especially feedback and tutoring (Fox, 2013).

Open: The concept of openness in education is subject to ongoing debates (Baker, 2017). With regard to MOOCs, the term "open" can refer to various dimensions, such as open access to materials, free-of-charge courses, transparency regarding tools and platforms, minimal prerequisites, or adherence to open educational practices. MOOCs commonly offer open access to course materials, though they may not always be free of charge. Additional services like tutoring or certification often come with associated costs. The interpretation of openness appears to be a fundamental distinction among various MOOC initiatives and approaches. (Knox, 2017). For MOOCs in training and professional development, evidence points towards a reduced concept of openness (Kögler et al., 2020).

Online: MOOC content is delivered via the Internet, constituting the fundamental aspect shared across various definitions. Nevertheless, there have been approaches to

blending and mixing MOOC technologies with face-to-face pedagogies right from the beginning (Delgado Kloos et al., 2015).

Course: relates to the concept of an academic course spanning several weeks (typically between four and twelve), with a syllabus, an instructor, lectures, readings, tutoring, feedback and both formative and summative assessments. Although many MOOCs lack some of those typical components (e.g., timely and informative feedback, meaningful assessments, individual tutoring), they should not be considered ordinary courses (Spector, 2017).

Within the historical lines of development, two paradigmatic MOOC approaches have emerged, each based on different aims and pedagogical ideas: connectivist MOOCs (cMOOCs) in the CCK08 tradition and extended MOOCs (xMOOCs) following the Stanford model (Tu & Sujo-Montes, 2015).

cMOOCs prioritize the creation of engaging and collaborative learning settings, emphasizing interactive elements. They promote active participation through discussions, social networking, content creation, and fostering creativity. In line with the suggested autonomy in educational goals, these courses substitute conventional assessments, such as Multiple-Choice formats, with constructivist assignments that better align with their philosophy. Guided by the theory of connectivism (Ifenthaler & Schumacher, 2016a), cMOOCs assert that knowledge is formed within networks that have to be navigated.

On the contrary, xMOOCs align with traditional behavioral-cognitivist theories regarding instruction as a transfer of knowledge. These courses focus on delivering content and assessing comprehension. The main components of xMOOCs are lecture videos, integrated quizzes, brief tests, and supplementary written materials. While some degree of cooperation and collaboration may be integrated, they do not take a central role. Table 2-1 shows a further comparison of the two paradigmatic approaches according to design criteria (Egloffstein, 2018; Kalz & Specht, 2013; Tu & Sujo-Montes, 2015):

Table 2-1

cMOOCs and xMOOCs Compared

Criterion	cMOOC	xMOOC
Learning design approach	Open design (not fixed), emerging activities	Fixed design, repeated activities
Interaction types	Focus on learner-learner interaction	Focus on learner-content interaction
Content structure	Content as a starting point, learners are expected to create/extend and share Content is fragmented (not bound to a course) Learners are expected to identify additional content	Formal course structure and flow Defined content Formal, structured content provision Learners are expected to master what they are taught
Teaching mode	Distributed multi-space interactions Personal sense-making through artifact creation and sharing	Instructor-lead Lecture-based instructions
Communication	Distributed, often blog-based, learner created-forums and spaces	Centralized discussion forums, if any
Assessment	Assignments, papers, create artifacts Instructor grading Primary peer evaluations	Quizzes, tests, assignments, create artifacts Automated grading Supplementary peer evaluations

While this ideal-typical categorization was applicable to the initial course models, the distinctions between xMOOCs and cMOOCs have become increasingly blurred over time as social learning and lecture-based approaches are being combined (Crosslin & Wakefield, 2016; Loizzo & Ertmer, 2016). More importantly, cMOOCs play a subordinate role in the current discussion. Currently, MOOCs are commonly associated with the xMOOC concept of video-based self-learning environments (Reich & Ruipérez-Valiente, 2019).

2.1.2 Technological Basis

Just as the current idea of MOOCs primarily refers to the xMOOC concept, it is primarily MOOC platforms when it comes to MOOC technology. While cMOOCs leverage a range of readily accessible internet tools and social networking services, xMOOCs, on the other hand, utilize platforms, i.e., proprietary Learning Management Systems specifically tailored for video-based instruction, large user groups, and scalability. In general, the current MOOC platforms operate similarly, with subtle differences and individual strengths and weaknesses (Oktavia et al., 2018). Table 2-2 summarizes typical features of traditional MOOC platforms (Egloffstein, 2018).

Platforms strongly influence what is done pedagogically (Blackmon & Major, 2017) and shape the organizational roles and the division of labor between the stakeholders in the design process (Kelkar, 2017). However, it is hard to determine exactly the influence of the underlying MOOC platform on instructional design, as other factors, such as the basic approaches to teaching and learning of course designers and facilitators, have to be taken into account. Nevertheless, pedagogical aspects should always be considered when deciding on a certain MOOC platform (Egloffstein, 2018).

Table 2-2

Typical Features of MOOC Platforms

Feature	Functions	Relevance for the learning process
Course catalogue	Overview on courses, aims, programs	Supports setting of personal learning goals Enables choice of adequate level of difficulty
Video player	Different video formats Captions, transcripts Adjustable speed In-video quizzes	Delivers knowledge through multimedia content Enables different access paths, barrier-free access
Assessment module	Different types of assessments From simple to complex Automated grading	Enables training of acquired knowledge and skills Enables learning transfer Enables adequate assessment formats in line with learning goals (constructive alignment)
Forum system	M:N communication Search function Filtering of posts Structuring of threads Commenting & rating	Enables communication and collaboration
Database for learning materials	Storing of learning objects	Provides learning resources
Progress bar	Display of personal learning path and results	Supports self-directed learning within the course (process view)
Personal dashboard	Display of courses, certificates, personal development Link to career websites Badges as micro-credentials	Supports self-directed learning over several courses (product view) Motivation through display of achievements
Feedback functions	Polls Surveys	Enables formative feedback on the learning process
Announcements	1:N communication News section Bulk-mailing function	Provide structures and scaffolds for the learning process
Course authoring environment	Enables structuring of contents Displays all relevant materials Easy to use Content exchange over units and courses, design for reuse	Enables the implementation of a pedagogically sound learning environment
Course management environment	Analytics dashboard Data dumps Metrics Reports	Provides information to instructors and tutors for individual and/or collective feedback and pedagogical interventions
Mobile client	Provides mobile access	Enables flexible mobile learning

2.1.3 Design Aspects

The design of learning environments describes the systematic analysis, planning, development, implementation, and evaluation of physical or virtual settings where learning takes place (Ifenthaler, 2012). Respective theoretical approaches are evolving, transitioning from instructional design (Branch, 2009) to learning design (Law, 2017) to learning experience design (Schmidt & Huang, 2022), while the associated shifts in meaning and their implications have not yet been conclusively clarified (Reigeluth & An, 2023; Wasson & Kirschner, 2020). Likewise, the absence of a definitive ontology in the field contributes to ambiguity in the utilization of terms like theory, framework, model, approach, principle, method, pattern, etc. Design itself is a multifaceted concept (Gibbons, 2014), encompassing both the process of designing and its outcomes. Nevertheless, there is broad consensus that design is critical in online learning, and as a result, a multitude of approaches have been developed to date (Martin & Bolliger, 2023; Seel et al., 2017).

From a pragmatist perspective, the design of an open online course is the arrangement of a set of design parameters confined by technical and organizational constraints (Stracke, 2019), guided by overarching instructional design models and, occasionally, supplemented by pedagogical frameworks. Technical parameters refer to the platform used and the functionalities provided by it. Organizational parameters refer to external specifications such as course scope, curricular integration, credits or workload, and the course delivery mode as a self-paced course without time restrictions or a session-based course with a fixed schedule. The latter significantly determines the scope of possible design decisions, as coordinated interactions with teachers and peers are only possible in session-based courses. In self-paced courses, teaching presence can be neglected." Pedagogical frameworks like, for example, problem-based learning (Verstegen et al., 2023) can convey a specific theoretical perspective on teaching and learning, along with the methods to implement it. Instructional design models, then, define the fundamental approach to the instructional design process and provide a description of the necessary process steps and the way they are organized (Branch & Kopcha, 2014). By far the most prominent and widespread instructional design model is the ADDIE (analysis, design, development, implementation, evaluation) framework (Branch, 2009; Stefaniak & Xu, 2020). Its phases are the major organizing principle in

most instructional design projects, making ADDIE an umbrella term for instructional design processes (Molenda, 2015). The generic ADDIE model has been used in various MOOC design projects (Buchem & Okatan, 2021; Trust & Pektas, 2017). In addition, numerous MOOC-specific guidelines or checklists have been outlined to describe educational design strategies and considerations (e.g., Conole, 2015), partly based on empirical findings (Hew, 2018; Yousef et al., 2014). Expanding the generic ADDIE model to incorporate MOOC-specific design considerations related to the dimensions of massiveness and openness provides a more comprehensive understanding of the design process (Sergis et al., 2017; Stracke et al., 2023). Most of these approaches are primarily descriptive and thus offer limited direct benefits for design practice. Prescriptive frameworks like the MOOC canvas (Alario-Hoyos et al., 2014) or MOOC design patterns (Warburton & Mor, 2015) try to mitigate this. However, the predominant drawback of all these approaches lies in their primary emphasis on design features without a strong pedagogical foundation. After all, the neglected role of pedagogy may be a central reason why the instructional design of MOOCs has been subject to substantial criticism (Spector, 2017; Schulmeister, 2014; Tu & Sujo-Montes, 2015). Newer pedagogically grounded prescriptive design models attempt to counter this and meet the various challenges associated with the design of MOOCs (V. Shah et al., 2022).

2.2 MOOCs in Professional Learning and Development

2.2.1 Domain and Use Cases

Professional learning and development "is concerned with the processes through which professionals or future professionals acquire, maintain or update their personal capacities to adequately deal with tasks and problems at their current or future workplaces" (Goller et al., 2022, p. 1). Professional learning and development can take place in a range of educational contexts, such as Higher Education, Vocational Education and Training (VET), adult and continuing education, and lifelong learning. Professional learning and development also includes training and workplace learning in its various forms, i.e., formal or informal learning that occurs for, at, or through work (Billet, 2022; Tynjäla 2008, 2013). As technology-enhanced learning in the workplace (Van der Klink et al., 2013) and technology-enhanced professional learning (Littlejohn &

Margaryan, 2014) have become more and more important in recent years, MOOCs have found their way into digital workplace learning (Ifenthaler, 2018). While considered suitable for just-in-time learning (Littlejohn & Pammer-Schindler, 2022), MOOCs demand certain prerequisites from learners, such as the agency to learn online (Littlejohn, 2023) and digital competencies (Castaño-Muñoz et al., 2017). Therefore, MOOCs are especially suitable for IT-enhanced strategies (W. C. Lee & Tan, 2023) of knowledge workers or in knowledge-intensive domains. Examples include teacher professional development (Castaño-Muñoz et al., 2018; Laurillard, 2016), business and management (Cho et al., 2022; Wei & Taecharungroj, 2022), and medicine and health care (V. Anderson et al., 2020; C. Milligan & Littlejohn, 2016).

In the context of work-related learning, MOOCs can be denoted as 'professional development MOOCs' (Bonk, Lee, et al., 2018). Implemented in the context of a business organization, those courses are referred to as Corporate MOOCs (COOCs). COOCs typically adhere to the academic xMOOC format but exhibit variations in several aspects (Egloffstein & Ifenthaler, 2017): (a) They are predominantly restricted to employees, (b) their accessibility is confined to within the organization, (c) they may incorporate additional instructional elements, and (d) they may feature custom-built company content. Enterprise MOOCs can be seen as an extension of this concept (Schwerer & Egloffstein, 2016): While primarily delivering company-specific knowledge and content, they transcend organizational boundaries by making these resources available to relevant stakeholders such as suppliers, customers, government, and administration, and the general public.

2.2.2 Corporate Implementation

According to Dodson et al. (2015), the fundamental strategies for integrating MOOCs into corporate training and development involve exploiting existing MOOCs, utilizing MOOCs as a means to showcase company offerings, and introducing MOOC-like solutions by building upon existing corporate training frameworks. Once the decision to integrate MOOCs into digital workplace learning has been made, three primary approaches emerge, given the array of options provided by MOOC providers (Egloffstein, 2018).

1. Use existing MOOCs, programs, credentials: Training and development department selects MOOCs or series of MOOCs out of existing programs and advises employees to take part (*curating approach*).
2. Develop corporate courses: Training and development department selects education service provider to develop COOCs for company training jointly (*partnering approach*).
3. Build up an own MOOC infrastructure: the company builds up and/or manages an own MOOC platform and the corresponding resources, creates and delivers contents and implements courses (*creating approach*).

Implications of this make-or-buy decision are summarized in Table 2-3 (Egloffstein, 2018).

Table 2-3

Approaches for Implementing MOOCs in Corporate Contexts

	'Curating': Use Existing Offerings	'Partnering': Develop Corporate Courses	'Creating': Build Infrastructure
Control over access	Low No exclusive rights for company members, anyone can take part	High Company can decide who to take part; tailored offerings for special user groups	High Company can decide whether to implement COOCs or courses for wider audiences
Control over content	Low Content is developed by MOOC provider or academic partner	Medium Content is developed jointly, maybe with academic partner	Very High Content is developed and owned by the company
Content fit	Low to Medium Content is general, on a rather academic level	High Content is specifically tailored to the company's needs	Very High Company can decide what content to implement
Costs	Low	Medium to High	Very High
Benefits	Professional training at very low costs; View from the outside; Link to cutting-edge academic knowledge and practices; High flexibility	Good fit by specially designed training programs; Opportunity to quickly react to training needs	Opportunity to act as an education service provider on the market; Opportunity to implement Enterprise MOOCs; Complete control

2.3 Summary

MOOCs serve as the primary technology for implementing open online learning. Currently, MOOCs are commonly associated with the xMOOCs approach, typically implemented as video-based self-learning environments with quizzes. As per the innovation level matrix for technology-supported learning by Seufert (2013), MOOCs can be attributed to low scores in both technological and pedagogical dimensions. MOOC design is grounded in traditional models such as ADDIE, complemented by MOOC-specific design parameters. Most existing design frameworks are only loosely connected to pedagogy. MOOCs have become established in professional learning and development and digital workplace learning but are tied to specific learner requirements such as digital competencies. With Corporate MOOCs and Enterprise MOOCs, special implementations have emerged in business organizations.

References

Alario-Hoyos, C., Pérez-Sanagustín, M., Cormier, D., & Delgado-Kloos, C. (2014). Proposal for a Conceptual Framework for Educators to Describe and Design MOOCs. *Journal of Universal Computer Science, 20*(1), 6–23. https://doi.org/10.3217/jucs-020-01-0006

Anderson, V., Gifford, J., & Wildman, J. (2020). An evaluation of social learning and learner outcomes in a massive open online course (MOOC): A healthcare sector case study. *Human Resource Development International, 23*(3), 208–237. https://doi.org/10.1080/13678868.2020.1721982

Baker, F. W. (2017). An alternative approach: Openness in education over the last 100 years. *TechTrends, 61*, 130–140. https://doi.org/10.1007/s11528-016-0095-7.

Billett, S. (2022). Learning in and Through Work: Positioning the Individual. In C. Harteis, D. Gijbels, & E. Kyndt (Eds.), *Research Approaches on Workplace Learning* (pp. 157–175). Springer, Cham. https://doi.org/10.1007/978-3-030-89582-2_7

Blackmon, S. J., & Major, C. H. (2017). Wherefore art thou MOOC?: Defining massive open online courses. *Online Learning Journal, 21*(4), 195–221. https://doi.org/10.24059/olj.v21i4.1272

Bonk, C. J., Lee, M. M., Reeves, T. C., & Reynolds, T. H. (2018). The emergence and design of massive open online courses. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design & technology* (4th Ed., pp. 250–258). Pearson.

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Branch, R. M., & Kopcha, T. J. (2014). Instructional Design Models. In J. M. Spector, M. D. Merrill, J. Elen, & M. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 77–87). Springer. https://doi.org/10.1007/978-1-4614-3185-5_7

Buchem, I., & Okatan, E. (2021). Using the ADDIE Model to Produce MOOCs: Experiences from the Oberred Project. In C. Meinel, T. Staubitz, S. Schweiger, C. Friedl, J. Kiers, M. Ebner, A. Lorenz, G. Ubachs, C. Mongenet, J. A. Ruipérez, M. C. Mendez, A. Merceron, & K. von Schmieden (Eds.), *Proceedings of EMOOCs 2021* (pp. 249–259). Universitätsverlag Potsdam.https://doi.org/10.25932/publishup-51030

Castaño-Muñoz, J., Kalz, M., Kreijns, K., & Punie, Y. (2018). Who is taking MOOCs for teachers' professional development on the use of ICT? A cross-sectional study from Spain. *Technology, Pedagogy and Education, 27*(5), 607–624. https://doi.org/10.1080/1475939X.2018.1528997

Castaño-Muñoz, J., Kreijns, K., Kalz, M., & Punie, Y. (2017). Does digital competence and occupational setting influence MOOC participation? Evidence from a cross-course survey. *Journal of Computing in Higher Education, 29*(1), 28–46. https://doi.org/10.1007/s12528-016-9123-z

Cho, M. H., Yang, T., Niu, Z., & Kim, J. K. (2022). Investigating what learners value in marketing MOOCs: A content analysis. *Journal of Computing in Higher Education*. Advance online publication. https://doi.org/10.1007/s12528-022-09347-w

Conole, G. (2015). Designing effective MOOCs. *Educational Media International, 52*(4), 239–252. https://doi.org/10.1080/09523987.2015.1125989

Crosslin, M., & Wakefield, J. S. (2016). What's Cooking in the MOOC Kitchen: Layered MOOCs. *TechTrends, 60*, 98–101. https://doi.org/10.1007/s11528-016-0036-5

Daniel, J. (2012). Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility. *Journal of Interactive Media in Education, 2012*(3), Art. 18. https://doi.org/10.5334/2012-18

Delgado Kloos, C., Muñoz-Merino, P. J., Alario-Hoyos, C., Estévez Ayres, I., & Fernández-Panadero, C. (2015). Mixing and blending MOOC technologies with face-to-face pedagogies. *Proceedings of the 2015 IEEE Global Engineering Education Conference (EDUCON)* (pp. 967–971). Tallinn, Estonia. https://doi.org/10.1109/EDUCON.2015.7096090

Dodson, M. N., Kitburi, K., & Berge, Z. L. (2015). Possibilities for MOOCs in Corporate Training and Development. *Performance Improvement, 54*(10), 14–21. https://doi.org/10.1002/pfi.21532

Egloffstein, M. (2018). Massive open online courses in digital workplace learning: Current state and future perspectives. In D. Ifenthaler (Ed.), *Digital workplace learning: Bridging formal and informal learning with digital technologies* (pp. 149–166). Springer. https://doi.org/10.1007/978-3-319-46215-8

Egloffstein, M., & Ifenthaler, D. (2017). Employee Perspectives on MOOCs for Workplace Learning. *TechTrends, 61*(1), 65–70. https://doi.org/10.1007/s11528-016-0127-3

Fox, A. (2013). From MOOCs to SPOCs: Supplementing the classroom experience with small private online courses. *Communications of the ACM, 56*, 36–40. https://doi.org/10.1145/2535918

Gibbons, A. S. (2014). Eight Views of Instructional Design and What They Should Mean to Instructional Designers. In B. Hokanson & A. Gibbons (Eds.), *Design in Educational Technology* (pp. 15–36). Springer. https://doi.org/10.1007/978-3-319-00927-8_2

Goller, M., Kyndt, E., Paloniemi, S., & Damşa, C. (2022). Addressing Methodological Challenges in Research on Professional Learning and Development. In M. Goller, E. Kyndt, S. Paloniemi, & C. Damşa (Eds.), *Methods for Researching Professional Learning and Development* (pp. 1–16). Springer. https://doi.org/10.1007/978-3-031-08518-5_1

Hew, K. F. (2018). Unpacking the Strategies of Ten Highly Rated MOOCs: Implications for Engaging Students in Large Online Courses. *Teachers College Record, 120*(1), 1–40. https://doi.org/10.1177/016146811812000107

Ifenthaler, D. (2012). Design of Learning Environments. In N. M. Seel (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 929–931). Springer. https://doi.org/10.1007/978-1-4419-1428-6_186

Ifenthaler, D. (2018). How We Learn at the Digital Workplace. In D. Ifenthaler (Ed.), *Digital Workplace Learning* (pp. 3–8). Springer. https://doi.org/10.1007/978-3-319-46215-8_1

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (2015). Internet: Its impact and its potential for learning and instruction. In J. M. Spector (Ed.), *The SAGE encyclopedia of educational technology* (pp. 416–422). SAGE. https://doi.org/10.4135/9781483346397.n176

Ifenthaler, D., & Schumacher, C. (2016a). Connectivism. In S. Danver (Ed.), *The SAGE encyclopedia of online education* (pp. 242–244). SAGE. http://dx.doi.org/10.4135/9781483318332.n82

Joksimović, S., Poquet, O., Kovanović, V., Dowell, N., Mills, C., Gašević, D., Dawson, S., Graesser, A. C., & Brooks, C. (2018). How Do We Model Learning at Scale? A Systematic Review of Research on MOOCs. *Review of Educational Research, 88*(1), 43–86. https://doi.org/10.3102/0034654317740335

Kalz, M., & Specht, M. (2013). *If MOOCs are the answer, did we ask the right questions? Implications for the design of large-scale online courses.* Working paper 2013/25. Maastricht School of Management.

Kasch, J., van Rosmalen, P., & Kalz, M. (2017). A Framework towards Educational Scalability of Open Online Courses. *Journal of Universal Computer Science*, *23*(9), 845–867. https://doi.org/10.3217/JUCS-023-09-0845

Kelkar, S. (2018). Engineering a platform: The construction of interfaces, users, organizational roles, and the division of labor. *New Media & Society*, *20*(7), 2629–2646. https://doi.org/10.1177/1461444817728682

Knox, J. (2017). Massive Open Online Courses (MOOCs). In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1372–1378). Springer. https://doi.org/10.1007/978-981-287-588-4_219

Kögler, K., Egloffstein, M., & Schönberger, B. (2020). Openness in MOOCs for training and professional development – An exploration of entry and participation barriers. In E. Wuttke, J. Seifried, & H. M. Niegemann (Eds.), *Vocational education and training in the age of digitization: Challenges and opportunities* (pp. 205–223). Barbara Budrich. https://doi.org/10.3224/84742432

Laurillard, D. (2016). The educational problem that MOOCs could solve: professional development for teachers of disadvantaged students. *Research in Learning Technology, 24*. https://doi.org/10.3402/rlt.v24.29369

Law, N. (2017). Instructional design and learning design. In L. Lin & J. M. Spector (Eds.), *The sciences of learning and instructional design. Constructive articulation between communities* (pp. 186-201). Routledge.

Lee, W.C., & Tan, B.C.Y. (2023). Workplace learning strategies, enablers, and challenges in the context of digital innovation. *Journal of Workplace Learning, 35*(2), 192–209. https://doi.org/10.1108/JWL-04-2022-0045

Littlejohn, A. (2023). Challenges of Digital Professional Learning: Digital Technology Systems Are No Substitute for Human Agency. In K. Evans, W. O. Lee, J. Markowitsch, & M. Zukas (Eds.), *Third International Handbook of Lifelong Learning* (pp. 1201–1218). Springer. https://doi.org/10.1007/978-3-031-19592-1_56

Littlejohn, A., & Margaryan, A. (2014). Technology-Enhanced Professional Learning. In S. Billett, C. Harteis, & H. Gruber (Eds.), *International Handbook of Research in Professional and Practice-based Learning* (pp. 1187–1212). Springer. https://doi.org/10.1007/978-94-017-8902-8_43

Littlejohn, A., & Pammer-Schindler, V. (2022). Technologies for Professional Learning. In C. Harteis, D. Gijbels, & E. Kyndt (Eds.), *Research Approaches on Workplace Learning* (pp. 321–346). Springer. https://doi.org/10.1007/978-3-030-89582-2_15

Loizzo, J., & Ertmer, P. A. (2016). MOOCocracy: The learning culture of massive open online courses. *Educational Technology Research & Development, 64*(6), 1013–1032. https://doi.org/10.1007/s11423-016-9444-7

Martin, F., & Bolliger, D. U. (2023). Designing Online Learning in Higher Education. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 1217–1236). Springer. https://doi.org/10.1007/978-981-19-2080-6_72

Martindale, T. (2015). Massive Open Online Courses. In J. M. Spector (Ed.), *Encyclopedia of Educational Technology* (pp. 486–488). SAGE. https://doi.org/10.4135/9781483346397

Milligan, C., & Littlejohn, A. (2016). How health professionals regulate their learning in massive open online courses. *The Internet and Higher Education, 31*, 113–121. https://doi.org/10.1016/j.iheduc.2016.07.005

Molenda, M. (2015). In Search of the Elusive ADDIE Model. *Performance Improvement, 54*(2), 40–42. https://doi.org/10.1002/pfi.21461

Oktavia, T., Prabowo, H., Meyliana, & Supangkat, S. H. (2018). The Comparison of MOOC (Massive Open Online Course) Platforms of edX and Coursera (Study Case: Student of Programming Courses). *Proceedings of the 2018 International Conference on Information Management and Technology (ICIMTech)* (pp. 339–344). https://doi.org/10.1109/ICIMTech.2018.8528178.

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science, 363*(6423), 130-131. https://doi.org/10.1126/science.aav7958

Reigeluth, C. M., & An, Y. (2023). What's the Difference Between Learning Experience Design and Instructional Design? *The Journal of Applied Instructional Design, 12*(3). https://doi.org/10.59668/515.12897

Schmidt, M., & Huang, R. (2022). Defining Learning Experience Design: Voices from the Field of Learning Design & Technology. *TechTrends, 66*(2), 141–158. https://doi.org/10.1007/s11528-021-00656-y

Schulmeister, R. (2014). The position of xMOOCs in educational systems. *eleed, 10*(1). https://www.eleed.de/archive/10/4074

Seel, N. M., Blumschein, P., Lehmann, T., & Podolskiy, O. (2017). *Instructional Design for Learning – Theoretical Foundations*. Sense. https://doi.org/10.1007/978-94-6300-941-6

Sergis, S., Sampson, D. G., & Pelliccione, L. (2017). Educational Design for MOOCs: Design Considerations for Technology-Supported Learning at Large Scale. In M. Jemni, Kinshuk, & M. K. Khribi (Eds.), *Open Education: from OER to MOOCs* (pp. 39–71). Springer. https://doi.org/10.1007/978-3-662-52925-6_3

Seufert, S. (2013). *Bildungsmanagement* [Educational Management]. Schäffer-Poeschel.

Shah, V., Murthy, S., Warriem, J., Sahasrabudhe, S., Banerjee, G., & Iyer, S. (2022). Learner-centric MOOC model: A pedagogical design model towards active learner participation and higher completion rates. *Educational Technology Research and Development*, 70(1), 263–288. https://doi.org/10.1007/s11423-022-10081-4

Spector, J. M. (2017). A Critical Look at MOOCs. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open Education: from OERs to MOOCs* (pp. 135–147). Springer. https://doi.org/10.1007/978-3-662-52925-6_7

Stefaniak, J., & Xu, M. (2020). An Examination of the Systemic Reach of Instructional Design Models: a Systematic Review. *TechTrends, 64*(6), 710–719. https://doi.org/10.1007/s11528-020-00539-8

Stracke, C. M. (2019). The Quality Reference Framework for MOOC Design. In M. Scheffel, J. Broisin, V. Pammer-Schindler, A. Ioannou, & J. Schneider (Eds.), *Transforming Learning with Meaningful Technologies. EC-TEL 2019*. LCNS, Vol. 11722 (pp. 673–677). Springer. https://doi.org/10.1007/978-3-030-29736-7_64

Stracke, C. M., Burgos, D., & Tlili, A. (2023). Instructional Quality and Learning Design of Massive Open Online Courses. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 1391–1412). Springer. https://doi.org/10.1007/978-981-19-2080-6_95

Trust, T., & Pektas, E. (2018). Using the ADDIE Model and Universal Design for Learning Principles to Develop an Open Online Course for Teacher Professional Development. *Journal of Digital Learning in Teacher Education, 34*(4), 219–233. https://doi.org/10.1080/21532974.2018.1494521

Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research Review, 3*(2), 130–154. https://doi.org/10.1016/j.edurev.2007.12.001

Tynjälä, P. (2013). Toward a 3-P Model of Workplace Learning: A Literature Review. *Vocations and Learning, 6*, 11–36. https://doi.org/10.1007/s12186-012-9091-z

Van der Klink, M., Drachsler, H., & Sloep, P. (2013). Technology-enhanced learning in the workplace. In D.Derks, & A. Bakker (Eds.), *The Psychology of Digital Media at Work* (pp. 145–165). Psychology Press.

Verstegen, D., Spruijt, A., Fonteijn, H., & van Merriënboer, J. (2023). MOOCs and Problem-Based Learning: A Happy Marriage? In S. Goundar (Ed.), *Massive Open Online Courses - Current Practice and Future Trends*. InTech Open. https://doi.org/10.5772/intechopen.1001472

Warburton, S., & Mor, Y. (2015). A set of patterns for the structured design of MOOCs. *Open Learning, 30*(3), 206–220. https://doi.org/10.1080/02680513.2015.1100070

Wasson, B., & Kirschner, P. A. (2020). Learning Design: European Approaches. *TechTrends, 64*(9), 815–827. https://doi.org/10.1007/s11528-020-00498-0

Wei, X., & Taecharungroj, V. (2022). How to improve learning experience in MOOCs an analysis of online reviews of business courses on Coursera. *The International Journal of Management Education, 20*(3), 100675. https://doi.org/10.1016/J.IJME.2022.100675

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2014). What Drives a Successful MOOC? An Empirical Examination of Criteria to Assure Design Quality of MOOCs. *Proceedings of the 2014 IEEE 14th International Conference on Advanced Learning Technologie*s (pp. 44–48). https://doi.org/10.1109/ICALT.2014.23.

3 Employee Perspectives on MOOCs for Workplace Learning

3.1 Introduction

In times of rapidly changing working environments, evolving job roles, and novel work practices, professional learning is becoming more and more important. With special regard to twenty-first-century competencies, learning for work must be a continual and highly individualized process (Eraut, 2000; Tynjälä, 2008) that can only partly be addressed in traditional training programs. Self-regulated learning at or near the workplace is gaining more and more importance, especially when formal and informal learning can be combined (Ertmer & Newby, 1996; Lehmann et al., 2014). Generally, contemporary workplace learning calls for a reconsideration of the form and design of learning environments, with a special focus on learning technologies (Noe et al., 2014). Against this background, Massive Open Online Courses (MOOCs) are considered a promising alternative in corporate learning, with a number of potential benefits, for example, in terms of scalability, flexibility, and adaptivity (Tu & Sujo-Montes, 2015). However, little is known about how MOOCs are perceived among the relevant stakeholders in the business context. Recent survey studies indicate that employers tend to be rather positive towards MOOCs (Radford et al., 2014) and that the open format is considered to be a specific trajectory in the corporate setting (Olsson, 2016). On the other hand, most employers are unaware of their employees' participation in MOOCs (Castaño-Muñoz et al., 2016). Thus, it might not be enough to just look at employers' attitudes to get the whole picture. When it comes to further exploring the acceptance of MOOCs for workplace learning, the employee perspective also has to be taken into account.

3.2 Digital Workplace Learning

The use of technology in professional learning can provide a plethora of solutions to support work and work-related learning activities (Littlejohn & Margaryan, 2014). For corporate organizations, digital technologies enable the implementation of customized learning environments, even on a small scale. Digital learning can be broadly defined as any set of technology-based methods and practices that can be applied to support

learning and instruction. Emerging opportunities for digital learning include game-based learning, simulations, social networks, learning analytics, mobile applications, or MOOCs (Ifenthaler et al., 2015). Access to digital technologies changes learning at the workplace by providing cost-effective delivery modes, easy-to-access learning resources, and flexible learning environments. For example, mobile tools can broaden the physical boundaries of the learning and working environment. Social media can provide participation in community building. Simulations and game-based learning solutions are (pseudo-)realistic and especially motivating methods for the acquisition of skills (Tynjälä et al., 2014). According to Brookshire et al. (2011), additional benefits for employees include flexibility and control over their learning experience; the ability to take extra time with more challenging material; a safer environment with less pressure than classroom learning; the ability to learn anytime, anywhere; and adaptability for a variety of learning styles and needs. Challenges for digital workplace learning, on the other hand, lie in characteristics of the design of the training or training system, specific workplace characteristics, and learners' dispositions, making the employee perspective even more important.

Currently, digital workplace learning is mostly implemented in the shape of formal learning environments (Noe et al., 2014). As learning at work commonly happens through social and intellectual actions that were not intentionally designed for learning, it supports pertinent activities like reflecting, interacting, collaborating, knowledge sharing, or networking in communities of practice where digital technologies can reach their full potential (Tynjälä et al., 2014). Hence, the real opportunity for digital technology in workplace learning is supporting informal learning and fostering enablers for lifelong learning. Despite the number of benefits identified, little research has been conducted on digital workplace learning and on how digital technologies can bridge formal and informal learning at the workplace.

3.3 Corporate MOOCs

MOOCs are online courses with free and open registration, allowing unlimited participation via the Internet. Two major categories of MOOCs are distinguished on the basis of their different pedagogies: connectivist MOOCs (cMOOCs) and extended

MOOCs (xMOOCS). cMOOCs focus on providing interactive learning environments, encouraging discussions, social networks, and blog engagement (e.g., Twitter, Facebook, YouTube, WordPress, Blogger), creativity, peer assessment, and autonomy of educational objectives. xMOOCs concentrate on a traditional cognitive-behaviorist approach of content delivery and knowledge transfer through lecture videos, integrated quizzes, and short tests (White, 2014).

MOOCs are a growing element in higher education. The advantage of reaching large numbers of learners worldwide is especially attractive for universities and institutions (Ifenthaler & Schumacher, 2016b). Class sizes usually range from a few hundred to one hundred thousand students enrolling in the courses provided by large universities via platforms like Coursera, edX, Udacity, and KhanAcademy (N. Li et al., 2015). Likewise, MOOCs offer a wide range of options for professional and lifelong learning (Kalz, 2015). They can be used to qualify people who did not have access to higher education before, as well as to provide employees with skills and qualifications relevant to their current jobs or for future career development.

Corporate MOOCs differ from academic MOOCs: (1) They are mostly limited to employees, (2) they are open only within the organization, (3) they may include face-to-face elements (e.g., discussions) if colleagues are co-located, and (4) they may include custom-built content if the topic requires it. From an HR perspective, corporate MOOCs can provide a flexible, scalable, and, therefore, cost-effective means of training that allows the contents to be tailored specifically to organizational needs.

3.4 Purpose of the Study

The potential of MOOCs for workplace learning has not yet been researched extensively. A recent study showed a relatively low awareness of MOOCs among employers. However, once the employers understood what they were, they identified potential for vocational education and workplace learning (Radford et al., 2014). Therefore, the purpose of this research is to further explore the acceptance of MOOCs for workplace learning. Specifically, this research focuses on the perspectives of employees with regard to motivation, credentials, and incentives related to participation in corporate MOOCs, leading to the following research questions:

RQ 1. For which learning purposes would employees use MOOCs?

RQ 2. Which MOOC topics are of interest to employees?

RQ 3. How important are credentials and incentives for employees when participating in MOOCs?

3.5 Method

3.5.1 Design and Participants

The study utilized a survey research design that considered the purpose of the study and the access to potential participants. The principal means of data collection was an online survey, which was conducted in April 2015.

In total, *N* = 119 employees (51 % female, 49 % male) participated. Their average age was 35.66 years (*SD* = 11.93, *Min* = 20, *Max* = 65). Thirteen percent were employed in a small enterprise, 30 % in a medium-sized enterprise, and 57 % in a large enterprise. Thirty-three percent were employed in the engineering industry, 16 % in the financial sector, 15 % in wholesale, 9 % in IT, 8 % in education, 3 % in public service, and 16 % in other sectors. Sixty-one percent of the participants reported an annual salary of up to 40,000 €, 33 % earned between 40,000 € and 80,000 €, and 6 % earned more than 80,000 € per year. The self-reported competencies for using computers and software in general (88 %) as well as Internet applications (85 %) were relatively high.

3.5.2 Instrument

The survey instrument was developed and validated by the researchers of this study. A pilot test was used to assess the accuracy and clarity of the instrument's items and instructions. Experts established content validity by reviewing the items and suggesting further improvements. The group of experts consisted of educational researchers with a specific focus on educational technology and workplace learning. The survey consisted of seven sections with acceptable reliability (see Table 3-1 for reliability coefficients): 1. ICT competencies (2 items), 2. Motivation to participate in MOOCs (4 items), 3. Online learning in the organization (5 items), 4. Credentials for participation in MOOCs (7 items), 5. Incentives for participation in MOOCs (5 items), 6. Interest in MOOC

topics (12 topics), and 7. Demographic information (7 items). Most items were answered on a five-point Likert scale (5 = strongly agree; 1 = strongly disagree). It took approximately 15 min to complete the survey. Table 3-1 shows examples of items for the seven sections of the survey instrument.

Table 3-1

Sample Items of the Survey Instrument (Translated From German)

Section	Item
ICT competencies 2 items Cronbach's alpha=.817	I feel competent using desktop applications. I find it easy to navigate the Internet.
Motivation to participate in MOOCs 4 items Cronbach's alpha=.709	I would like to participate in a MOOC for personal learning purposes. I would like to participate in a MOOC for professional learning purposes.
Online learning in the organization 5 items Cronbach's alpha=.589	My organization hosts an e-learning platform for workplace learning. I would rather use MOOCs than the organization's e-learning platform.
Credentials for participation 7 items Cronbach's alpha=.825	It is important to receive a certificate for participating in a MOOC. MOOC certificates reflect my knowledge and competencies.
Incentives for participation 5 items Cronbach's alpha=.631	A monetary bonus from my organization would motivate me to participate in MOOCs. Paid leave would motivate me to participate in MOOCs.
Interest in MOOC topics 12 topics Cronbach's alpha=.763	Topics included languages, presentation skills, career planning, management, etc.
Demographic information 7 items	What is your current position in the organization? How many employees does your organization have?

3.5.3 Data Analysis

All data stored data on the survey platform was anonymized, exported, and analyzed using SPSS V.22. Given the limited space allowed for this paper, not all data could be reported. Initial data checks showed that the distributions of ratings and scores satisfied the assumptions underlying the analysis procedures. All effects were assessed at the .05 level. Effect sizes were reported where appropriate.

3.6 Results

Since 2012, the N = 119 employees of this study had participated in *M* = 1.53 (*SD* = .76, *Min* = 1, *Max* = 4) MOOCs.

3.6.1 Learning Purpose of MOOCs (RQ1)

Table 3-2 shows descriptive statistics and zero-order correlations of learning purposes for using MOOCs: (1) personal, (2) social, (3) on the job, and (4) career development. A strong positive correlation was found between on-the-job (*M* = 4.28, *SD* = .82) learning purpose and career development (*M* = 4.13, *SD* = 1.10) learning purpose (*r* = .719, *p* < .001).

Table 3-2

Descriptive Statistics and Zero-Order Correlations of Learning Purposes for Using MOOCs

Variable	1	2	3	4
1. Personal learning purpose	–			
2. Social learning purpose	.431***	–		
3. On-the-job learning purpose	.251**	.475***	–	
4. Career development learning purpose	.128	.473***	.719***	–
M	3.45	3.42	4.28	4.13
SD	1.33	1.20	.82	1.10
N	119	119	119	119

Note. ** *p* < .01, *** *p* < .001.

Further analysis revealed significant differences between the learning purposes of MOOCs. On-the-job learning purpose (*M* = 4.28, *SD* = .82) was rated higher than personal learning purpose (*M* = 3.45, *SD* = 1.33), *t*(118) = 6.61, *p* < .001, *d* = .75, and social learning purpose (*M* = 3.42, *SD* = 1.20), *t*(118) = 8.63, *p* < .001, *d* = .83. Similarly, yet with lower effect sizes, career development learning purpose (*M* = 4.13, *SD* = 1.10) was rated higher than personal learning purpose (*M* = 3.45, *SD* = 1.33), *t*(118) = 4.67, *p* < .001, *d* = .56, and social learning purpose (*M* = 3.42, *SD* = 1.20), *t*(118) = 6.60, *p* < .001, *d* = .61.

3.6.2 MOOC Topics (RQ2)

The employees reported a broad interest in MOOC topics (see Table 3-3). More specifically, MOOC topics directly relevant to the job included communication skills (50 %), presentation skills (45 %), management (43 %), and coaching (43 %). Nutrition (52 %), languages (45 %), and sports (35 %) were additional MOOC topics of interest but were not directly relevant to the job. As shown in Table 3-3, Chi-Square analysis identified significant differences between job- and non-job-related interests for all topics.

Table 3-3

Frequencies (Percentage) of Interest in MOOC Topics

Topic	Not interested	Interested and relevant for the job	Interested but not relevant for the job	Chi-square
Languages	23 (19 %)	40 (34 %)	56 (47 %)	13.73**
Presentation	55 (46 %)	53 (45 %)	11 (9 %)	31.13***
Career planning	63 (53 %)	44 (37 %)	12 (10 %)	33.50***
Management	48 (40 %)	51 (43 %)	20 (17 %)	14.74**
Communication	48 (40 %)	59 (50 %)	12 (10 %)	30.47***
Desktop Publishing	64 (54 %)	30 (25 %)	25 (21 %)	22.71***
Sports	71 (60 %)	6 (5 %)	42 (35 %)	53.46***
Corporate finance	57 (48 %)	45 (38 %)	17 (14 %)	21.24***
Coaching	51 (43 %)	51 (43 %)	16 (14 %)	20.76***
Marketing	56 (48 %)	43 (36 %)	19 (16 %)	17.92***
Arts	80 (67 %)	2 (2 %)	37 (31 %)	76.96**
Nutrition	53 (45 %)	4 (3 %)	61 (52 %)	48.42***

Note. ** $p < .01$, *** $p < .001$.

3.6.3 Credentials and Incentives (RQ3)

The employees expected to receive credentials for participation in MOOCs ($M = 4.12$, $SD = 1.27$). However, it was less important for them to receive credentials for their performance in MOOCs ($M = 3.91$, $SD = 1.35$), $t(118) = 2.20$, $p < .05$, $d = .16$. Employees saw only little value in MOOC credentials because credentials for participating in a MOOC ($M = 2.55$, $SD = 1.18$) and credentials for performance in MOOCs ($M = 2.83$, $SD = 1.15$) seem to not reflect their work-related knowledge and

competencies. In addition, the employees believed that their employers did not value credentials for participating in MOOCs (M = 3.12, SD = 1.28) or for their performance in MOOCs (M = 3.33, SD = 1.19).

Regarding incentives, the employees were conservative in expecting paid leave (M = 3.78, SD = 1.27) and monetary bonuses (M = 3.55, SD = 1.24) for participating in MOOCs. In order to investigate further drivers for participating in MOOCs, a correlational analysis was computed between the participation frequency of MOOCs and items related to credentials and incentives. The participation frequency of MOOCs was positively related to willingness to learn outside the workplace, r = .231, p < .01, as well as positively related to the prospect of receiving monetary bonuses, r = .195, p < .05. In contrast, a negative correlation was found between the participation frequency of MOOCs and the expectation of receiving a certificate for participating in a MOOC, r = −.181, p < .05.

3.7 Discussion and Future Consideration

Corporate MOOCs have been identified as a valuable tool for businesses and organizations (Radford et al., 2014). However, only a few businesses and organizations are using MOOCs extensively, and there is still limited understanding of their potential as professional learning environments (C. Milligan & Littlejohn, 2014). Moreover, there is little empirical evidence on the acceptance and effectiveness of corporate MOOCs.

The first findings of this study suggest that employees in businesses have similar reasons to participate in MOOCs as students in higher education (Berland et al., 2014). Content seems crucial, as there is a special interest in participating in MOOCs for professional purposes (on-the-job learning purpose, career development learning purpose). Corporate MOOCs, thus, are required to focus on specific work-related issues, which in most cases require custom-built content and expert teachers from within the business context. Smaller, work-related content units, sometimes referred to as learning nuggets, can lead to more flexibility in learning, which then resembles a process of content curation.

Apart from that, the results indicate broad interest in various MOOC topics, not only those from the professional domain. This suggests a general interest in MOOC learning and a positive attitude towards MOOCs among the population surveyed.

When it comes to credentials, the results remain equivocal. On the one hand, employees expect credentials for participating in MOOCs. However, they also doubt their value. Moreover, employers do not seem to honor the credentials and certificates earned through MOOCs too much, as they are not linked closely enough to job-related learning. Here, the so-called micro-credentials could represent smaller sets of work-related skills or competencies more accurately (Ifenthaler et al., 2016; Jovanovic & Devedzic, 2015; Mah, 2016). As a consequence, the validity of current MOOC assessment practices could be called into question. For MOOCs in digital workplace learning, assessment procedures should be closely linked to work-related learning goals and thus go beyond mere multiple-choice questions in most cases. A more ecologically valid assessment might subsequently lead to a better acceptance of credentials by the relevant stakeholders (and vice versa), which is the most crucial factor for the integration of MOOCs in professional training programs.

Further considerations pertain to the instructional or learning design of MOOCs for professional learning. Here, it might be necessary to expand the rigid xMOOC model to suit the demands of digital workplace learning. Adaptive learning designs with flexible access points building on prior knowledge and a choice of content according to learner preferences can lead to motivational gains and a better learning experience. Additional motivational elements can help prevent monotony. Problem-centered assessments that require the development and externalization of mental models can foster links to the participants' own professional contexts (Seel et al., 2013). A MOOC on value-based management aiming at both academic and professional learners currently being built by the Mannheim Business School will implement some of these ideas (www.mannheim-business-school.com).

This study and its results have some limitations. First, the sample of this study must be considered small and non-representative. The findings are valid for generating further hypotheses, but care must be taken in generalizing the results to a larger population. Second, the participants' lack of experience with MOOCs could result in

biased conclusions regarding the overall importance of MOOCs for workplace learning as well as the expectations toward credentials and incentives. Third, such findings provoke questions requiring additional qualitative and quantitative research: Why, for example, is the focus on social learning opportunities in MOOCs rated lowest? What additional topics for MOOCs could be linked directly to workplace learning? Focus groups or in-depth interviews offer the opportunity to explore such issues in more depth. Last, the rich information stored in MOOC databases could provide an additional layer of insights with regard to motivation and performance in MOOCs when linked to workplace learning (Ifenthaler, 2015; Ifenthaler & Widanapathirana, 2014; Pardos et al., 2016).

Further research on MOOCs may focus on in-depth learning process analyses, where these non-reactive learning analytics data are combined with in-situ self-reports on cognitive and non-cognitive (i.e., motivational, emotional, volitional) aspects of learning. Such process analyses can add to the much-needed learning science perspective on MOOCs (Fischer, 2014) and may help to draw a bigger picture of how to make the most effective use of MOOCs in workplace settings.

References

Berland, M., Baker, R. S., & Bilkstein, P. (2014). Educational data mining and learning analytics: Applications to constructionist research. *Technology, Knowledge and Learning, 19*(1–2), 205–220. https://doi.org/10.1007/s10758-014-9223-7

Brookshire, R. G., Lybarger, K. M., & Keane, L. B. (2011). Virtual workplace learning: Promises met? In M. Malloch, L. Cairns, K. Evans, & B. O'Connor (Eds.), *The SAGE handbook of workplace learning* (pp. 331–340). SAGE.

Castaño Muñoz, J., Kalz, M., Kreijns, K., & Punie, Y. (2016). Influence of employer support for professional development on MOOCs enrolment and completion: Results from a cross-course survey. In M. Khalil, M. Ebner, M. Kopp, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the EUROPEAN STAKEHOLDER SUMMIT on experiences and best practices in and around MOOCs - EMOOOCS 2016* (pp. 251–263). Graz: University of Graz.

Eraut, M. (2000). Non-formal learning and tacit knowledge in professional work. *British Journal of Educational Psychology, 70*, 113–136. https://doi.org/10.1348/000709900158001

Ertmer, P. A., & Newby, T. J. (1996). The expert learner: Strategic, self-regulated, and reflective. *Instructional Science, 24*(1), 1–24. https://doi.org/10.1007/BF00156001

Fischer, G. (2014). Beyond hype and underestimation: Identifying research challenges for the future of MOOCs. *Distance Education, 35*(2), 149–158. https://doi.org/10.1080/01587919.2014.920752

Ifenthaler, D. (2015). Learning analytics. In J. M. Spector (Ed.), The SAGE encyclopedia of educational technology (Vol. 2, pp. 447–451). SAGE. https://doi.org/10.4135/9781483346397

Ifenthaler, D., & Schumacher, C. (2016). Udacity. In S. Danver (Ed.), *The SAGE encyclopedia of online education* (pp. 1149–1151). SAGE. https://doi.org/10.4135/9781483318332

Ifenthaler, D., & Widanapathirana, C. (2014). Development and validation of a learning analytics framework: Two case studies using support vector machines. *Technology, Knowledge and Learning, 19*(1–2), 221–240. https://doi.org/10.1007/s10758-014-9226-4.

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (2015). Internet: Its impact and its potential for learning and instruction. In J. M. Spector (Ed.), *The SAGE encyclopedia of educational technology* (Vol. 1, pp. 416–422). SAGE. https://doi.org/10.4135/9781483346397.n176

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (Eds.). (2016). Foundations of digital badges and micro-credentials. *Demonstrating and Recognizing Knowledge and Competencies* Springer. https://doi.org/10.1007/978-3-319-15425-1

Jovanovic, J., & Devedzic, V. (2015). Open badges: Novel means to motivate, scaffold and recognize learning. *Technology, Knowledge and Learning, 20*(1), 115–119. https://doi.org/10.1007/s10758-014-9232-6.

Kalz, M. (2015). Lifelong learning and its support with new technologies. In J. D. Wright (Ed.), *International encyclopedia of the social & behavioral sciences* (2nd ed., Vol. 14, pp. 93–99). Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.92006-3

Lehmann, T., Haehnlein, I., & Ifenthaler, D. (2014). Cognitive, metacognitive, and motivational perspectives on preflection in self-regulated online learning. *Computers in Human Behavior, 32*, 313–323. https://doi.org/10.1016/j.chb.2013.07.051

Li, N., Kidziński, Ł., Jermann, P., & Dillenbourg, P. (2015). MOOC video interaction patterns: What do they tell us? In G. Conole, T. Klobučar, C. Rensing, J. Konert, & É. Lavoué (Eds.), *Design for Teaching and Learning in a Networked World* (Vol. 9307, pp. 197–210). Springer. https://doi.org/10.1007/978-3-319-24258-3_15

Littlejohn, A., & Margaryan, A. (2014). Technology-enhanced professional learning. In S. Billett, C. Harteis, & H. Gruber (Eds.), *International Handbook of Research in Professional and Practice-based Learning* (pp. 1187–1212). Springer. https://doi.org/10.1007/978-94-017-8902-8_43

Mah, D.-K. (2016). Learning analytics and digital badges: Potential impact on student retention in higher education. *Technology, Knowledge and Learning, 21*(3), 285–305. https://doi.org/10.1007/s10758-016-9286-8

Milligan, C., & Littlejohn, A. (2014). Supporting professional learning in a massive open online course. *The International Review of Research in Open and Distance Learning, 15*(5), 197–213. https://doi.org/10.19173/irrodl.v15i5.1855

Noe, R. A., Clarke, A. D. M., & Klein, H. J. (2014). Learning in the twenty-first-century workplace. *Annual Review of Organizational Psychology and Organizational* Behavior, *1*, 245–275. https://doi.org/10.1146/annurev-orgpsych-031413-091321

Olsson, U. (2016). Open courses and MOOCs as professional development – is the openness a hindrance? *Education and Training, 58*(2), 229–243. https://doi.org/10.1108/ET-01-2015-0006

Pardos, Z. A., Whyte, A., & Kao, K. (2016). moocRP: An open learning analytics platform. *Technology, Knowledge and Learning, 21*(1), 75–98. https://doi.org/10.1007/s10758-015-9268-2

Radford, A. W., Robles, J., Cataylo, S., Horn, L., Thornton, J., & Whitfield, K. (2014). The employer potential of MOOCs: A mixed-methods study of human resource professionals' thinking on MOOCs. *The International Review of Research in Open and Distributed Learning, 15*(5), 1–25. https://doi.org/10.19173/irrodl.v15i5.1842

Seel, N. M., Ifenthaler, D., & Pirnay-Dummer, P. (2013). Mental models and their role in learning by insight and creative problem solving. In J. M. Spector, B. B. Lockee, S. E. Smaldino, & M. Herring (Eds.), *Learning, Problem Solving, and Mind Tools: Essays in Honor of David H. Jonassen* (pp. 10–34). Routledge. https://doi.org/10.4324/9780203111062

Tu, C. H., & Sujo-Montes, L. E. (2015). MOOCs. In R. Papa (Ed.), *Media Rich Instruction. Connecting Curriculum to All Learners.* (pp. 287–304). Springer. https://doi.org/10.1007/978-3-319-00152-4_18

Tynjälä, P. (2008). Perspectives into learning in the workplace. *Educational Research Review, 3*(2), 130–154. https://doi.org/10.1016/j.edurev.2007.12.001

Tynjälä, P., Häkkinen, P., & Hämäläinen, R. (2014). TEL@work – towards integration of theory and practice. *British Journal of Educational Technology, 45*(6), 990–1000. https://doi.org/10.1111/bjet.12164

White B. (2014). Is "MOOC-Mania" over? In: S. K. S. Cheung, J. Fong, J. Zhang, R. Kwan, & L. F. Kwok (Eds.), *Hybrid Learning. Theory and Practice. ICHL 2014.* (pp. 11–15). Springer. https://doi.org/10.1007/978-3-319-08961-4_2

4 Instructional Quality of Business MOOCs: Indicators and Initial Findings

4.1 Introduction

Massive open online courses (MOOCs) have been a trending topic in educational technology since its inception in 2008. Departing from utopian-like expectations, such as the democratization of higher education with unrestricted and ubiquitous access, MOOCs have overcome much disillusionment and criticism (Wiley, 2015) and reached a state of productivity. In the past, many MOOCs showed unsatisfactory completion rates (Jordan, 2015), leading research toward topics like motivation, retention and completion, and satisfaction or engagement (Joksimović et al., 2018; Zhu et al., 2018). Parts of these phenomena investigated in the past few years are associated with the instructional quality of MOOCs. Margaryan et al. (2015) have operationalized these concerns under the umbrella of *instructional design quality*, which is intended to represent the level of implementation of instructional design principles.

In the meantime, MOOC providers like Coursera, edX, Udacity, or FutureLearn are shifting their offerings toward more business-oriented formats and corporate training (D. Shah, 2019). MOOCs are taking root as tools for digital workplace learning, thereby, gaining acceptance among employers (Hamori, 2017) as well as employees (Egloffstein & Ifenthaler, 2017). With more than 18 % of MOOCs stemming from the field of business and management, business MOOCs formed the second-largest section among the global MOOC offerings in 2018 (D. Shah, 2018); stated another way, of the 11,400 MOOCs offered in 2018 (D. Shah, 2019), nearly one in five were business MOOCs.

A market review in the field of business and management from 2018 revealed 481 business MOOCs offered by the top 100 universities from the Times Higher Education Ranking (Egloffstein et al., 2019). Looking at the topics covered, 27 % of those business MOOCs could be assigned to the general and strategic management subdomain, 16 % dealt with entrepreneurship, 15 % covered topics from accounting and finance, and 12 % addressed management and leadership skills (with the rest of the courses being classified into one of six additional smaller sections). Given the number and diversity of those courses, it becomes evident that business schools are starting to seize the potential of MOOCs for academic teaching (Whitaker et al., 2016). At the same time,

business MOOCs are becoming more important for professional learning and development.

Against this background, the instructional design of business MOOCs and its relationship to quality aspects comes into the spotlight. A fundamental question is this: How can the instructional quality of MOOCs in the field of business and management be determined? In response, we introduce an instrument for evaluating business MOOCs against a set of theoretically grounded instructional design principles. After an overview of related research, we describe the indicators, present a pilot study, and offer implications for future research and development in this area and with this instrument.

4.2 Assessing Pedagogical Aspects of MOOCs

The concept of *instructional quality* is central to the design and evaluation of MOOCs. Although quality issues have been a trending topic in the MOOC literature (Zawacki-Richter et al., 2018), there is still comparatively little research on the pedagogical aspects of MOOCs and their relationship to quality (Margaryan et al., 2015). As operationalizations of instructional quality depend on the underlying instructional model and pedagogical assumptions in the corresponding domain, different frameworks and approaches have been applied.

Generally, standardized evaluation instruments for online courses (Baldwin et al., 2018) can be used for MOOCs as well. For example, Lowenthal and Hodges (2015) applied Quality Matters (QM), a common quality-assurance framework from the United States. The QM peer-review process is centered around eight general standards, with at least five among them directly linked to instructional quality (e.g., Standard 3: Assessment and measurement, Standard 4: Instructional materials). In an evaluation of six MOOCs from different providers, none passed the initial review, all failing on college-related learner support standards.

Khalil et al. (2015) developed an evaluation grid for xMOOCs. While the 30 criteria in the three categories — system, interaction, and contents— of this evaluation grid were not developed upon a specific pedagogical theory, they clearly relate to instructional quality. The elaborate evaluation of 15 courses from 12 different providers involved participant observation and the documentation of interaction and activities. Results

show high average scores in the content category over all courses and striking deficiencies in the interaction category in four of the courses.

In a qualitative embedded single case study, Kocdar et al. (2017) analyzed three Coursera-style xMOOCs in depth. As a research framework, they applied the 12 dimensions for characterizing MOOCs by Conole (2013), some of which can be directly associated with instructional quality (e.g., degree of communication, type of learner pathway, and amount of reflection). The results of Kocdar et al.'s (2017) study showed that the 'openness,' 'massiveness,' 'diversity,'" 'use of multimedia,' 'communication among learners,' 'learning pathway,' and 'amount of reflection' dimensions were rated high. The 'communication with instructors,' 'degree of collaboration,' and 'autonomy' dimensions were rated medium, whereas the 'quality assurance,' 'certification,' and 'formal learning' dimensions were rated low.

Yilmaz et al. (2017) evaluated six Turkish MOOCs from a single platform according to instructional design principles. The 32 items of their online evaluation form were structured according to the seven principles for good practice in undergraduate education (e.g., ease of use, emphasizing time on task, encouraging active learning, feedback) by Chickering and Gamson (1987) and based on the 2016 version of the Quality Online Course Initiative Rubric (Illinois Online Network, 2018). Results showed that paid courses had no advantages over free courses. The authors also found a number of drawbacks, such as limited instructor feedback or lack of opportunities for resource sharing among students.

Building on the well-known e-learning design principles (i.e., segmentation, redundancy, pretraining, contiguity, learner control, modality, practice, worked examples, feedback, coherence, multimedia, and personalization principle) by Clark and Mayer (2016), Oh et al. (2018) analyzed 40 STEM MOOCs. Their initial findings showed differences in the application of those principles: 'segmentation' and 'redundancy' were applied to a very large extent, whereas 'practice,' 'worked examples,' and 'feedback' principles were least applied. Further analyses revealed significant platform differences in the application of the 'contiguity,' 'practice,' and 'feedback' principles, as well as significant differences in the application of the 'redundancy,' 'practice,' and 'feedback' principles according to the course level difficulty (introductory vs. intermediate).

As a clearly pedagogically oriented approach, the assessing MOOC pedagogies (AMP) tool (Swan et al., 2015) builds on an existing instrument for evaluating the pedagogical dimensions of computer-based education by Reeves (1996). AMP generates a course-specific profile over 10 pedagogical dimensions (i.e., epistemology, role of teacher, focus of activities, structure, approach to content, feedback, cooperative learning, accommodation of individual differences, activities/assessment, and user role), each being rated on a bipolar scale. An initial comparison of 13 STEM MOOCs revealed differences in pedagogies on the provider level. The expanded sample then showed further differences between STEM and non-STEM courses. Additionally, three pedagogical patterns, so-called *metaphors for learning* (Swan et al., 2016), have been identified (i.e., acquisition, participation, and self-direction).

Fan (2017) later used the AMP tool to evaluate 10 MOOCs from the Chinese provider XuetangX. This analysis revealed differences in the pedagogical approaches of STEM and non-STEM MOOCs. In an analysis of four MOOCs from the Malaysian UNIMAS platform, Taib et al. (2017) asked both learners and instructors to apply the AMP tool. Results showed differences in the respective course profiles, with only four dimensions rated unequivocally by learners and instructors over the courses surveyed. Quintana and Tan (2019) recently introduced an expanded version of the AMP tool with adjusted terminology and more sophisticated indicators. After rating 20 MOOCs (from the same platform and institution but from different subject areas), they demonstrated how nearest-neighbor cluster analysis can help identify pedagogically similar MOOCs.

The evaluation framework used by Margaryan et al. (2015) is based on a set of design criteria originally developed for professional learning (Collis & Margaryan, 2005) and the Expanded Pebble-in-the-Pond Instructional Design Checklist (Merrill, 2013). The Course Scan rating scheme builds on the first principles of instruction, as synthesized by Merrill (2002): Learning is promoted when (1) instruction is *problem-* or *task-centered*, (2) learners *activate* existing knowledge and connect it to new knowledge, (3) learners are exposed to *demonstrations* of what they are expected to learn, (4) learners *apply* and practice what they have learned, and (5) learners *integrate* what they have learned into their everyday life. These five principles focus on learning activities. In addition, five further theoretically grounded principles focusing on learning resources and learning

support were incorporated into the rating instrument: (6) *collective knowledge*: learning is promoted when learners contribute to the collective knowledge; (7) *collaboration*: learning is promoted when learners collaborate with others; (8) *differentiation*: learning is promoted when different learners are provided with individualized learning pathways; (9) *authentic resources*: learning is promoted when learning resources come from real-world settings, and (10) *feedback*: learning is promoted when learners are given expert feedback on their performance.

The Course Scan instrument has 37 items in three sections: (a) Course Details (7 items), (b) Objectives and Organization (6 items), and (c) Instructional Principles (24 items). Among a heterogeneous sample of 76 MOOCs with different pedagogies (xMOOCs and cMOOCs) from different providers and domains, the instructional quality was essentially low: Out of 72 possible total points, no MOOC scored above 28 points. While nearly all MOOCs presented well-packaged, structured offerings, there was only limited evidence of instructional principles.

Chukwuemeka et al. (2015) used the Course Scan rubric to evaluate 27 random courses from the Open Education Europa Network. Their results indicated low overall instructional quality, as most of the courses did not follow the principles of instruction. Likewise, the 12 offerings from Eastern Mediterranean University Open CourseWare analyzed by Yoila and Chukwuemeka (2015) scored rather low. Watson et al. (2017) used an extended version of the Course Scan instrument to assess nine MOOCs on attitudinal change, yielding better results than in the reference study.

4.3 Analyzing MOOCs in the Field of Business and Management

4.3.1 Research Questions

Given the partially inconclusive findings on pedagogical aspects of MOOCs on the one hand and the importance of content-related pedagogies on the other, we decided to analyze instructional quality not as an overarching generic concept but rather in a domain-specific approach. As MOOCs from the field of business and management represent one of the largest sections in the global MOOC market and as there is only scarce evidence concerning their instructional quality, the following research questions (RQs) formed the basis of this exploratory study:

RQ 1. How can the instructional quality of MOOCs in the field of business and management be described in terms of structuredness and fit with existing instructional design principles?

RQ 2. Which categories point toward high instructional quality of business MOOCs, and which categories indicate room for improvement?

RQ 3. Are there systematic differences concerning instructional quality based on distinctive features of business MOOCs, such as provider/platform, geographic region, and authoring institution?

4.3.2 Rating Instrument, Sample, and Procedure

Due to its conceptual fit with some common principles of business education (e.g., problem-centeredness and active learning) and its focus on professional learning, we used the Course Scan rating scheme as a basis for our instrument. After an initial review, we decided to drop similar and potentially equivocal indicators and thus reduce the number of items (e.g., "To what extent are the problems in the course typical of those learners will encounter in the real world?" vs. "To what extent do the activities in the course relate to the participants' real workplace problems?"). In contrast to the original instrument, with item numbers ranging between 1 (e.g., *activation*) and 6 (*problem centeredness*), we decided to address each of Merrill's principles with two distinctive items and each of the more straightforward additional principles with only one single item. The final Concise Course Scan (CCS) rubric consists of three sections with 20 items in total.

Section A comprises five items in five categories, which refer to the structuredness and clarity of a course. High ratings imply a clear and comprehensive description of the *course structure*, its *contents*, the expected *effort*, the *target audience*, and the corresponding *learning goals*. In Section B, we operationalized Merrill's first principles of instruction. Ten items address the five categories: problem-centeredness, activation, demonstration, application, and integration (covered by two items each). Section C comprises of five items in five additional categories, which reflect key instructional quality aspects, like feedback, collaboration and cooperation, authenticity of learning materials, and individualization and differentiation. Following the

assumption that learner activity plays a crucial role in instructional quality, we exchanged the contribution to a collective knowledge pool category (whose operationalization was very close to the collaboration category) from the original Course Scan rubric accordingly.

Table 4-1 illustrates the CCS rubric and its sections, categories, and items. The categories in Section A and C are operationalized by one item, those in Section B by two items each. Every item is rated on a scale from 0 (*not at all true*—i.e., not in place) to 3 (*very much true*—i.e., in place to a large extent) points. For the weighting of the sections, we decided on a ratio of 1:2:2 for the points to be achieved in A, B, and C. This was based on the assumptions that instructional quality should be determined by the implementation of instructional principles rather than by course organization, and that the first principles and the additional principles should be equally important. Therefore, we doubled the raw points of Section C before adding them to the calculation. All in all, a weighted sum score adding up to a maximum of 75 points was calculated over the three sections as a measure for the overall instructional quality of a MOOC.

An analysis of the internal consistency of the instrument revealed a Cronbach's alpha of .822, which is satisfactory. In Section A, there were two items that slightly affected the internal consistency negatively—namely, learning goals (1) and requirements/effort (3). As these items are highly relevant for determining the course objectives and organization, excluding them from the rubric was not considered. The CCS rubric is subject to ongoing development concerning the formulation of categories, items, and indicators.

Table 4-1

Concise Course Scan Rubric

Category	Items	Max. pts.
A) Structuredness and clarity		15 x 1
1. Learning goals	Learning goals are described comprehensively.	
2. Audience	The target audience is clearly described.	
3. Requirements/effort	Course requirements are described sufficiently.	
4. Course contents	The course contents are described in detail.	
5. Course structure	The course structure is clear.	
B) First principles of instruction		30 x 1
6. Problem centeredness	The course tasks are linked to real-world problems.	
	The course tasks are at the center of activities.	
7. Activation	The necessary prior knowledge is clearly described.	
	The course elements (contents, tasks) build on prior knowledge.	
8. Demonstration	New knowledge is being demonstrated in a coherent way.	
	Media is being used adequately to demonstrate new knowledge.	
9. Application	New knowledge can be applied and practiced in a coherent way.	
	The knowledge transfer to additional contexts is being promoted.	
10. Integration	The reflection of new knowledge is being promoted.	
	The discussion of new knowledge is being promoted.	
C) Additional principles of instruction		15 x 2
11. Feedback	Feedback is an integral element of the course.	
12. Authentic resources	The course materials are authentic.	
13. Differentiation	The course enables different learning pathways, according to learners' needs.	
14. Cooperation/ collaboration	The course promotes collaboration and cooperation.	
15. Learner/activity orientation	The course promotes active learning.	

Note. Items scored from 0 to 3 points each.

The sample of our pilot study (see Appendix A) consisted of *N* = 101 courses. We randomly selected the courses from MOOC aggregators and course catalogues. Primary inclusion criteria were course language (generally English, with one 'outlier' taught in German selected for comparison only) and course accessibility during the assessment period. In an attempt to approximate the market shares from the time of the assessment, we included courses from seven different MOOC providers, with a different number of courses each. The sample included MOOCs from eight topic areas in the field of business and management. Eighty-six courses were authored by academic institutions and 15 by nonacademic institutions. Most of the authoring institutions were North American (*n* = 38) or European (*n* = 37). In addition, 17 courses were authored by Australian institutions, eight from Asia, and just one from Africa. Session-based courses (*n* = 76) outweighed the self-paced courses (*n* = 25) in the sample. As calculated from the given information in the course specifications, the mean course length was 5.1 weeks (*SD* = 2.5; *min* = 1 week, *max* = 13 weeks), and the participants were engaged in coursework for approximately four hours per week (*SD* = 2.1; *min* = .5 hours; *max* = 11 hours).

Three trained raters, each with a background in pedagogy and instructional design, performed the assessment within a period of four months. After an initial training, it took about one-and-a-half hours on average to rate one single course. Five courses were coded by all three raters. Intercoder reliability was analyzed with Kendall's coefficient of concordance. The overall reliability was satisfying (*W* = .85). Pairwise comparisons of raters led to values between *W* = .83 and *W* = .99.

4.4 Results

4.4.1 Overall Instructional Quality of Business MOOCs (RQ1)

For the first research question, we analyzed the mean scores and standard deviations for each section and for the weighted sum scores. Concerning Section A (i.e., structuredness and clarity), the courses reached 11.55 points out of 15 on average (*SD* = 2.10). The lowest score of seven was reached by three courses in the sample, while the highest score of 15 was reached by six of the 101 MOOCs we analyzed. In terms of Section B (i.e., first principles of instruction), the mean score was 16.34 points out of 30 (*SD* = 5.58). A minimum score of 5—which illustrated a very low instructional quality—was assigned to two courses with the topics business intelligence and strategic management. The highest score of 27 points was assigned to only one MOOC on social enterprises. In Section C (i.e., Additional principles), the mean score was 12.85 points out of 30 (*SD* = 3.35).

Across all category groups, the mean weighted sum score was 40.75 points of a potential 75 points (*SD* = 9.25). The courses with the highest ratings reached 56 points, and the lowest ratings only added up to 17 points. The top 10 courses, reaching between 53 and 56 points on the CCS rubric, are shown in Table 4-2. Reflecting on the achieved ratings over the three sections, it becomes obvious that even among the top-rated courses, Section C falls behind when compared to Section B.

Table 4-2

Top 10 Courses From the CCS Assessment

Course title	Provider	Institution	Section A (≤ 15 pts.)	Section B (≤ 30 pts.)	Section C [a] (≤ 30 pts.)	Overall (≤ 75 pts.)
Business Foundations	edX	University of British Columbia	14	24	18	56
Commercialization of Social Enterprises	Future Learn	Free University of Bruxelles	11	27	18	56
Operations Management	Coursera	University of Illinois	15	23	18	56
Innovation Management	Future Learn	University of Leeds	13	27	16	56
Fundamentals of Project Planning and Management	Future Learn	University of Virginia	14	22	20	56
Reputation Management in a Digital World	edX	Curtin University	14	24	16	54
Business Model Implementation	edX	Delft University of Technology	13	24	16	53
Global Impact: Cultural Psychology	Coursera	University of Illinois at Urbana-Champaign	13	22	18	53
Leading and Managing People-Centered Change	Future Learn	Durham University	11	24	18	53
Ethics for Managers	Canvas Network	Santa Clara University	14	21	18	53

Note. [a] Raw points in Section C weighted with factor 2.

Further, a correlation analysis revealed significant interrelations between the three sections. High ratings on structuredness and clarity (Section A) correspond with a higher

quality related to the Merrill's (2002) first principles of instruction detailed in Section B (r = .418**) as well as with better scores regarding the additional principles of instruction found in Section C (r = .342**). The strongest correlation, however, was found between Section B and C (r = .646**). Not too surprisingly, it appears that courses that address principles like problem-centeredness or integration are likely to show higher values concerning authentic resources or learner/activity orientation.

4.4.2 Areas of Improvement (RQ2)

In the next step, we set out to identify categories that showed room for improvement. Table 4-3 offers an overview of the means and standard deviations for all categories. The highest average rating within Section A (M = 2.56; SD = .65) was reached in the category covering clear descriptions of the course contents, with the highest score of 3 reached by n = 66 courses of the sample. The lowest mean score was noted for the category clear description of the target audience. Notably, seven courses were rated with the minimum score of 0 in this category. In the other categories in Section A, there were only a few courses with the lowest rating (n < 10), and most courses reached higher scores.

Pertaining to Section B, the highest mean ratings (M = 2.08; SD = .65) were observed for the item on the adequate implementation of media (demonstration category). The highest score was reached by n = 36 courses here. The lowest ratings were achieved for the item on problem orientation (problem centeredness category; M = 1.39; SD =.87). Lower rated categories were integration (M = 1.68; SD = .66), application (M = 1.55; SD = .84) and activation (M = 1.49; SD = .69). The number of courses which were rated 0 on an item varied between n = 1 (integration: reflection being promoted) and n = 35 (application: knowledge transfer being promoted). On average, there were n = 17 courses rated 0 which is a higher amount compared to Section A.

In Section C, finally, the best ratings were assigned for a regular integration of feedback during the course (M = 1.99; SD = .84). The maximum score of 3 points was assigned to 32 courses. Learner orientation (M = .68; SD = .49) as well as the degree of differentiation (M = .50; SD = .50) were rated particularly low. Concerning the

implementation of different learning pathways according to the learners' needs, *n* = 50 courses were rated 0.

All in all, Section A shows much less room for improvement than the other sections, while two categories in Section B and C were rated particularly low.

Table 4-3

Descriptive Statistics Over the Categories of the CCS Assessment

Category	*M*	*SD*	*Min*	*Max*
Section A				
Learning goals	2.35	.655	1	3
Audience	2.00	1.01	0	3
Requirements	2.32	.958	0	3
Course contents	2.56	.654	1	3
Course structure	2.33	.665	0	3
Section B				
Problem-centeredness	1.39	.874	0	3
Activation	1.49	.687	0	2.5
Demonstration	2.08	.653	0.5	3
Application	1.55	.843	0	3
Integration	1.68	.655	0.5	3
Section C				
Feedback	1.99	.843	0	3
Authentic resources	1.98	.678	0	3
Differentiation/individualization	.50	.502	0	1
Cooperation/collaboration	1.27	.615	0	3
Learner/activity orientation	.68	.488	0	2

Note. Categories in Sections A and C based on single items. Categories in Section B based on two-item-scales.

4.4.3 Distinctive Course Features and Instructional Quality (RQ3)

Concerning systematic differences between different groups of business MOOCs, we focused on six distinctive features. We considered provider/platform, course topic, region, pacing, course type, and authoring institution as relevant categories that could have an influence on instructional quality. As detailed in Table 4, we conducted variance analyses and found significant differences due to provider/platform, region, and authoring institution, as shown in Table 4-4.

Table 4-4

Systematic Differences Between the Courses Analyzed in the CCS Assessment

Section	(A)		(B)		(C) [a]		Total [b]	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Provider/platform								
Canvas Network (*n* = 10)	12.3	1.7	17.0	3.8	13.2	4.2	42.5	8.1
Coursera (*n* = 25)	11.5	2.1	16.2	5.6	12.2	3.8	39.9	10.0
edX (*n* = 24)	12.3	2.2	18.5	4.3	13.2	2.3	43.9	6.8
FutureLearn (*n* = 19)	12.1	1.8	19.3	4.4	13.7	2.8	45.0	6.6
iversity (*n* = 8)	11.3	2.4	18.0	3.3	16.0	1.9	45.3	3.2
Open2Study (*n* = 10)	9.9	.3	7.5	.9	11.4	2.5	28.8	3.5
Udacity (*n* = 5)	8.8	1.6	9.8	4.6	8.4	3.6	27.0	9.5
F-value	3.93**		11.11**		3.94**		9.19**	
η^2	η^2 = .200		η^2 = .415		η^2 = .201		η^2 = .370	
Region								
North America (*n* = 38)	11.7	2.4	17.2	5.2	12.3	3.8	41.3	10.0
Europe (*n* = 37)	11.9	1.8	17.8	4.9	14.1	2.9	43.7	7.5
Asia (*n* = 8)	11.1	2.6	14.1	4.9	11.8	2.9	37.0	8.8
Australia (*n* = 17)	10.7	1.6	12.3	6.4	12.2	2.3	35.2	9.1
Africa (*n* = 1)	12.0	--	16.0	--	8.00	--	36.0	--
F-value	1.050		3.795**		2.453*		3.123*	
η^2	η^2 = .042		η^2 = .137		η^2 = .093		η^2 = .115	
Authoring institution								
Academic (*n* = 86)	11.7	2.0	17.1	5.2	13.2	3.3	41.9	8.5
Nonacademic (*n* = 15)	10.7	2.4	12.2	5.9	12.2	3.3	33.9	10.6
T-value	1.659		3.266**		2.463*		3.274**	
η^2	η^2 = .027		η^2 = .097		η^2 = .058		η^2 = .098	

Note. [a b] Analysis based on weighted scores. * $p < .05$. ** $p < .01$.

Concerning *provider/platform*, we found significant differences between Udacity and the other MOOC providers ($.002 < p < .039$) as well as between Open2Study and the other providers evaluated in this study ($.000 < p < .039$). Thereby, Udacity showed significantly lower mean ratings than the rest. The effect sizes were the strongest for Section B ($\eta^2 = .415$). The highest means were reached by courses administrated by FutureLearn and iversity. However, these differences were not statistically significant.

In search of potential regional differences, we analyzed MOOCs from five geographic *regions* (i.e., North America, Europe, Asia, Australia, and Africa). We found small but significant differences in instructional quality in every section except Section A. In our sample, Australian courses showed the lowest means in most of the categories. This, however, relates to the fact that most of the Australian courses in our sample were offered by the provider/platform Open2Study and that these courses did not fare too well in our evaluation rubric. In contrast, courses from Europe scored significantly higher ($p = .018$; $\eta^2 = .115$).

With regard to the *authoring institution*, we found that MOOCs that were authored by academic institutions showed slightly higher instructional quality than those from nonacademic institutions. The total effect was small but statistically significant ($p = .001$; $\eta^2 = .098$).

Significant effects were not revealed for any of the other variables and categories analyzed. In detail, *course topic*, *course type*, and *pacing* were irrelevant when discussing potential impact factors on instructional quality. First of all, in terms of the eight different topic areas addressed by the MOOCs in the sample (see Appendix B), we did not find any statistically significant differences. There was no systematic variation of instructional quality due to course topics here. Secondly, we analyzed different course types, as we differentiated four groups by a median split of the variables weekly course load and course length. This led to four distinctive course types: short course/high effort, short course/low effort, long course/high effort, and long course/low effort. However, the intensity and duration of the coursework implemented in the MOOCs of our sample were not systematically related to their instructional quality. Finally, being either session-based or self-paced, the MOOCs in this study did not significantly differ with respect to instructional quality.

4.5 Discussion

4.5.1 Findings and Implications

This research focused on analysis of the instructional quality of MOOCs from the field of business and management. We introduced a rating instrument with 20 items in 15 categories in three sections. In an explorative study, three trained raters analyzed *N* = 101 business MOOCs. The overall findings indicate low overall instructional quality of the analyzed MOOCs. This finding corresponds to previous research in the field (e.g., Margaryan et al., 2015). Structuredness and clarity as well as adequate media integration as part of the Demonstration category were rated best, but otherwise the implementation of instructional design principles (first principles from Merrill [2002] as well as additional principles) was rather insufficient. More specifically, the rated courses showed substantial shortcomings with regard to an adequate individualized support of learners and the implementation of collaborative elements. Such results correspond with Spector's (2017) call for greater personalized learning in MOOCs, be it with adaptive digital technology or through instructor-selected activities (Bonk, Zhu, et al., 2018).

Our results also point toward ample room for improvement in MOOC design. From the domain-specific perspective, the low scores in problem/task orientation are of most concern. In their present implementations, business MOOCs do not fit too well with the case-based teaching approach widely accepted as good practice in business education. For problem-centered business MOOCs, there is a clear need for "relevant and intentionally designed activities with both formative and summative assessments" (Spector 2017, p. 143) developed around complex, real-world tasks with corresponding authentic materials. This, of course, might come into conflict with one of the defining characteristics of the MOOC concept, which is to provide highly scalable online instruction at very low marginal costs. Hence, it remains a challenging task for instructional designers to bridge this gap and to explicitly address domain-specific pedagogical affordances.

In line with Reich (2015), our study also focused on comparisons of MOOCs across different contexts. With respect to systematic differences between business MOOCs depending on their characteristic features, we analyzed the potential effects of six variables: provider/platform, region, authoring institution, course type, pacing, and

course topic. We found that courses administered by Open2study and Udacity scored significantly lower than MOOCs from other providers, with Udacity (who have been focusing on corporate training in recent years) scoring lowest in most of the categories. Further, courses authored by nonacademic institutions scored slightly lower. One suggestion, therefore, is that providers of VET or professional development MOOCs should take adequate actions not to fall behind (Paton et al., 2018a), especially when following the demands for smaller course sizes and tailored 'learning nuggets' that seem to evolve around MOOCs in professional contexts (e.g., Egloffstein & Schwerer, 2019). In contrast, academic business MOOCs can be considered suitable for professional learning and development given that these MOOCs seem to align better with the instructional quality standards established in the field. The observed variations due to provider/platform and regional differences point in the same direction, as most of the Australian courses in our sample ran on the Open2Study platform. Although one could have expected that "platform capabilities have a strong influence on what can and will be done pedagogically" (Blackmon & Major, 2017, p. 210), we did not find any additional platform differences of statistical significance. Here, a deeper analysis with an extended sample is necessary to further clarify possible effects. With regard to course type (intensity), topic, and pacing, no systematic differences could be found.

4.5.2 Limitations and Future Research

The reported study has some evident limitations. First, the sample size and selection could be questioned, as the 101 business MOOCs in this study are far from being representative. Although we tried to approximate the market shares with a 'snapshot' at the time of our analysis, we could, of course, capture only a fraction of the global MOOC market. XuetangX from China, for example, the third-largest MOOC provider in terms of registered students (D., Shah, 2018), had to be omitted due to language barriers. The same applies to Miríadax, which serves the Ibero-American world, France Université Numérique, and a number of other regional providers. Cross-cultural studies could provide fruitful insights here, as it is largely unclear how regional influences could affect the concept of instructional quality.

Likewise, the rating instrument must be continuously improved, with a constant focus on valid indicators. As business MOOCs keep on evolving, we will continue our study and try to include more courses in our sample. Repeated measures, on the other hand, could provide valuable insights not only for research but also for a systematic quality assurance. MOOC providers then could build on empirically grounded instructional design knowledge to improve their offerings. Additionally, it seems necessary to analyze learner interactions and instructional processes in MOOCs more rigorously. Such research is needed because the relationship between instructional design quality and instructional process quality is still debated. Most probably, a thorough course scan with participant observation over a longer period could lead to a better understanding here.

Regarding the instructional quality of MOOCs in general, we concur with Littlejohn and Hood's (2018) call for the development and evaluation of new measures. Thereby, measures from the instructor perspective must be complemented by measures capturing the learner perspective. Learner characteristics, learning processes, and learning outcomes (Biggs, 1993) could provide a rich set of additional indicators for instructional quality. An extended learning analytics approach focusing on learner motivation and emotions could add others layers of detail.

The current study presents valuable insights into the instructional quality of MOOCs in the field of business and management. Drawing upon the results, future tasks for instructional designers in this rapidly evolving field of distance education become evident. As this occurs, a prospective agenda for MOOC research can be mapped and interrogated.

References

Baldwin, S., Ching, Y.-H., & Hsu, Y.-C. (2018). Online course design in higher education: A review of national and statewide evaluation instruments. *TechTrends, 62*(1), 46–57. https://doi.org/10.1007/s11528-017-0215-z

Biggs, J. (1993). From theory to practice: A cognitive systems approach. *Higher Education Research & Development*, 12(1), 73–85. https://doi.org/10.1080/0729436930120107

Blackmon, S. J., & Major, C. H. (2017). Wherefore art thou MOOC? Defining massive open online courses. *Online Learning Journal, 21*(4), 195–221. https://doi.org/10.24059/olj.v21i4.1272

Bonk, C. J., Zhu, M., Kim, M., Xu, S., Sabir, N., & Sari, A. R. (2018). Pushing toward a more personalized MOOC: Exploring instructor selected activities, resources, and technologies for MOOC design and implementation. *The International Review of Research in Open and Distributed Learning, 19*(4), 92–115. https://doi.org/10.19173/irrodl.v19i4.3439

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 39*(7), 3–7.

Chukwuemeka, E. J., Yoila, A. O., & Iscioglu, E. (2015). Instructional design quality: An evaluation of open education Europa networks' open courses using the first principles of instruction. *International Journal of Science and Research, 4*(11), 878–882.

Clark, R. C., & Mayer, R. E. (2016). *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (4th ed.). John Wiley & Sons.

Collis, B., & Margaryan, A. (2005). Design criteria for work-based learning. Merrill's first principles of instruction expanded. *British Journal of Educational Technology, 36*(5), 725–739. https://doi.org/10.1111/j.1467-8535.2005.00507.x

Conole, G. (2013). MOOCs as disruptive technologies: Strategies for enhancing the learner experience and quality of MOOCs. *Revista de Educación a Distancia, 39*, 1–17. http://dx.doi.org/10.6018/red/50/2

Egloffstein, M., Ebner, B., & Ifenthaler, D. (2019). Digital learning from scratch: Initiating MOOCs within a business school. In M. Calise, C. Delgado-Klos, C. Mongenet, J. Reich, J. A. Ruipérez-Valiente, G. Shimshon, T. Staubitz, & M. Wirsing (Eds.), *EMOOCs-WIP 2019: Proceedings of Work in Progress Papers of the Research, Experience and Business Tracks* (pp. 121–127). CEUR Workshop Proceedings. https://ceur-ws.org/Vol-2356/experience_short7.pdf

Egloffstein, M., & Ifenthaler, D. (2017). Employee perspectives on MOOCs for workplace learning. *TechTrends, 61*(1), 65–70. https://doi.org/10.1007/s11528-016-0127-3

Egloffstein, M., & Schwerer, F. (2019). Participation and achievement in enterprise MOOCs for professional development: Initial findings from the openSAP University. In D. Sampson, J. M. Spector, D. Ifenthaler, P. Isaías, & S. Sergis (Eds.), *Learning technologies for transforming large-scale teaching, learning, and assessment* (pp. 91–103). Springer. https://doi.org/10.1007/978-3-030-15130-0_6

Fan, Y. (2017). Use the AMP tool to characterize pedagogical approaches taken by MOOC courses in Mainland China. *International Journal for Educational Media and Technology, 11*(1), 141–146. https://ijemt.org/index.php/journal/article/view/257

Hamori, M. (2017). The drivers of employer support for professional skill development in MOOCs. In C. Delgado Kloos, P. Jermann, M. Pérez-Sanagustín, D. Seaton, & S. White (Eds.), *Digital education: Out to the world and back to the campus. EMOOCs 2017* (pp. 203–209). Springer. https://doi.org/10.1007/978-3-319-59044-8_24

Illinois Online Network. (2018). *Quality Online Course Initiative (QOCI) Rubric*. https://www.uis.edu/ion/resources/qoci/

Joksimović, S., Poquet, O., Kovanović, V., Dowell, N., Mills, C., Gašević, D., Dawson, S., Graesser, A. C., & Brooks, C. (2018). How Do We Model Learning at Scale? A Systematic Review of Research on MOOCs. *Review of Educational Research, 88*(1), 43–86. https://doi.org/10.3102/0034654317740335

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. *The International Review of Research in Open and Distance Learning, 16*(3), 341–358. https://doi.org/10.19173/irrodl.v16i3.2112

Khalil, M., Brunner, H., & Ebner, M. (2015). Evaluation grid for xMOOCs. *International Journal of Emerging Technologies in Learning, 10*(4), 40–45. https://doi.org/10.3991/ijet.v10i4.4653

Kocdar, S., Okur, M., & Bozkurt, A. (2017). An examination of xMOOCs: An embedded single case study based on Conole's 12 dimensions. *The Turkish Online Journal of Distance Education, 18*(4), 52–65. https://doi.org/10.17718/tojde.340381

Littlejohn, A., & Hood, N. (2018). Designing for quality? In A. Littlejohn, & N. Hood (Eds.), *Reconceptualising learning in the digital age: The [un]democratising potential of MOOCs* (pp. 79–94). Springer. https://doi.org/10.1007/978-981-10-8893-3

Lowenthal, P. R., & Hodges, C. B. (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), 83–101. https://doi.org/10.19173/irrodl.v16i5.2348

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education, 80*, 77–83. https://doi.org/10.1016/j.compedu.2014.08.005

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59. https://doi.org/10.1007/BF02505024

Merrill, M. D. (2013). *First principles of instruction: Identifying and designing effective, efficient and engaging instruction*. Pfeiffer.

Oh, E. G., Chang, Y., & Park, S. W. (2018). *Design review of MOOCs: Application of e-learning design principles*. Paper presented at the 2018 AECT Convention. Kansas City, MO.

Paton, R. M., Fluck, A. E., & Scanlan, J. D. (2018a). Engagement and retention in VET MOOCs and online courses: A systematic review of literature from 2013 to 2017. *Computers & Education, 125*, 191–201. https://doi.org/10.1016/j.compedu.2018.06.013

Quintana, R., & Tan, Y. (2019). *Characterizing MOOC pedagogies: Exploring new tools and methods for learning designers and researchers*. Paper presented at the 2019 AERA Annual Meeting. Toronto, Ontario.

Reeves, T. (1996). *Evaluating what really matters in computer-based education*. https://www.eduworks.com/Documents/Workshops/EdMedia1998/docs/reeves.html

Reich, J. (2015). Rebooting MOOC research. *Science, 347*(6217), 34–35. https://doi.org/10.1126/science.1261627

Shah, D. (2018, December 12). *By the numbers: MOOCS in 2018*. Class Central. https://www.class-central.com/report/mooc-stats-2018/

Shah, D. (2019, January 6). *Year of MOOC-based degrees: A review of MOOC stats and trends in 2018.* Class Central. https://www.class-central.com/report/moocs-stats-and-trends-2018/

Spector, J. M. (2017). A critical look at MOOCs. In M. Jemni, Kinshuk, & M. K. Khribi (Eds.), *Open education: from OER to MOOCs* (pp. 135–147). Springer. https://doi.org/10.1007/978-3-662-52925-6_7

Swan, K., Day, S., & Bogle, L. (2016). Metaphors for learning & MOOC pedagogies. *Proceedings of Third ACM Conference on Learning at Scale* (L@S) (pp. 125–128). https://doi.org/10.1145/2876034.2893385

Swan, K., Day, S., Bogle, L., & van Prooyen, T. (2015). AMP: A tool for characterizing the pedagogical approaches of MOOCs. In C. J. Bonk, M. M. Lee, T. C. Reeves, & T. H. Reynolds (Eds.), *MOOCs and open education around the world* (pp. 105–118). Routledge.

Taib, T. M., Chuah, K. M., & Aziz, N. A. (2017). Understanding pedagogical approaches of Unimas MOOCs in encouraging globalized learning community. *International Journal of Business and Society, 18*, 838–844.

Watson, W. R., Watson, S. L., & Janakiraman, S. (2017). Instructional quality of massive open online courses: A review of attitudinal change MOOCs. *International Journal of Learning Technology, 12*(3), 219–240. https://doi.org/10.1504/IJLT.2017.088406

Whitaker, J., New, J. R., & Ireland, R. D. (2016). MOOCs and the Online Delivery of Business Education: What's new? What's not? What now? *Academy of Management Learning & Education, 15*(2), 345–365. https://doi.org/10.5465/amle.2013.0021

Wiley, D. (2015). The MOOC misstep and the open education infrastructure. In C. J. Bonk, M. M. Lee, T. C. Reeves, & T. H. Reynolds (Eds.), *MOOCs and open education around the world* (pp. 3–11). Routledge.

Yılmaz, A. B., Ünal, M., & Çakır, H. (2017). Evaluating MOOCs according to instructional design principles. *Journal of Learning and Teaching in Digital Age, 2*(2), 26–35. https://dergipark.org.tr/en/download/article-file/1175608

Yoila, A. O., & Chukwuemeka, E. J. (2015). Instructional design quality evaluation of Eastern Mediterranean University open courses. *International Journal of Scientific Research in Science, Engineering and Technology, 1(*6), 1–7. https://ijsrset.com/paper/562.pdf

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), 242–259. https://doi.org/10.19173/irrodl.v19i1.3356

Zhu, M., Sari, A., & Lee, M. M. (2018). A systematic review of research methods and topics of the empirical MOOC literature (2014–2016). *The Internet and Higher Education, 37*, 31–39. https://doi.org/10.1016/j.iheduc.2018.01.002

5 Participation and Achievement in Enterprise MOOCs for Professional Development: Initial Findings From the openSAP University

5.1 Introduction

Massive Open Online Courses (MOOCs) have been a trending topic in online learning and especially in academic education over recent years. Departing from enormous expectations (like no less than the democratization of the education sector through educational technology), academic MOOCs currently might just have overcome what is called the 'trough of disillusionment' in the Gartner Hype Cycle-model (White, 2014; Bozkurt et al., 2016). Quite a few MOOCs in academia fell short of their self-imposed targets, facing challenges like unsatisfactory completion rates (Jordan, 2015) and questionable instructional quality (Margaryan et al., 2015). However, there is a growing body of research on the design of MOOCs (Sergis et al., 2017), and promising developments to reach the 'plateau of productivity' are underway.

In this light, academic MOOC providers like Udacity (Ifenthaler & Schumacher, 2016b) shifted their offerings away from the ideas of open education toward more business-oriented formats, while the corporate sector itself became aware of the MOOCs. As contemporary workplace learning calls for a reconceptualization of learning environments with a special focus on learning technologies (Noe et al., 2014), MOOCs can be seen as a promising option in technology-enhanced training and development (Egloffstein & Ifenthaler, 2017). MOOCs are associated with flexible, scalable, and measurable knowledge transfer. They are expected to save costs and promote lifelong learning. For professional development, MOOCs can suit the demands of corporations that have to deal with an increasingly complex and rapidly evolving business environment, shortened lifecycles of products and services, and a global stakeholder network in demand for highly topical job-relevant knowledge (Egloffstein & Ifenthaler, 2017). However, there are still only a few substantial corporate MOOC initiatives, and little is known about MOOCs in professional learning and development (Hamori, 2017; Castaño-Muñoz et al., 2017). Therefore, this exploratory study aims to shed light on corporate MOOCs and their learners. For the example of openSAP, a major Enterprise MOOC platform, participants' characteristics and their intentions on using MOOCs are

being analyzed with regard to actual achievement, leading to first insights on how MOOCs are currently utilized for professional learning.

The rest of the chapter is structured as follows: In section 2, we briefly describe the concept of Enterprise MOOCs. Section 3 introduces openSAP as a major example of Enterprise MOOCs and as the research context of the study at hand. Section 4 covers the exploratory study and its research questions, methods, and results. The chapter closes with a conclusion and an outlook on future research.

5.2 Enterprise MOOCs in Professional Development

MOOCs are basically online courses with free and open registration that allow for large participant groups via the Internet. According to the different underlying pedagogies, two major categories of MOOCs can be differentiated (Ifenthaler et al., 2015; Tu & Sujo-Montes, 2015): (1) connectivist MOOCs (cMOOCs) focus on collaboration and learner networks. They provide interactive learning environments, foster discussions, peer learning, and assessment, and promote autonomy of educational objectives and social network engagement. cMOOCs do not rely on one single platform but make use of different tools and applications like Twitter, Facebook, YouTube, WordPress, etc. (2) extended MOOCs (xMOOCs), on the other hand, are based on a traditional cognitive-behaviorist approach and focus primarily on scalable content delivery. Typical elements are lecture videos, integrated quizzes, and short (mostly multiple-choice) online tests for automated assessment.

Corporate MOOCs mostly follow the xMOOC-model but can differ from academic MOOCs in various aspects (Egloffstein & Ifenthaler, 2017): (1) They are mostly limited to employees, (2) they are only open within the organization, (3) they may include additional instructional elements (e.g., discussions), and (4) they may include custom-built content. Enterprise MOOCs can be seen as an extension of this concept: Although they also deal with corporate knowledge or product specific content, they are not limited to a special target group within the organization. Instead, they are open to relevant stakeholders like suppliers, customers, the government, and the general public.

Recent studies indicate that employers tend to have a rather positive attitude towards the use of MOOCs in professional learning (Radford et al., 2014). Likewise, openness, as promoted in Enterprise MOOCs, was not seen as a hindrance by managers and HR specialists, so Enterprise MOOCs could be suitable for organized professional development (Olsson, 2016). In the following section, a major implementation of the Enterprise MOOC concept will be introduced.

5.3 Case Study: Enterprise MOOCs at openSAP

5.3.1 The openSAP University

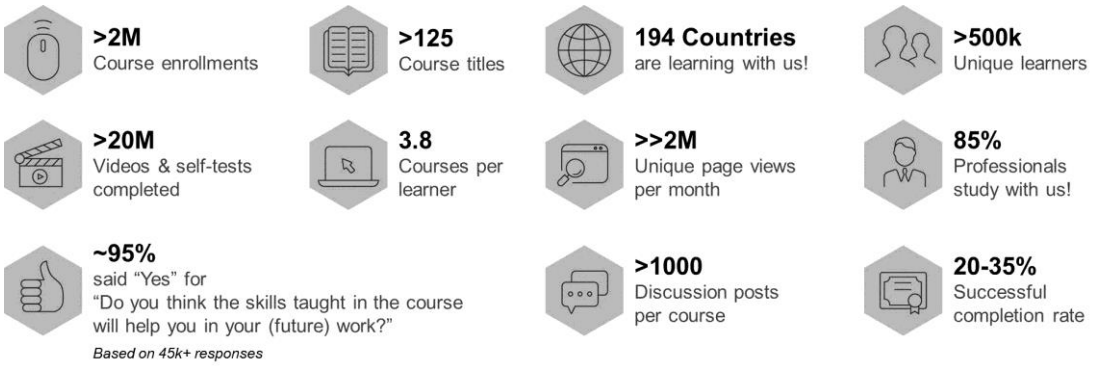
The openSAP University (available at https://open.sap.com) claims to be the first Enterprise MOOC platform on the market (Renz et al., 2016). Since 2013, SAP SE has offered online courses free of charge, providing basic knowledge about product and innovation topics in the area of business and information technology. Applying the xMOOC format, openSAP enables scalable knowledge transfer throughout its entire ecosystem, including partners and customers. The corresponding platform infrastructure (Xikolo Management System) is hosted and being developed by the Hasso Plattner Institute (HPI) based in Potsdam, Germany. This enables business-specific technical adjustments and improvements in a co-innovative partnership. Within SAP, a dedicated team is responsible for managing the course portfolio and the platform instance, as well as the course production with all its associated tasks, like instructional design, communication, quality management, and operations. These well-defined processes enable a short time-to-market production cycle and, thus, a fast distribution of new knowledge to the respective stakeholders.

An overview of the most important indicators of key achievements of openSAP is given in Figure 5-1. Until the third quarter of 2017, more than 125 courses have been delivered, excluding re-runs of courses, updates, and localized offerings (translation to languages other than English or German). On the openSAP platform, more than 500k unique learners from over 194 countries have been registered. Learners take 3.8 courses on average, which has led to over 2 million course enrolments until mid-2017. More than 50 % of the unique learners are located in India, the USA, or Germany. Most of the users

are professionals (approx. 85 %), with only a small amount among them being SAP internals (approx. 15 %).

Figure 5-1

openSAP Key Achievements



5.3.2 Learning Environment and Instructional Design

The openSAP platform provides learning anywhere, anytime, on any device. The platform itself is available in five languages to ease navigation and ensure a global reach. The content is mostly produced in English. Some exceptions (e.g., courses in Mandarin) guarantee a standardized delivery to larger global audiences. The offering is open to anyone, free of charge, and mostly free from knowledge prerequisites. Registration with a valid email address is the only precondition for participating in a course. While it is possible to download all the course contents, assessments take place exclusively online. In addition, every openSAP course follows a well-defined structure. Thus, courses have a defined start and end date, and the content is divided into several weeks (on average, four to six) to provide a guiding structure for the learners. Regardless of the fixed course duration, it is possible to enroll in a course at any given time. Every week, new content is released to keep users at a similar learning pace. One course week includes various learning elements:

- Video lectures of approximately 15 minutes are released week-by-week throughout the course. Once they have been released, videos can be viewed at any time or downloaded for offline viewing. Videos are complemented by elaborate transcripts and subtitles.

- After each video unit, the user has the opportunity to test his or her knowledge. These so-called self-tests are not graded, and they can be attempted several times.
- Wiki pages provide participants with text-based information about the course. They are adaptable for various use cases, like, for example, introducing a demo system used for hands-on exercises, providing a summary of download links or other additional resources.
- At the end of each week, an assessment containing ten questions in a multiple-answer or multiple-response format is conducted. Participants have 60 minutes in total to answer the questions and only one attempt. To keep users motivated, all assignments have a weekly deadline for submission, so users have to learn continuously. The points collected in these weekly assignments and the final exam add up to the overall course performance.

The suggested average learning time is four to six hours per week. At the end of each course, a final exam about the whole course contents is conducted in the same format as the weekly assignments, yet with more questions that have to be answered within 120 minutes. The overall points of the final exam equal the sum of all weekly assignments. As an alternative to the final exam, openSAP offers peer assessment for examination in selected courses. This is used primarily if a task cannot be evaluated in a computerized way and thus needs a more complex assessment format.

Participants can earn two kinds of certificates. To obtain a *Confirmation of Participation (COP)*, learners need to work with at least 50 % of the given learning materials. To earn a *Record of Achievement (ROA)*, learners need to participate in the weekly assignments and the final exam and collect at least 50 % of the overall points available. Outside the regular course runs, all content remains available except for the graded assignments, final exams, and peer assessments. Thus, it is still possible to earn a COP, but not an ROA outside the regular course runs. Outside the regular runs, courses are labeled ‘self-paced courses’.

Courses are complemented with additional features: Discussion forums aim at fostering exchange between learners. Course-specific weekly announcements help users keep track and stay active over the weeks. Collaboration spaces enable smaller

groups to jointly deepen their knowledge and go beyond the weekly content. File sharing, online documents, a discussion board, and a video chat are implemented here as collaboration tools.

5.4 Participation and Achievement at openSAP

5.4.1 Purpose of the Study

Regardless of their potential benefits, MOOCs in corporate training and development have not yet been researched extensively. A survey study showed a comparatively low awareness of MOOCs among employers. However, once the concept was acknowledged, potentials for professional and workplace learning were identified (Radford et al., 2014). On the other hand, studies highlight that most employers are unaware of their employees' participation in MOOCs (Castaño Muñoz et al., 2016). Although a learner's current context and professional role impact learning in a MOOC (Hood et al., 2015), there are still only a few studies that characterize the learners taking part in MOOCs for professional development. Therefore, the purpose of this research is to explore the participation in Enterprise MOOCs, which involves participants' characteristics, their initial intentions on how to use the MOOCs and on what to achieve, and their actual achievement in the course. The following research questions are addressed:

RQ1. Who is participating in Enterprise MOOCs at openSAP?

RQ2. What are participants' MOOC-related experiences, intended usage contexts, and learning objectives for Enterprise MOOCs at openSAP?

RQ3. What are participants' achievements in Enterprise MOOCs at openSAP?

5.4.2 Courses Analyzed

In total, five different courses on the openSAP Enterprise MOOC platform have been analyzed:

- *Next Steps in HANA Cloud Platform (HC)* is the successor of the introductory course Introduction to HANA Cloud Platform. It comprises six weeks that ran for the third time (second repeat). The course focused on the product SAP HANA Cloud Platform

and how to develop native/HTML5 applications, apply advanced security features, and develop widgets on the SAP HANA Cloud Portal. Therefore, mainly application developers were targeted by this offering. For additional hands-on exercises, a trail system was provided. The use of this system was not mandatory and had no consequences on participants´ course performance.

- *Introduction to SuccessFactors Solutions (SF)* is an introductory course and ran for the first time over four weeks. The course focused on the product SAP SuccessFactors and how this cloud-based solution supports the full HR lifecycle. The course was open to anyone interested and had no specific prerequisites or entry requirements.
- *Application Development for Business ByDesign (AD)* is a six-week introductory course and was conducted for the first time. The overall objective of the course was to enable participants to develop add-ons to meet specific business needs for the product SAP Business ByDesign. The target audience included mainly application developers.
- *SAP S/4HANA – Deep Dive (S4)* is the successor of the introductory course SAP S/4 HANA in a Nutshell, which is four weeks long and was delivered for the first time. The purpose of this deep dive course was to look at the product SAP S/4HANA in detail along the customer lifecycle. There were no prerequisites for this course.
- *Driving Business Results with Big Data (BD)* is a five-week course that was run for the first time on the platform. The course focused on the topic of big data, what it takes to extract value from big data, and solutions on how to acquire, store, analyze, and act on big data. Within the course, SAP Rapid Deployment solutions, which help businesses adopt big data solutions and related technology, were presented. The target audience was anyone involved or interested in big data.

5.4.3 Sample and Method

For the purpose of data collection, specifically designed short questionnaires were coded and linked to the Xikolo learning management platform so that the survey could be integrated into the course environment in a seamless manner. In the study at hand,

participant demographics (6 single-choice items, age classified due to privacy reasons) and data on previous MOOC experience, the intended usage context, and the intended learning objective (1 single-choice item each) have been merged with achievement data (actual credential achieved), and a sample of usable data sets was generated. Data was analyzed using Microsoft Excel 2010 and standard procedures of SPSS 23. While the number of responses seems considerably high in absolute terms, the pertaining response rates point towards a limited representativeness of the subsamples. Table 5-1 gives an overview of the population and the sample of the study.

Table 5-1

Sample of the Study

Sample metrics	HC	SF	AD	S4	BD	Total
Enrolments (half-way) [a]	5,962	9,620	3,397	18,448	7,993	45,420
Responses	687	2,651	581	4,529	1,546	9,994
Response rate (percentage)	11.5	27.6	17.1	24.6	19.3	22.0

Note. [a] Enrolments half-way: number of enrolments after half of the course time, including no-shows. Participants still have the chance to fully reach the course objective (RoA) from that point onwards.

5.4.4 Results

5.4.4.1 Participant Characteristics (RQ1)

Table 5-2 shows participant characteristics for the five surveyed openSAP courses.

Table 5-2

Participant Characteristics (Percentages of the Samples)

Characteristic	HC	SF	AD	S4	BD	Total
Age group [a]						
Juniors	18.3	13.4	21.9	13.2	19.5	15.1
Experienced	74.5	79.1	70.9	76.6	71.9	76.0
Seniors	7.1	7.5	7.2	10.2	8.7	8.9
Gender						
Female	14.6	31.2	16.2	16.2	19.1	20.5
Male	84.4	67.7	82.8	82.8	79.7	78.4
Location						
Americas	18.9	22.5	20.7	20.2	20.0	20.7
Asia Pacific	40.2	43.0	40.4	40.0	37.1	40.4
Europe	36.7	27.6	30.5	35.4	34.6	33.0
Middle East, Africa	3.2	6.1	7.2	3.5	6.9	4.9
Academic Background						
None / other	6.6	6.5	6.7	6.2	6.7	6.4
Bachelor's degree	46.4	44.5	49.9	46.4	41.8	45.4
Master's degree	36.7	47.3	41.3	45.8	47.2	46.0
Doctoral degree	3.2	1.3	1.7	1.3	3.9	1.8
Professional status						
Student	4.5	2.2	6.4	2.0	6.3	3.1
Employed	83.0	87.6	77.3	89.1	78.6	86.0
Self-employed	8.4	6.3	9.8	6.0	8.5	6.9
Not employed	3.8	3.3	5.7	2.2	6.0	3.4
Field of work						
IT	66.4	63.7	65.1	64.6	61.1	64.0
Not IT	33.6	36.3	34.9	35.4	38.9	36.0

Note. [a] Age group - Juniors: < 25 ys., Experienced: 26 – 50 ys., Seniors > 50 ys.; *N* = 9,994; missing values not presented.

Participant characteristics present a consistent picture over the five courses. The vast majority of participants are in the medium age group 'Experienced', and most of them are male. Only the SF MOOC shows a higher proportion of female participants. Geographically, people from all over the world take part in openSAP Enterprise MOOCs,

with especially high participation rates from the Asia Pacific region. The vast majority of the participants have an academic background. With regard to professional status, most participants are employed and, not surprisingly, mostly working in the IT business.

5.4.4.2 Participants' MOOC Experiences, Intended Usage Contexts, and Learning Objectives (RQ2)

Table 5-3 shows participants' MOOC-related previous experiences and intentions.

Table 5-3

MOOC-Related Experiences and Intentions (Percentages of the Samples)

Experiences & intentions	HC	SF	AD	S4	BD	Total
Previous MOOC experience [a]						
None	13.2	35.9	26.0	26.0	16.2	23.7
Little	16.2	15.3	12.4	12.4	12.3	15.5
Medium	41.6	30.3	32.7	32.7	39.4	36.8
High	28.2	17.7	27.9	27.9	31.3	23.2
Intended usage context						
Working time	22.4	26.3	23.2	28.4	19.7	25.8
Leisure time	61.7	56.5	57.7	55.6	65.4	57.9
Travel time	3.3	2.0	2.1	2.7	2.7	2.5
Other occasions	11.5	12.6	15.0	11.7	10.9	12.0
Intended learning objective [b]						
ROA	86.6	85.6	80.9	85.3	85.4	85.2
COP	6.8	7.1	10.0	8.3	7.8	7.9
NC	3.9	5.2	5.5	4.0	3.8	4.4
N/A	2.6	2.1	3.6	2.4	3.0	2.5

Note. [a] MOOC experience – Little: 1 MOOC, Medium: 2 – 5 MOOCs, High: > 5 MOOCs.
[b] Intended Learning Objective – ROA: Record of Achievement, COP: Confirmation of Participation, NC: No Certificate, N/A: Not Available. *N* = 9,994; missing values not presented.

Looking at participants' previous experiences and intentions, results are also rather consistent over the courses surveyed. Most participants are aware of the MOOC concept and have relevant previous experience. Looking at the intentions, it becomes clear that participants expect to make use of openSAP Enterprise MOOCs mostly outside

their working hours. As a learning objective, the vast majority of participants aim to obtain a full Record of Achievement.

5.4.4.3 Participants' Achievements (RQ3)

With respect to participants' results, completion and achievement rates are displayed in Table 5-4. Achievement categories were calculated by comparing the intended learning objectives (cf. Table 5-3) with the actual achievements after finishing the course. When both variables match, participants are categorized as *Achievers*. *Underachievers* are participants aiming at an ROA who only achieved a COP or NC, and participants aiming at a COP who only achieved NC — *Overachievers* vice versa. Participants with no intended learning objective N/A were categorized as those not aiming at any certificate (NC). Table 5-4 shows participants' MOOC-related previous experiences and intentions.

Table 5-4

Completion and Achievement Rates (Percentages of the Samples)

	HC	SF	AD	S4	BD	Total
Completion categories						
ROA	38.7	47.5	31.5	47.8	40.0	45.0
COP	14.7	16.8	13.8	13.6	14.2	14.6
NC	46.6	37.7	54.7	38.6	45.8	40.4
Achievement categories						
Overachievers	1.5	3.7	2.6	3.6	2.3	4.2
Achievers	54.1	45.8	58.5	45.3	53.1	49.5
Underachievers	41.8	48.4	35.3	48.7	41.6	46.3

Note. *N* = 9,994; missing values not presented.

Table 5-4 shows high completion rates among the surveyed sample. It has to be noted that the actual (official) course completion rates are notably lower, as they also take the no-shows into account, which were not included in the sample. However, in the surveyed sample, almost 60 % of the participants achieved a certificate which points towards a high level of motivation and/or the relevance of the contents.

Looking at achievement categories, more than half of the participants in the five courses reached or exceeded their initial objectives. To gain a deeper understanding of the relationship between intended learning objectives and actual achievements, the achievement patterns for the total sample have been depicted in Figure 5-2. Outer circles symbolize intended learning objectives, and inner circles symbolize actual achievement. Achievement patterns can then be described as transitions between intended learning objectives and actual achievement. For example, 49.0 % of the participants with the intended learning objective ROA (which made up 85.2 % of the total sample) actually received this credential, classifying them as Achievers.

Figure 5-2

Achievement Patterns

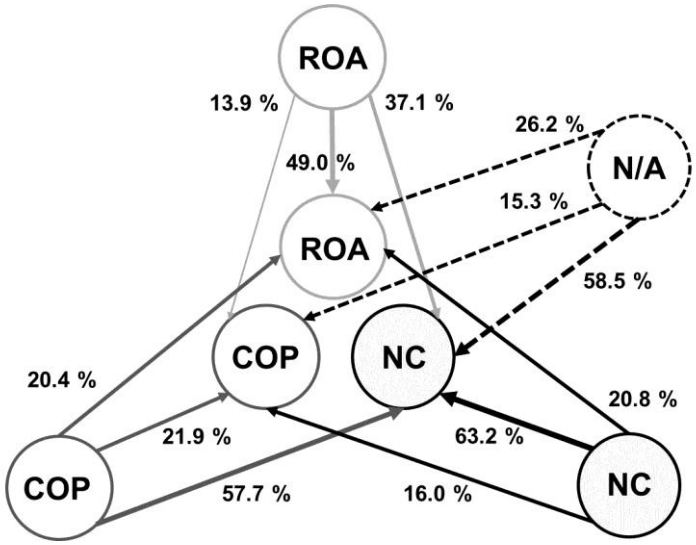


Figure 5-2 shows that the highest transition rates relate to the 'Achievers' category – with one notable exception, as the majority of the participants aiming at a COP fail to achieve anything. Generally, the number of people aiming at a full ROA is about 10 times higher over all five courses (cf. Table 5-3). However, among the few people aiming at a COP, the majority do not reach their intended learning objective. Aiming at a COP is apparently not positively related to success, which questions the motivational value of that particular credential.

5.5 Conclusion

This chapter presented initial findings on participants in Enterprise MOOCs, as well as their intentions and achievements, using the example of openSAP. Results indicate that Enterprise MOOCs can be a valuable tool for professional learning and development, especially in technology-oriented domains where quick access to up-to-date knowledge is crucial. The courses seem to suit the demands of highly qualified professional learners from all around the globe.

Looking at the intended usage context, it becomes clear that MOOCs are not primarily used in digital workplace learning, but rather in off- or near-the-job contexts. As this seems more of an organizational than a technical or instructional design aspect, awareness among employers and responsible HR managers should be raised, so that Enterprise MOOCs can become a fully accepted medium of corporate training instead of just an additional nice-to-have. For MOOC designers, on the other hand, it might be worthwhile to consider building smaller self-paced courses, which could then be better integrated into workplace learning settings.

With respect to completion rates, the study indicates that academic drop-out concepts do not fit too well within the enterprise context. When participants are looking for specific pieces of content without actually studying in lengthy academic-style courses, course completion rates might not be the best measure of success. Analyzing achievement patterns by comparing intended learning objectives and actual achievements might be a first step toward more reliable and realistic performance indicators. Additional micro-credentialing with badges or gamification mechanisms (Ifenthaler et al., 2016) might better suit the learner demands for small-scale learning in professional contexts.

Apart from being merely descriptive, the study at hand has some methodological shortcomings, most notably an apparent sample bias. Completion rates within the sample are higher than the openSAP average, as users not taking part in the survey could not be included. Thus, achievement results must be interpreted with caution. Also, possible differences between the surveyed courses should be taken into account.

All in all, the study provides first insights into the relationships between intentions and achievement in Enterprise MOOCs. In future studies, these relationships should be

investigated more thoroughly. A combination of additional sample data (e.g., on motivational variables) and system-generated performance data (e.g., from learning analytic tools) seems to be a promising approach here. Generally, the learning science perspective (Fischer, 2014) seems equally important to MOOCs in the corporate or enterprise context as it is in academic learning, so much additional research needs to be undertaken.

References

Bozkurt, A., Keskin, N. O., & de Waard, I. (2016). Research trends in Massive Open Online Course (MOOC) theses and dissertations: Surfing the Tsunami wave. *Open Praxis, 8*(3), 203–221. https://doi.org/10.5944/openpraxis.8.3.287

Castaño Muñoz, J., Kalz, M., Kreijns, K., & Punie, Y. (2016). Influence of employer support for professional development on MOOCs enrolment and completion: Results from a cross-course survey. In M. Khalil, M. Ebner, M. Kopp, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the European stakeholder summit on experiences and best practices in and around MOOCs – EMOOOCS 2016* (pp. 251–263). https://doi.org/10.5281/zenodo.375422

Castaño-Muñoz, J., Kreijns, K., Kalz, M., & Punie, Y. (2017). Does digital competence and occupational setting influence MOOC participation? Evidence from a cross-course survey. *Journal of Computing in Higher Education, 29*(1), 28–46. https://doi.org/10.1007/s12528-016-9123-z

Egloffstein, M., & Ifenthaler, D. (2017). Employee perspectives on MOOCs for workplace learning. *TechTrends, 61*(1), 65–70. https://doi.org/10.1007/s11528-016-0127-3

Fischer, G. (2014). Beyond Hype and Underestimation: Identifying Research Challenges for the Future of MOOCs. *Distance Education Journal, 35*(2), 149–158. https://doi.org/10.1080/01587919.2014.920752

Hamori, M. (2017). The Drivers of Employer Support for Professional Skill Development in MOOCs. In C. Delgado Kloos, P. Jermann, M. Pérez-Sanagustín, D. Seaton, & S. White (Eds.), *Digital Education: Out to the World and Back to the Campus. EMOOCs 2017*. Springer. https://doi.org/10.1007/978-3-319-59044-8_24

Hood, N., Littlejohn, A., & Milligan, C. (2015). Context counts: How learners' contexts influence learning in a MOOC. *Computers & Education, 91*, 83–91. https://doi.org/10.1016/j.compedu.2015.10.019

Ifenthaler, D., & Schumacher, C. (2016). Udacity. In S. Danver (Ed.), *The SAGE encyclopedia of online education* (pp. 1149–1151). SAGE. https://doi.org/10.4135/9781483318332.n372

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (2015). Internet: Its impact and its potential for learning and instruction. In J. M. Spector (Ed.), *The SAGE encyclopedia of educational technology* (pp. 416–422). SAGE. https://doi.org/10.4135/9781483346397.n176

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (Eds.). (2016). *Foundation of Digital Badges and Micro-Credentials. Demonstrating and Recognizing Knowledge and Competencies*. Springer. https://doi.org/10.1007/978-3-319-15425-1

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. *International Review of Research in Open and Distance Learning, 16*(3), 341–358. https://doi.org/10.19173/irrodl.v16i3.2112

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of Massive Open Online Courses (MOOCs). *Computers & Education, 80*, 77–83. https://doi.org/10.1016/j.compedu.2014.08.005

Noe, R. A., Clarke, A. D. M., & Klein, H. J. (2014). Learning in the twenty-first-century workplace. *Annual Review of Organizational Psychology and Organizational Behavior, 1*, 245–275. https://doi.org/10.1146/annurev-orgpsych-031413-091321

Olsson, U. (2016). Open courses and MOOCs as professional development – is the openness a hindrance? *Education + Training, 58*(2), 229–243. https://doi.org/10.1108/ET-01-2015-0006

Radford, A. W., Robles, J., Cataylo, S., Horn, L., Thornton, J., & Whitfield, K. (2014). The employer potential of MOOCs: A mixed-methods study of human resource professionals' thinking on MOOCs. *The International Review of Research in Open and Distributed Learning, 15*(5), 1–25. https://doi.org/10.19173/irrodl.v15i5.1842

Renz, J., Schwerer, F., & Meinel, C. (2016). openSAP: Evaluating xMOOC Usage and Challenges for Scalable and Open Enterprise Education. *International Journal of Advanced Corporate Learning, 9*(2), 34–39. https://doi.org/10.3991/ijac.v9i2.6008

Sergis, S., Sampson, D. G., & Pelliccione, L. (2017). Educational Design for MOOCs: Design Considerations for Technology-Supported Learning at Large Scale. In M. Jemni, Kinshuk, & M. K. Khribi (Eds.), *Open Education: from OER to MOOCs* (pp. 39–71). Springer. https://doi.org/10.1007/978-3-662-52925-6_3

Tu, C. H., & Sujo-Montes, L. E. (2015). MOOCs. In R. Papa (Ed.), *Media Rich Instruction. Connecting Curriculum to All Learners.* (pp. 287–304). Springer. https://doi.org/10.1007/978-3-319-00152-4_18

White B. (2014). Is "MOOC-Mania" over? In: S. K. S. Cheung, J. Fong, J. Zhang, R. Kwan, & L. F. Kwok (Eds.), *Hybrid Learning. Theory and Practice. ICHL 2014.* (pp. 11–15). Springer. https://doi.org/10.1007/978-3-319-08961-4_2

6 Course Design Approaches and Behavioral Patterns in Massive Open Online Courses for Professional Learning

6.1 Introduction

More than ten years after their inception, Massive Open Online Courses (MOOCs) have gained a foothold in academia and have also become a viable alternative for professional learning (Littenberg-Tobias & Reich, 2021) and corporate training (Egloffstein & Ifenthaler, 2017). In this light, current discussions center around the transfer and recognition of MOOC credits between higher education and continuing education (R. L. Moore, 2022), as well as the evolution of the course format through modularization to better align with education and training requirements (Serth et al., 2022).

While many companies are not yet fully realizing the potential of MOOCs for training and development (Condé & Cisel, 2019) or lack adequate support for employees taking MOOCs (Hamori, 2021; 2023), others are operating their own platforms, offering corporate (internal focus: courses for employees) or enterprise (internal and external focus: courses for stakeholders) MOOCs (Egloffstein, 2018). For instance, openSAP, an open learning platform for the information technology sector, implements so-called openSAP Enterprise MOOCs (Schwerer & Egloffstein, 2016) to transfer relevant knowledge within the organization as well as to external stakeholders and the public (Renz et al., 2019).

Considering the persisting challenges associated with MOOCs in terms of instructional quality (Egloffstein et al., 2019; Margaryan et al., 2015) or low completion rates (N. Li et al., 2015; Reich & Ruipérez-Valiente, 2019), openSAP strives to optimize its offering and continuously improve the learning experience based on scientific evidence. Following the idea that learning analytics can be a solution to current MOOC handicaps (Bozkurt, 2021), openSAP initiated several collaborative research projects aimed at improving the learning design of MOOCs (Ifenthaler, 2017a) and advancing the state of research on online learning in training and professional development.

This paper reports an exploratory study focusing on learner behavior in different openSAP Enterprise MOOCs. Building on previous research findings (Rohloff, Schwerer, et al., 2020; Şahin et al., 2021), the study seeks to (a) identify behavioral patterns in

openSAP Enterprise MOOCs and (b) determine differences according to course design as well as learner achievement in order to derive evidence-based design recommendations. The study illustrates how learning analytics approaches can inform course design and facilitation.

6.2 Background

6.2.1 Research Context: openSAP

SAP is a major multinational software company based in Germany. As part of SAP's digital education strategy, the openSAP learning platform was launched in 2013 to meet the increasing demands of partners, customers, and suppliers for SAP-related knowledge on time. OpenSAP delivers knowledge via scalable online courses based on the xMOOC principles, thus suitable for larger audiences. The main topic areas are technology and software, business, or design; while some additional courses provide insights on corporate social responsibility-related topics. The technical infrastructure is based on a MOOC platform developed at the Hasso Plattner Institute (HPI) in Potsdam, Germany. According to company data provided by openSAP, the platform had more than 1,300,000 registered participants from over 200 countries, of which about 85% had a professional background, with more than six million enrollments in over 200 different courses in 2022.

Concerning instructional design (ID), openSAP Enterprise MOOCs follow an elaborate xMOOC model, providing structured and well-organized course offerings (Bonk et al., 2015). The courses are open to everyone free of charge, providing videos, quizzes, and interaction over a fixed period. Every course has a fixed start and end date with a registration period of several weeks in advance. Once the course has started, new content is released week by week, mostly with video elements of approximately 15 minutes in length. Every video element is followed by a short, ungraded self-test with multiple-choice and multiple-answer questions to reflect on the content. Hands-on exercises can complement this, for example, in interactive coding assignments in programming courses. Every openSAP course has a course-specific discussion forum available, allowing participants to interact with peers and content experts who are available during the course run. A set of collaborative tools is provided in so-called

Collab Spaces, which allow dedicated breakout sessions or working in smaller groups. At the end of each week, a graded assignment about the content enables participants to reflect on and document their learning performance. The average workload per week is four to six hours. A course usually concludes with a final exam covering all the course content, counting for 50 % of the highest attainable score. OpenSAP offers two kinds of certificates. Learners receive a *confirmation of participation* (COP) by accessing at least 50 % of the overall course content (= *progress*). Moreover, participants will obtain a *record of achievement* (ROA) when achieving at least 50% of the points available in graded assignments (= *performance*).

6.2.2 Related Research: Sequential Analysis of Learning Behavior

As learning analytics research increasingly focuses on exploring the process nature of learning (Ifenthaler et al., 2021), a plethora of methods are being employed. Examples include epistemic network analysis, temporal process mining, or stochastic process mining (Saint et al., 2020). Approaches for analyzing activity sequences involve sequential pattern mining, Markov chains, and hidden Markov models (Boroujeni & Dillenbourg, 2018). As a long-established method of inferential statistics (Wald, 1973; Bakeman & Gottman, 1997), sequential analysis is also used for investigating the behavior of learners in online learning systems (Hou et al., 2010; Şahin et al., 2020). Identifying latent patterns in learner behavior based on sequences of system interactions can offer valuable insights for aligning course design with individual learning processes, thereby leveraging the use of instructional technologies and ultimately enhancing learning success.

Thus, sequential analysis has been applied in several MOOC settings: Boroujeni and Dillenbourg (2018) detected latent study patterns by comparing a hypothesis-driven approach with an unsupervised, data-driven approach. Their methods could be deployed during the course, enabling real-time support and feedback. Shang et al. (2020) adopted Lag Sequential Analysis (LSA) to explore the factors affecting the learning efficiency of adult learners. The study found 92 types of significant behavioral transformation sequences reflecting the characteristics of adult learners, such as task orientation,

active exploration, and self-regulation ability, as well as correlations with learning efficiency.

B. Liu et al. (2021) investigated the differences between certificate achievers and explorers. Eleven behaviors were extracted, with six essential behaviors highly related to certificate achievement. Compared to explorers, certificate achievers exhibited more bidirectional behaviors in terms of interactive and course-related activities, as well as more repetitive behaviors in terms of course-related and graded assessment activities.

S. Li et al. (2021) explored MOOC learners' time investment patterns and their relationships with learning performance, session time allocation, and learning sequences by analyzing the data from a Chinese MOOC. Seven time-investment patterns of MOOC learners were defined, and learning performance differed among them.

Most recently, S. Li et al. (2022) detected the differences in learning engagement and learning patterns amongst three groups of learners with different achievement levels (failed, satisfactory, excellent). The study found differences in both learning engagement and learning patterns among the three groups.

All those studies were conducted with the explicit intention of improving the underlying learning environment and advancing instructional design as well as course facilitation. However, none explicitly focused on professional learners, and none employed a differential perspective concerning course design.

6.3 Research Questions

Building upon previous research findings and grounded in the corporate research context, this study aims to investigate behavioral patterns in openSAP Enterprise MOOCs and explore their relationship to the underlying course design as well as to learner performance. The guiding research questions were:

RQ1. Are there behavior patterns in enterprise MOOCs for professional learning?

RQ2. Do interaction sequences differ according to the underlying course design approach?

RQ3. Are there interaction sequences for high-achieving learners?

6.4 Method

6.4.1 Data Collection and Participants

User events from 13 openSAP Enterprise MOOCs were analyzed with regard to learner behavior patterns. The courses in the sample were intentionally selected by openSAP to represent the full spectrum of their offering. They show variations in terms of length, effort, and design parameters like assessment configuration or additional instructional design elements (e.g., reflection prompts, coding exercises, or team peer assessments). Based on the underlying course design approach, openSAP grouped these courses into three clusters: lecture-oriented courses (strictly following the video-based xMOOC format), system interaction-oriented courses (featuring interactions with the platform as an integral element, e.g., programming courses), and discussion-oriented courses (featuring communication as an integral element). Data collection was carried out in line with openSAP's data protection policy, based on the participants' consent when accessing the platform. Accordingly, no personal data that could have identified individuals was analyzed. The sample reflects the overall population of openSAP learners, which consists predominantly of professional learners with an academic background, aged 25 to 40, participating voluntarily and without financial compensation. Table 6-1 provides an overview of the sample. Additional information on the courses can be found in Appendix B.

Table 6-1

Descriptive Information on the Courses in the Sample

Course design approach	Course code	Topic area[1]	Course length (wks)	Workload (hrs)	Assessment configuration[2]	Additional ID elements	Enrollments[3]	COPs issued[4]	ROAs issued[5]
Lecture-oriented	xm1	biz	1	3	w	0	4609	1679	1318
	leo2	biz	2	8	w+f	1	10542	2576	1687
	sbw1	biz	6	24	w	1	11664	1274	967
	build1	des	4	16	w+f	2	7749	1429	849
	ieux1	tech	1	4	w	0	13431	3944	2719
System interaction-oriented	java1	tech	5	30	w+e+f	3	21693	2941	2318
	mobile3	tech	5	25	w+f	1	10374	1652	1195
	s4h15	biz	4	16	w+f	0	18265	5149	3884
	sps2	tech	3	12	w+f	1	10940	2607	1896
	sps3	des	5	20	w+p	1	6629	932	651
Discussion-oriented	cwr1-1	des	3	12	w+p	2	1810	412	253
	dafie1	des	5	20	w+p	2	5283	1101	651
	pa1-tl	biz	3	12	w+f	1	6904	1888	1333

Note. [1] biz: business; des: design; tech: technology
[2] w: weekly assignment; f: final exam; e: graded exercise; p: peer assessment
[3] at course end
[4] COP: Confirmation of participation
[5] ROA: Record of achievement.

The dataset consists of learners' interactions with the digital learning environment based on traceable system states and events. In the preceding data preparation step, the event data generated by platform interactions were coded for each learner. A total of N_A = 10,454,430 activities of N_L = 72,668 learners were analyzed.

6.4.2 Procedure and Analysis

We applied a two-stage procedure, exploring two levels of analysis. At the aggregate level, we followed the predefined system-side mapping of learner events to four global categories, depending on the area of the platform in which the interactions take place:

learning (L), discussion (D), progress (P), and announcement (A). We further examined learners' sequential behavior patterns on the more granular level of system interactions. These interactions belong to 20 system event types, such as submitting assignments, downloading presentations, submitting surveys, visiting textual instructions, visiting videos, playing videos from category (L), posting comments, posting replies for category (D), visiting progress in category (P), and visiting announcements in category (A).

The first phase of the analysis was centered around the process of Lag Sequential Analysis on the aggregate level. In the first step, event sequences were created for each learner based on their interactions with the learning platform. An example of such an event sequence would be: LLLLDDLLLPDAALLLL. In the second step, transitional frequency matrices were created to represent the number of transitions between system interactions. Subsequently, the transition probability matrices were mapped out, which indicate the statistical probabilities of given transitions between system interactions. Transitional probability is a conditional probability; events occur at different times and 'lag' is used to express these time differences (Şahin et al., 2020). To test the statistical significance of the transitions, *z*-scores were calculated, together with a Bonferroni adjustment to determine the *z*-score threshold. In the Bonferroni adjustment, the α-value is divided by the number of cells in the table, a new α-value is determined, and the equivalent of this value in the two-way critical *z*-value is calculated. Cells for which the absolute value of the corrected residual is greater than the newly determined critical *z*-value are interpreted as contributing to significance (Terzi Müftüoglu et al., 2023). A state transition diagram was generated to display the results in the last step. In addition to the overall view, a differential analysis for the three course clusters was conducted to determine whether the course design approach impacted possible high-level patterns.

The second phase of the analysis includes LSA with the 20 system event types on the level of system interactions. First, LSA was carried out separately for the three-course clusters based on the underlying course design approach. Second, LSA was carried out separately for different achievement groups within those clusters. Following the openSAP certification guidelines, we focused on a rather broad group of high-achieving learners (over 50 % progress and performance, eligible for both COP and ROA) in the context of this study.

6.5 Results

6.5.1 Behavioral Patterns Over All Courses (RQ1)

For the 13 courses in the sample, significant transitions between the four main categories could be traced. Table 6-2 shows the respective z-scores.

Table 6-2

Z-Scores Based on Interaction Categories for the Overall Sample

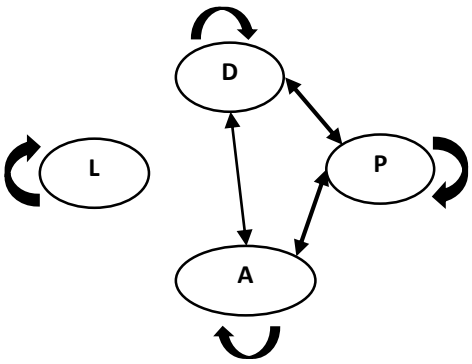
Categories	Announcement	Discussion	Learning	Progress
Announcement	197.144*	11.319*	-86.617	45.578*
Discussion	8.932*	460.772*	-310.098	35.690*
Learning	-101.585	-304.711	269.246*	-78.470
Progress	70.902*	17.189*	-73.601	60.690*

Note. *z*-score threshold: 2.96; * statistically significant transitions.

The respective state transition diagram for statistically significant transitions is shown in Figure 6-1.

Figure 6-1

State Transition Diagram for the Overall Sample



The state transition diagram shows significant transitions between all the main categories except for the learning category. From the perspective of high-level interaction categories, the biggest category regarding captured events is rather isolated. We further analyzed these high-level patterns in a differential approach, looking at the high-level transitions in each course cluster (Table 6-3).

Table 6-3

Z-Scores Based on Interaction Categories for the Course Clusters

Categories	Announcement	Discussion	Learning	Progress
Discussion-oriented courses				
Announcement	225.416*	-4.178	-37.202	-2.670
Discussion	-4.251	436.478*	-362.705	59.893*
Learning	-48.962	-377.085	477.399*	-278.262
Progress	-4.523	68.285*	-306.144	376.757*
Lecture-oriented courses				
Announcement	265.408*	6.900*	-88.170	65.215*
Discussion	6.203*	1004.308*	-806.506	55.079*
Learning	-108.899	-781.635	722.747*	-162.965
Progress	98.560*	19.281*	-140.481	167.670*
System interaction-oriented courses				
Announcement	289.587*	34.922*	-104.917	66.849*
Discussion	23.674*	1347.325*	-1042.840	20.147*
Learning	-116.352	-1019.694	852.753*	-92.554
Progress	96.786*	-15.873	-68.575	102.990*

Note. *z*-score threshold: 2.96; * statistically significant transitions.

Besides some obvious differences related to the course design, the central global pattern, i.e., the 'isolated' learning category, can still be found in all course clusters. A closer look at these results reveals that learners interact primarily within the learning category (e.g., with learning materials) and then log off, rather than interacting with or in the other main categories, announcement, progress, and discussion.

6.5.2 Interaction Sequences According to Course Design (RQ2)

On the level of granular interactions, there are twenty interaction categories and numerous subsequent transitions. An excerpt of the table of significant transitions for three interaction categories is presented in Table 6-4. For our explorative analysis, we purposefully selected Video play as a typical MOOC-related learning activity, Assignment submit as the main activity for demonstrating performance, and Progress (i.e., viewing the progress page) as a metacognitive activity for managing the learning process.

Detailed information about the whole set of significant transactions for all interaction types can be found in Appendix C.

Table 6-4

Selected Interaction Level Transactions According to Course Cluster

	Lecture-oriented courses [L]	System interaction-oriented courses [S]	Discussion-oriented courses [D]
Assignment submit	→ Assignment submit [LSD] → Progress [LSD] → Textual discussion prompt visit [LSD] → Textual download visit [LSD] → Textual instructional visit [LSD] → Survey submit [L] → Video download [L]	→ Assignment submit [LSD] → Progress [LSD] → Textual discussion prompt visit [LSD] → Textual download visit [LSD] → Textual instructional visit [LSD] → Announcement [S]	→ Assignment submit [LSD] → Progress [LSD] → Textual discussion prompt visit [LSD] → Textual download visit [LSD] → Textual instructional visit [LSD] → Video visit [D]
Progress	→ Announcement [LSD] → Assignment submit [LS] → Discussion visit [LS] → Final exam submit [LSD] → Progress [LSD] → Survey submit [LSD] → Textual discussion prompt visit [LSD] → Textual download visit [LSD] → Textual instructional visit [LSD] → Video download [L]	→ Announcement [LSD] → Assignment submit [LS] → Discussion visit [LS] → Final exam submit [LSD] → Progress [LSD] → Survey submit [LSD] → Textual discussion prompt visit [LSD] → Textual download visit [LSD] → Textual instructional visit [LSD]	→ Announcement [LSD] → Post reply [D] → Post visit [D] → Final exam submit [LSD] → Progress [LSD] → Survey submit [LSD] → Textual discussion prompt visit [LSD] → Textual download visit [LSD] → Textual instructional visit [LSD]
Video play	→ Video play [LSD]	→ Video play [LSD]	→ Video play [LSD]

Note. [xxx] indicates significant transitions for all three course clusters; [xx] indicates significant transitions for two course clusters as indicated by the letters in parentheses; [x] indicates significant transitions that only apply to the respective course cluster.

The results show several similarities among the significant interactions. Both for Assignment submit and Progress, there are significant transitions to Progress and the textual interaction categories for the three course clusters. For Progress, Announcement (i.e., viewing the announcement page) and Final exam submit are additional joint transitions. For Video play, there is only one joint transition, which is the one to the Video

play category itself. Notable singularities, i.e., significant transactions that only appear in one single course cluster, are as follows: Assignment submit to Video download for lecture-oriented courses, to Announcement and Progress for system interaction-oriented courses, and to Video visit for discussion-oriented courses, as well as Progress to Video download for lecture oriented courses and to the discussion categories Post reply and Post visit in discussion-oriented courses.

6.5.3 Interaction Sequences According to Learner Achievement (RQ3)

In the differential analysis for the three selected interaction types, several significant transitions could be exclusively associated with high-achievement learners (high progress and high performance). For lecture-oriented courses, Progress to Textual download visit is a high achiever pattern. For system interaction-oriented courses, Assignment submit to Announcement is a high achiever pattern. For discussion-oriented courses, high achiever patterns are: Progress to Final exam submit and Progress to Survey submit. The metacognitively oriented interactions Progress and Announcement are part of all these high-achievement patterns, either as starting or following interactions.

6.6 Discussion

6.6.1 Findings and Implications

The findings of this study illustrate how learning analytics approaches can be applied to open online courses in professional learning to provide insights for course design and facilitation. We explored typical behavioral patterns in openSAP Enterprise MOOCs and possible variations according to course design approaches on an aggregate level and the granular level of system interactions. Findings indicate that (1) there are consistent patterns and that (2) several distinctive transitions become evident when a differential perspective is adopted concerning the underlying course design. Among the top-level categories, the learning category, which contains the majority of system interactions, remains isolated from the other categories, both from the holistic and a differential perspective, according to course design. This might be due to a clear learner focus on

working through the content and towards the assignments, while the announcement, progress, and discussion categories are more likely to be addressed at the beginning or the end of a learning session. Moreover, announcements are also communicated via additional channels (e.g., via email), and the learner's progress is partly visible in the learning area, too. If there is a need to better connect learning activities to collaborative (e.g., discussions) or metacognitive (e.g., announcements or progress visits) activities, it cannot be decided at this level of analysis.

Hence, the following analysis focused on the interaction level and differentiated courses according to the underlying design approach, where common and distinctive patterns could be found. Perhaps most striking is the isolated role of videos for all course clusters. Following the traditional xMOOC-model, one would expect learners to interact with a video and then with a self-test or other content elements (N. Li et al., 2015; Ou et al., 2019). However, the findings show that learners play videos without subsequent significant transitions afterward, which does not fit the linear way that learning typically is organized in MOOCs (Chew et al., 2017). From a research perspective, a more detailed analysis is needed here. For example, video metrics could be considered (N. Li et al., 2015; Yoon et al., 2021). Based on this result, a preliminary design recommendation could be directly integrating interactive instructional elements like quizzes into the videos.

Moreover, the distinctive transactions in lecture-oriented courses connecting performance display and metacognition with video downloads seem to represent a rather consumerist pattern that needs to be questioned from a learning science perspective (Ogunyemi et al., 2022; V. Shah et al., 2022) and considering the discussion of instructional quality (Margaryan et al., 2015). A global design recommendation would be to supplement the classic, sometimes rigid xMOOCs model with (mandatory) additional instructional elements to promote learner engagement.

Looking at the high achiever patterns within the scope of this analysis, the role of metacognitively oriented interactions becomes evident. So, another initial design recommendation could be to foster those interactions by integrating metacognitively oriented elements further into the course structure (Zhu & Bonk, 2019), for example, by adaptive metacognitive prompts or an advanced progress indicator. To sum up, we can

conclude that there are typical behavior patterns in openSAP Enterprise MOOCs that differ according to course design and that it seems feasible to connect those patterns to learner achievement to derive evidence-based design recommendations.

6.6.2 Limitations and Future Research

Subsequent research must substantiate those results, extending the scope across interaction categories and additional achievement groups (e.g., low achievers) to gain more comprehensive insights. Bearing in mind that especially for professional learning, course completion (or attrition) does not account for the diversity of learner enrollment motivations (R. L. Moore & Blackmon, 2022; Schwerer & Egloffstein, 2016), alternative achievement groups or engagement patterns (Huang et al., 2023) need to be delineated to develop suitable design recommendations for different learner groups.

Within the scope of this research, LSA was conducted based on system events. In addition, other metrics, such as time spent, could be included (Boroujeni & Dillenbourg, 2019), allowing for the discovery of more in-depth patterns and a deeper understanding of the learning process (Ifenthaler et al., 2018; Knight et al., 2017). Despite bringing in various learner data from different course design approaches, our research was limited to only one platform. When platform capabilities strongly influence what is done pedagogically (Blackmon & Major, 2017), it seems rather obvious that platform capabilities also limit the scope of possible learner interactions. Therefore, expanding our research on different providers and platforms for MOOCs for professional learning would be desirable. Methodologically, this would imply a generalization of the current operationalization beyond the context under consideration, with possible changes towards more generic interaction categories.

Finally, our analysis was based on the underlying assumption that learner behavior reflects cognitive and affective learner engagement, and that learner engagement leads to learning success. While this is a common assumption in research on self-directed online learning scenarios, our findings suggest that a deeper analysis of activities and interactions may be needed to understand the learning processes in enterprise MOOCs better. Following Martin & Borup (2022) and Kimmons et al. (2020), behavioral engagement with technology can be either passive (i.e., using technology to receive

information), interactive (i.e., learning activities that require learners' active involvement), or creative (i.e., using technology to create an artifact, commonly to demonstrate an understanding of the course content). The influence of these different behavioral categories on achievement in different course design formats needs to be further researched to derive substantial design recommendations. Likewise, it is important to note that there is more to learner engagement than observable interactions. In our analysis, we mainly focused on learner-content and learner-interface interactions. Other themes for research on environmental affordances for online learner engagement include presence, community, collaboration, and communication (Martin & Borup, 2022). In summary, we hope that the further development of our approach will provide deeper insights into (successful) online learning behavior in enterprise MOOCs and offer starting points for advancing these learning environments.

References

Bakeman, R., & Gottman, J. (1997). *Observing interaction: An introduction to sequential analysis* (2nd ed.). Cambridge University Press.

Blackmon, S. J., & Major, C. H. (2017). Wherefore art thou MOOC? Defining massive open online courses. *Online Learning, 21*(4), 195–221. https://doi.org/10.24059/olj.v21i4.1272

Bonk, C. J., Lee, M. M., Reeves, T. C., & Reynolds, T. H. (Eds.) (2015). *MOOCs and open education around the world.* Taylor and Francis. https://doi.org/10.4324/9781315751108

Boroujeni, M., & Dillenbourg, P. (2019). Discovery and temporal analysis of MOOC study patterns. *Journal of Learning Analytics, 6*(1), 16–33. https://doi.org/10.18608/jla.2019.61.2

Bozkurt, A. (2021). Surfing on three waves of MOOCs: An examination and snapshot of research in massive open online courses. *Open Praxis, 13*(3), 296–311. https://doi.org/10.5944/openpraxis.13.3.132

Chew, S. W., Cheng, I-L., & Chen, N.-S. (2017). Yet another perspective about designing and implementing a MOOC. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open education: From OERs to MOOCs. Lecture Notes in Educational Technology* (pp. 117–133). Springer. https://doi.org/10.1007/978-3-662-52925-6_6

Condé, J., & Cisel, M. (2019). On the Use of MOOCs in Companies: A Panorama of Current Practices. In M. Calise, C. Delgado Kloos, J. Reich, J. Ruiperez-Valiente, & M. Wirsing (Eds.), *Digital Education: At the MOOC Crossroads Where the Interests of Academia and Business Converge. EMOOCs 2019* (pp. 37–46). Springer. https://doi.org/10.1007/978-3-030-19875-6_5

Egloffstein, M. (2018). Massive open online courses in digital workplace learning: Current state and future perspectives. In D. Ifenthaler (Ed.), *Digital workplace learning: Bridging formal and informal learning with digital technologies* (pp. 149–166). Springer. https://doi.org/10.1007/978-3-319-46215-8

Egloffstein, M., & Ifenthaler, D. (2017). Employee perspectives on MOOCs for workplace learning. *TechTrends*, *61*(1), 65–70. https://doi.org/10.1007/s11528-016-0127-3

Egloffstein, M., Koegler, K., & Ifenthaler, D. (2019). Instructional quality of business MOOCs: Indicators and initial findings. *Online Learning Journal*, *23*(4), 85–105. https://doi.org/10.24059/olj.v23i4.2091

Hamori, M. (2021). MOOCs at work: what induces employer support for them? *The International Journal of Human Resource Management*, *32*(20), 4190–4214. https://doi.org/10.1080/09585192.2019.1616593

Hamori, M. (2023). Self-directed learning in massive open online courses and its application at the workplace: Does employer support matter? *Journal of Business Research, 157*, 113590. https://doi.org/10.1016/j.jbusres.2022.113590

Hou, H. T., Chang, K. E., & Sung, Y. T. (2010). Applying lag sequential analysis to detect visual behavioural patterns of online learning activities. *British Journal of Educational Technology, 41*(2), E25–E27. https://doi.org/10.1111/j.1467-8535.2009.00935.x

Huang, H., Jew, L., & Qi, D. (2023). Take a MOOC and then drop: A systematic review of MOOC engagement pattern and dropout factor. *Heliyon 9*(4), e15220. https://doi.org/10.1016/j.heliyon.2023.e15220

Ifenthaler, D. (2017a). Learning analytics design. In L. Lin, & J. M. Spector (Eds.), *The sciences of learning and instructional design: Constructive articulation between communities* (pp. 202–211). Routledge. https://doi.org/10.4324/9781315684444-13

Ifenthaler, D., Gibson, D. C., & Dobozy, E. (2018). Informing learning design through analytics: Applying network graph analysis. *Australasian Journal of Educational Technology*, *34*(2), 117–132. https://doi.org/10.14742/ajet.3767

Ifenthaler, D., Gibson, D. C., Prasse, D., Shimada, A., & Yamada, M. (2021). Putting learning back into learning analytics: Actions for policy makers, researchers, and practitioners. *Educational Technology Research and Development*, *69*(4), 2131–2150. https://doi.org/10.1007/s11423-020-09909-8

Kimmons, R., Graham, C. R., & West, R. E. (2020). The PICRAT model for technology integration in teacher preparation. *Contemporary Issues in Technology and Teacher Education, 20*(1), 176–198. https://citejournal.org/volume-20/issue-1-20/general/the-picrat-model-for-technology-integration-in-teacher-preparation/

Knight, S., Wise, A., & Chen, B. (2017). Time for change: Why learning analytics needs temporal analysis. *Journal of Learning Analytics*, *4*(3), 7–17. https://doi.org/10.18608/jla.2017.43.2

Li, N., Kidziński, Ł., Jermann, P., & Dillenbourg, P. (2015). MOOC video interaction patterns: What do they tell us? In G. Conole, T. Klobučar, C. Rensing, J. Konert, & É. Lavoué (Eds.), *Design for teaching and learning in a networked world. LNCS Vol. 9307* (pp. 197–210). Springer. https://doi.org/10.1007/978-3-319-24258-3_15

Li, S., Du, J., & Sun, J. (2022). Unfolding the learning behaviour patterns of MOOC learners with different levels of achievement. *International Journal of Educational Technology in Higher Education, 19*(1). https://doi.org/10.1186/s41239-022-00328-8

Li, S., Wang, S., Du, J., Pei, Y., & Shen, X. (2021). MOOC learners' time-investment patterns and temporal-learning characteristics. *Journal of Computer Assisted Learning, 38*(1), 152–166. https://doi.org/10.1111/jcal.12597

Littenberg-Tobias, J., & Reich, J. (2020). Evaluating access, quality, and equity in online learning: A case study of a MOOC-based blended professional degree. *The Internet and Higher Education, 47*, 10759. https://doi.org/10.1016/j.iheduc.2020.100759

Liu, B., Wu, Y., Xing, W., Cheng, G., & Guo, S. (2021). Exploring behavioural differences between certificate achievers and explorers in MOOCs. *Asia Pacific Journal of Education, 42*(4), 802–814. https://doi.org/10.1080/02188791.2020.1868974

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers and Education, 80*, 77–83. https://doi.org/10.1016/j.compedu.2014.08.005

Martin, F., & Borup, J. (2022). Online learner engagement: Conceptual definitions, research themes, and supportive practices. *Educational Psychologist, 57*(3), 162–177. https://doi.org/10.1080/00461520.2022.2089147

Moore, R. L. (2022). Introducing mesocredentials: Connecting MOOC achievement with academic credit. *Distance Education*, *43*(2), 271–289. https://doi.org/10.1080/01587919.2022.2064823

Moore, R. L., & Blackmon, S. J. (2022). From the learner's perspective: A systematic review of MOOC learner experiences (2008–2021). *Computers & Education 190*, 104596. https://doi.org/10.1016/j.compedu.2022.104596

Ogunyemi, A. A., Quaicoe, J. S., & Bauters, M. (2022). Indicators for enhancing learners' engagement in massive open online courses: A systematic review. *Computers and Education Open*, 100088. https://doi.org/10.1016/j.caeo.2022.100088

Ou, C., Joyner, D. A., & Goel, A. K. (2019). Designing and developing video lessons for online learning: A seven-principle model. *Online Learning Journal, 23*(2), 82–104. https://doi.org/10.24059/olj.v23i2.1449

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science, 363*(6423), 130–131. https://doi.org/10.1126/science.aav7958

Renz, J., Meinel, C., & Link, C. (2019). openSAP: Why are enterprise MOOCs working? *International Journal of Advanced Corporate Learning, 12*(3), 59–69. https://doi.org/10.3991/ijac.v12i3.11262

Rohloff, T., Schwerer, F., Schenk, N., & Meinel, C. (2020). openSAP: Learner behavior and activity in self-paced enterprise MOOCs. *International Journal of Advanced Corporate Learning, 13*(2), 30–40. https://doi.org/10.3991/ijac.v13i2.16531

Şahin, M., Egloffstein, M., Bothe, M., Rohloff, T., Schenk, N., Schwerer, F., & Ifenthaler, D. (2021). Behavioral patterns in enterprise MOOCs at openSAP. In C. Meinel, T. Staubitz, S. Schweiger, C. Friedl, J. Kiers, M. Ebner, A. Lorenz, G. Ubachs, C. Mongenet, J. A. Ruipérez-Valiente, & M. Cortes Mendez (Eds.), *EMOOCs 2021* (pp. 281–288). Universitätsverlag Potsdam. https://doi.org/10.25932/publishup-51030

Şahin, M., Keskin, S., & Yurdugül H. (2020). Sequential analysis of online learning behaviors according to e-learning readiness. In P. Isaias, D. G. Sampson, & D. Ifenthaler (Eds.), *Online Teaching and Learning in Higher Education* (pp. 117–131). Springer. https://doi.org/10.1007/978-3-030-48190-2_7

Saint, J., Gaševic, D., Matcha, W., Uzir, N. A., & Pardo, A. (2020). Combining analytic methods to unlock sequential and temporal patterns of self-regulated learning. In V. Kovanović, M. Scheffel, N. Pinkwart, & K. Verbert (Eds.), *LAK 2020 Conference Proceedings* (pp. 402–411). Association for Computing Machinery. https://doi.org/10.1145/3375462.3375487

Schwerer, F., & Egloffstein, M. (2016). Participation and achievement in enterprise MOOCs for professional learning. In D. G. Sampson (Ed.), *Proceedings of the 13th International Conference on Cognition and Exploratory Learning in the Digital Age (CELDA 2016)* (pp. 269–276). https://files.eric.ed.gov/fulltext/ED571404.pdf

Serth, S., Staubitz, T., van Elten, M., & Meinel, C. (2022). Measuring the effects of course modularizations in online courses for life-long learners. *Frontiers in Education, 7*, 1008545. https://doi.org/10.3389/feduc.2022.1008545

Shah, V., Murthy, S., Warriem, J., Sahasrabudhe, S., Banerjee, G., & Iyer, S. (2022). Learner-centric MOOC model: A pedagogical design model towards active learner participation and higher completion rates. *Educational Technology Research and Development 70*, 263–288. https://doi.org/10.1007/s11423-022-10081-4

Shang, J., Xiao, R., & Zhang, Y. (2020). A sequential analysis on the online learning behaviors of Chinese adult learners: Take the KGC learning platform as an example. In S. Cheung, R. Li, K. Phusavat, N. Paoprasert, & L. Kwok (Eds.), *Blended Learning. Education in a Smart Learning Environment. ICBL 2020*. *Lecture Notes in Computer Science, vol 12218* (pp. 61–76). Springer. https://doi.org/10.1007/978-3-030-51968-1_6

Terzi Müftüoglu, C., Sahin, M., & Yurdugül, H. (2023). Cellwise residual testing in two-way contingency tables: Post-hoc tests for chi-square analysis. *Educational Technology Theory and Practice, 13*(1), 304–328. https://doi.org/10.17943/etku.1075830

Wald, A. (1973). *Sequential analysis*. Dover Publications.

Yoon, M., Lee, J., & Jo, I-H. (2021). Video learning analytics: Investigating behavioral patterns and learner clusters in video-based online learning. *The Internet and Higher Education 50*, 100806. https://doi.org/10.1016/j.iheduc.2021.100806

Zhu, M., & Bonk, C. J. (2019). Designing MOOCs to facilitate participant self-monitoring for self-directed learning. *Online Learning Journal, 23*(4), 106–134. https://doi.org/10.24059/olj.v23i4.2037

7 Discussion and Further Research

To provide an overview of the contribution of this thesis, the final chapter summarizes the main findings in four subsections (Section 7.1) related to the specific studies and their research aims, as described in the introductory chapter. Drawing on these findings, implications and recommendations for the design of open online learning for professional development are derived (Section 7.2). Following that, perspectives for future research are outlined, considering the limitations of the thesis (Section 7.3). The thesis concludes with final remarks on future developments in open online learning (Section 7.4).

7.1 Findings on MOOCs in Professional Learning and Development

7.1.1 Findings on Employee Perspectives

Study 1 was one of the first to look into institutional aspects of the integration of MOOCS into workplace learning contexts. The suitability and acceptance of MOOCs for professional development were analyzed from the employees' perspective, irrespective of specific activities in MOOCs or on a particular MOOC platform. Specifically, the study examined learning purposes, topics of interest, and viewpoints regarding credentials and incentives.

Results show employees' high emphasis on career development and on-the-job learning purposes, while the personal learning purpose was rated slightly lower. This corresponds to findings identifying job relevance as well as current and future career-related benefits as significant motives for engaging in MOOCs (M. Liu et al., 2020; C. Milligan & Littlejohn, 2017). In Study 1, employees further reported interest in MOOC topics directly relevant to the job, such as communication or presentation skills, pointing towards the idea that MOOCs could be a vehicle to close undergraduate skill gaps and increase employability (Calonge & M. Shah, 2016). Furthermore, employees saw only little value in MOOC credentials, believing their employers did not value them. In fact, engaging in MOOCs enhances job retention but does not impact wages (Castaño-Muñoz & Rodrigues, 2021). While MOOC users tend to rate the earned competencies as applicable at work (Friedl et al., 2018), the labor market value of MOOC credentials

remains modest and ancillary to formal educational qualifications (Goglio et al., 2022), as hiring managers tend to have a clear preference for traditionally educated job applicants (Rosendale, 2017). Although corporations acknowledge the potential benefits of MOOCs for workplace learning, high expectations, initial negative experiences, and practical obstacles impede the widespread adoption of MOOCs (Żur & Friedl, 2021). Employees' modest expectations concerning incentives for taking MOOCs correspond with research findings on limited employer support (Hamori, 2021)—although inducements like reimbursements or time off from working hours seem to strengthen post-course employee retention (Hamori, 2023).

Despite promising bottom-up initiatives, research suggests that open online learning has yet to be widely adopted in workplace settings. Therefore, further research on MOOC integration should address design, implementation, and transfer. Simultaneously, aspects of awareness and acceptance need to be further explored. While the results of Study 1 remain relevant, they should be supplemented with current data better to reflect the changes in the field of educational technology and to align with the current praxis, as described in section 7.3.1.

7.1.2 Findings on Instructional Quality

As instructional quality continues to be a central aspect in models of MOOC quality (Abelbisi, 2020; Jansen et al., 2017; Stracke & Trisolini, 2021), the corresponding research has become increasingly nuanced. The various approaches can broadly be categorized into feature-based approaches (indicators directly based on technical or instructional design features) and theory-based approaches (indicators derived from theories in the field of learning, design and technology). Most of the theory-based approaches draw upon the first principles of instruction (Merrill, 2002), as operationalized in the pioneering study by Margaryan et al. (2015) through the use of a course scan rubric.

In Study 2, this instrument was adapted and context-specifically applied in the field of Business and Management. The results were in line with existing research, revealing an overall comparatively low instructional design quality. More specifically, the assessed courses exhibited significant deficiencies in providing adequate

individualized support for learners and implementing collaborative elements. These results are also evident in a more recent analysis based on Merrill's principles in the field of medicine (Hendriks et al., 2020). While components of problem-centeredness were present in all of the courses in this research, the ratings in this category in Study 2 fell behind. The fact that problem-centeredness is low in courses in the field of business and management might be a matter of concern, given that case-based teaching (with cases centered around business problems) is a widespread approach in business education (Whitaker et al., 2016). The limited instructional coherence may contribute to MOOCs not making a more significant impact on business and management education (Billsberry & Alony, 2023). In Study 2, most aspects of structuredness and clarity were rated high. That MOOCs typically provide well-structured learning offerings was reaffirmed in an alternative theory-based operationalization (Oh et al., 2020) based on the extended multimedia learning principles (Clark & Mayer, 2016) as a theoretical framework. While findings generally indicated a relatively low application of those principles, there were specific variations based on the platform, similar to what could be observed in Study 2.

Recent feature-based approaches focus more on areas of improvement to provide guidance for the (re-)design of MOOCs. The operationalization of the educational scalability framework (Kasch et al., 2017) in a design analysis instrument indicated scalable best practices on different complexity levels and across various learning activities: Scalable formative feedback and interaction can be delivered through various formats, such as quizzes, peer-feedback, and simulations (Kasch et al., 2021). Y. Wang (2023) applied a feature-based evaluation framework and revealed MOOC-specific limitations like single method for knowledge transfer, traditional assessment methods, and insufficient attention to learner initiative. V. Shah et al. (2023) constructed and validated a framework for the learner-centric formative evaluation of MOOC designs to improve pedagogy.

Current research on MOOC design is expanding its focus to include both design aspects and the learner. Oh et al. (2023) conducted a survey to explore learners' perspectives on MOOC design, revealing four dimensions they had valued: human interactions, navigation, professional development, and course workload. In addition to

direct survey assessments, learners' course reviews have been identified as valuable data sources that can be analyzed through sentiment analysis (Dalipi et al., 2021; Qi & Liu, 2021). L. Li et al. (2022) utilized this approach to identify key factors in MOOC pedagogy. Integrating the design and learner perspective, X. Wang et al. (2021) combined a Merrill-based instructional design review with sentiment analysis of learner feedback on top-rated courses from Coursera. The instructional design quality was at the medium-to-upper level, but with a need to improve the learning activities related to collaboration, differentiation, and collective knowledge. Furthermore, learner sentiment and instructional design quality had a significant positive correlation.

Research on the instructional quality of MOOCs is yielding consistent results regarding the strengths and weaknesses of this learning format. High levels of structure and good organization are countered by deficits in learner support, collaboration, and personalized learning. Quality differences exist concerning the implementation of design criteria such as problem-centeredness, which was specifically elaborated in Study 2 for the field of Business and Management. Informed by research, MOOC designers need to address these challenges in order to advance open online learning. In terms of research, a shift from purely descriptive to formative approaches involving the learner perspective is noticeable. However, the additional data sources used still need discussion in terms of validity and objectivity. After all, the type of approach pursued depends significantly on the intended purpose and context of the assessment (see Section 7.3.3).

7.1.3 Findings on Participation and Achievement in Enterprise MOOCs

With their nuanced concept of openness to various stakeholders and the general public, Enterprise MOOCs represent a particular implementation of online learning in the corporate context (Egloffstein, 2018). Study 3 provided the first comprehensive insights into the population of learners in Enterprise MOOCs on the openSAP platform. Learners' demographics, intentions, and achievements were explored in a descriptive approach.

In line with many other studies on MOOC demographics (Deng et al., 2019; Glass et al., 2016; Ruipérez-Valiente et al., 2022), most learners on the openSAP platform possessed an academic background. Moreover, most of the participants were

professional learners and, as such (see Study 1), were likely to primarily hold job- and career-oriented motives related to workplace needs (C. Milligan & Littlejohn, 2017; Watted & Barak, 2018) and stress the instrumental value of MOOC learning (Dai et al., 2022). That openSAP learners mostly planned to study in MOOCs other than during working times corresponds to similar findings on the use of MOOCs in companies (Condé & Cisel, 2019), pointing towards a low acceptance of MOOC learning at the workplace, as indicated in Study 1. The distribution of learners across geographic locations highlights openSAP as a genuinely global MOOC provider (Ruipérez-Valiente et al., 2022), serving participants from different continents. Given that learners' socioeconomic and cultural backgrounds influence MOOC learning (Gameel & Wilkins, 2019), this raises questions about potential implications for course design. Findings suggest that a one-size-fits-all approach may not be suitable, as, for example, South Asian learners tend to prefer video content, while learners from Anglo-Saxon countries favor reading texts like articles and video transcripts (Rizvi et al., 2023). Likewise, implementing social learning in MOOCs primarily supported Western learners from affluent countries (Rizvi et al., 2022). However, implementing culturally inclusive learning designs remains an objective for the future of openSAP and other providers.

Furthermore, Study 3 provided a detailed exploration of the achievement patterns of openSAP learners. Various publications have further elaborated the research approach of relating intentions to their fulfillment. Similar to the achievement categories from Study 3, Henderikx et al. (2017) operationalized three types of MOOC learners based on motivation theory: inclined actors, disinclined actors, and inclined abstainers. Assuming that the first two types are successful learners, the alternative success rates for two MOOCs were 59 % and 70 %. Subsequent research focused on analyzing the relationship between intentions and outcomes. Survey studies (Chaker et al., 2022; Y. Wang & Baker, 2018) and combined analyses of survey and trace data (Rabin et al., 2019; Semenova, 2021) identified influencing factors such as goal setting, flow, and action orientation. External factors and barriers contributing to the intention-behavior gap were explored accordingly (Henderikx et al., 2021; Celik & Cagiltay, 2023), while intention dynamics need to be further researched (Henderikx et al., 2018).

In summary, Study 3 yielded essential insights into the backgrounds and motives of learners in Enterprise MOOCs for professional learning and development. The results can also be utilized for the evidence-informed advancement of the offering and the implementation of learner-focused outcome indicators, as described in Section 7.3.4.

7.1.4 Findings on Behavioral Patterns in Enterprise MOOCs

Study 4 analyzed trace data from learners across 13 courses on the openSAP platform. In an exploratory approach, consistent behavioral patterns and variations of those patterns could be observed according to the underlying course design approaches. At the level of system interactions, video-oriented interactions stood relatively isolated from other interactions over all course categories, corresponding to an only-video interaction sequence pattern (Maldonado-Mahauad et al., 2018) or binge-watching motif (Davis et al., 2016). This may suggest an atypical use of MOOCs with learners not following the designed course structure (Jansen et al., 2022). The openSAP users—predominantly professional learners (Study 3)—may have perceived the courses as informational offerings without immediately following the course logic. The analysis of behavioral patterns of successful learners also highlighted the role of metacognitively oriented course elements. Self-monitoring of one's learning process (in the context analyzed through a progress dashboard) is a crucial component in prevalent models of self-regulated (D. Lee et al., 2019; Wong et al., 2019) or self-directed learning (Bonk & Zhu, 2023; Doo et al., 2023) in MOOCs.

The aim of Study 4 was to derive implications for optimizing course designs based on system-generated user data in a summative learning analytics approach. This aligns with the core ideas of learning analytics design, which involves using available information from various educational sources, including learner characteristics, behavior, and performance, as well as information on the learning design, to support pedagogical interventions and redesigns of learning environments (Ifenthaler, 2017a, 2017b). The exploratory approach from Study 4 has proven to be promising in this regard. Initial design recommendations could be derived. However, it is essential to point out, in addition to the limitations discussed in Chapter 6, that the highly data-driven approach needs to be much more grounded in learning theory. Models of self-regulated

learning could be particularly suitable here (Du et al., 2023). Given the specific operationalization of the interaction categories, the approach is currently limited to a single technological platform. However, if the approach were applied across all providers currently based on this platform (in addition to openSAP, these include, for example, openHPI, openWHO, eGov-Campus, and AI Campus), comparisons across contexts (Reich, 2015) could be implemented, and the meso-level of the MOOC learning analytics innovation cycles (Drachsler & Kalz, 2016) could be fully addressed.

Although the idea of integrating Learning Design and Learning Analytics has been discussed for some time (Lockyer & Dawson, 2011), there are comparatively few studies illustrating successful implementation in large-scale online learning (Cross et al., 2019; Frick et al., 2022; Ifenthaler et al., 2018; S. Milligan & Griffin, 2016). Likewise, research reviews suggest that the research field has yet to fully mature (Drugova et al., 2023; Mangaroska & Giannakos, 2019). For widespread use, the effort involved seems to be a crucial point, as learning analytics design is currently more of a research topic than a practical alternative. Only when appropriate frameworks (Law & Liang, 2020) and indicators (Ahmad et al., 2022) have been established can designers benefit from data analysis with reasonable effort. However, integrating multimodal data (Mangaroska et al., 2020) and formative, real-time approaches (Ifenthaler, 2017a) promise significant leaps in development.

7.2 Implications and Design Recommendations

Based on the four studies conducted and additional theoretical considerations, practical implications and design recommendations for the improvement of open online learning with MOOCs can be derived. The implications focus on possible improvements within the MOOC format (Section 7.2.1) and possible improvements that go beyond the MOOC format (Section 7.2.2), before design recommendations are summarized (Section 7.2.3).

7.2.1 Design for Instructional Coherence

Various studies have explored success factors for engagement and positive learning experiences in MOOCs from the learner perspective. The key factors include problem-centered learning with realistic contexts to facilitate transfer, active learning, support by timely feedback, high-quality content, materials, videos, and communications designed to generate interest, and helpful course resources (Deng & Benckendorff, 2021; Hew, 2016; Hew, 2018).

From the design perspective, theory-based sets of recommendations aim at fostering *self-directed learning* and *motivation*, with both concepts being closely related, as in Garrison's (1997) model of self-directed learning. In a narrative approach, Zhu and Bonk (2022) elaborated 15 practical guidelines for fostering learners' *self-directed online learning* with regard to course structure and timelines, materials, assessments, activities, communication, and aids for structuring the learning process. Examples include "Helping students set their own learning goals" (p. 5), "Providing reflection questions" (p. 9), or "Inserting application exercises for putting the course materials into practice" (p. 11). Another set of guidelines directly aimed at fostering *motivation* in (online) learning environments is connected to the ARCS (attention, relevance, confidence, satisfaction) model (Keller, 1987) that has been applied to a variety of learning contexts including MOOCs. The model employs a structured design methodology that involves the analysis of the motivations of target audiences, the design of motivational strategies based on this analysis and additional constraints, strategy implementation, and evaluation of the effects (K. Li & Moore, 2018). With regard to motivation, Merrill (2023) suggested enriching online courses by adding appropriate demonstration and application and by using a problem-centered instructional sequence.

Beyond practical guidelines aimed at specific course features, the more holistic approaches to fostering motivation include *gamification* and the implementation of *pedagogical frameworks and models*. Gamification describes the use of game design elements in non-game contexts (Deterding et al., 2011). In MOOCs, this can involve platform features such as badges or leaderboards or design features such as levels, time constraints, or challenges. Findings point towards positive effects of gamification on motivation and engagement (Khalil et al., 2018; Jarnac de Freitas & Mira da Silva, 2023). Implementing pedagogical frameworks like problem-based learning (Verstegen

et al., 2023) or goal-based scenarios (Schank et al., 1994) into MOOCs can help to foster motivation by a problem-centered, story-based course design continuously.

Following these guidelines may enhance the instructional quality and, thus, the learner experience in MOOCs. However, crucial to MOOC design quality is the *constructive alignment* of learning outcomes, teaching and learning activities, and assessments (Biggs et al., 2022). While the constructive alignment framework has faced criticism for being simplistically used as an administrative tool for quality control (Loughlin et al., 2021), it remains a powerful tool in higher education and work-related learning (Walsh, 2007), combining a learner-centered approach with an outcome-focused view on teaching and learning. Following this approach, the specification of *intended learning outcomes* marks the initiation of MOOC design. The focus is on what the learner can do or perform after completing the MOOC. This ensures a competency-oriented approach. *Teaching and learning* then align with these intended outcomes. Specifically, the relationship between instruction and construction and the nature and quantity of learner activities are determined. Drawing on T. Anderson's framework (2003), distinctions can be made between learner-content, learner-teacher, and learner-learner interactions. Student learning is supported as long as one of these three interaction types is provided at a high level (Kasch et al., 2021). In this context, organizational parameters, especially the course delivery mode, determine the possible options. For example, implementing teacher-learner or learner-learner interactions in self-paced courses is inherently less feasible than in session-based (instructor-paced) courses. Best practices for scalable learner-content interaction include elaborate formative feedback, simulated (authentic) learning tasks, and content and process hints. For learner-learner interaction, peer-feedback instruction and discussion prompts are essential, while for learner-teacher interaction, personalized feedback and guest speakers seem important (Kasch et al., 2021). According to the pedagogical truism that assessment determines learning, *assessment* is vital in constructive alignment. At the same time, assessment in MOOCs is also the focus of much criticism, whether for poor alignment or insufficient design (e.g., „trap of routine assessment“; Reich, 2020a, p. 171). Traditional MOOCs heavily rely on automated grading, which proves effective when a set of automatable decision rules can precisely define a correct answer. However, these “autograders” fall short when dealing with unstructured problem-solving tasks or

complex communication scenarios (Reich, 2020a, p. 171). Many MOOCs still hinge on the use of single or multiple-choice quizzes. This limitation can be alleviated by incorporating self-assessment (Admiraal et al., 2014) and diversifying quiz formats through H5P technology, ensuring a good quiz integration and providing sophisticated assessment feedback. In session-based MOOCs, peer assessments can provide additional benefits (Gamage et al., 2021; Staubitz et al., 2016). From a conceptual standpoint, MOOCs demonstrate greater efficacy in domains like computer science, STEM (science, technology, engineering, mathematics), and early language acquisition but may be less suited for other areas (Reich, 2022). This should be taken into account when adapting MOOCs for professional development.

"Context counts": With professional learners behaving differently, MOOCs for professional development should contextualize learning activities to promote self-regulated learning (Hood et al., 2015, p. 83). Contextual connections could be established through the consistent use of practical examples, realistic materials, or the involvement of field experts. Alternatively, contextual connections could be emphasized already in course development through participatory or co-design approaches (Cavignaux-Bros & Cristol, 2020), engaging relevant stakeholders. Constructive alignment and contextualization together can create the instructional coherence that characterizes high-quality open online learning.

7.2.2 Extending the MOOC Concept

Many of the shortcomings identified in Study 2 and discussed above can be addressed by organizational and technological transformations that go beyond the original MOOC concept.

The most widely employed organizational adaptation is *blended learning*, involving the integration of MOOCs into traditional courses or classroom arrangements. Blended learning represents an established delivery mode of online learning (Boelens et al., 2017) and has been implemented with MOOCs at both the course (Bralić & Divjak, 2018) and program (Littenberg-Tobias & Reich, 2021) levels. MOOC-based blended learning aims to provide a more wholesome learning experience by strengthening the social dimension (Jahnke et al., 2022) and combining the advantages of classroom and

distance learning. The presence of peers during in-person sessions allows for collaboration and social learning. Teacher presence facilitates tutoring, feedback, and personalized learning. Theoretical perspectives suggest that a higher level of cognitive, behavioral, and affective engagement can be achieved through course community support (Martin & Borup, 2022). Additionally, in-person sessions enable the implementation of traditional meaningful assessments, addressing the trustworthiness issues observed in MOOCs (Alexandron et al., 2020). From the professional learning and development perspective, blended settings facilitate contextualization, and individual learners can be directly addressed. On the other hand, in blended learning arrangements, the essential benefits of learning at scale are lost unless a large number of locally distributed face-to-face settings are implemented.

Findings indicate that shorter MOOCs with lower, more manageable weekly workloads benefit professional learners (Paton et al., 2018b; Tang & Xing, 2021). In line with developments like microlearning (Taylor & Hung, 2022) or mobile microlearning with MOOCs (Bothe et al., 2019), transforming MOOCs from an academic course format into smaller learning offerings in the sense of mini- or micro-MOOCs (Spector, 2014; Yu et al., 2017) seems to be a coherent alternative. Such a *modularization* describes the transformation of MOOCs from a comprehensive academic-style course format into small-scale, self-contained, flexible, and competence-oriented learning offerings (Egloffstein & Ifenthaler, 2023). The resulting modules are more sustainable and can be combined, reused, and incorporated into learning paths and blended learning more easily (Serth et al., 2022).

The technological enhancements of MOOCs currently under discussion are predominantly associated with the implementation of *learning analytics* and *artificial intelligence (AI)*. Despite these concepts evolving from distinct origins, there are significant areas of overlap, making a case to consider them together as one concept (Buckingham Shum & Luckin, 2019). Learning analytics use static and dynamic information about learners and learning environments, assessing, eliciting, and analyzing it for real-time modeling, prediction, and optimization of learning processes, learning environments, as well as educational decision-making (Ifenthaler, 2015). AI in education refers to the use of AI technologies or applications in educational settings to

facilitate teaching, learning, or decision-making (Hwang et al., 2020), which involves aspects like personalization, adaptive learning, automated grading, and intelligent tutoring. Both approaches rely on data, algorithms, and machine learning techniques, aiming to support educational practice (Seufert et al., 2019).

Many applications of learning analytics and AI in MOOCs aim to alleviate the discussed weaknesses (Study 2). For instance, chatbots can be utilized for tutoring and communication processes (Sonderegger & Seufert, 2022). Assessment can be enhanced through automated scoring, including free-text responses and automated feedback (Hahn et al., 2021). Self-directed learning can be supported through learner dashboards (Sun et al., 2021) and adaptive prompting (Schumacher & Ifenthaler, 2021). Individualization and personalization can be addressed through personalized learning paths (Yu et al., 2017), while intelligent tutoring can mitigate the lack of teaching presence (Yilmaz et al., 2022). These measures can all serve to further expand the iron triangle of scale, quality, and cost (Kasch et al., 2021), i.e., to increase scalability at manageable costs without sacrificing quality. Furthermore, the integration of learning analytics and AI offers diverse opportunities that are not currently addressed in existing online learning offerings, such as potential support for complex problem-solving (Joksimovic et al., 2023). However, alongside the often still-limited technology, there are also unresolved issues, including concerns related to privacy and data protection (Ifenthaler & Schumacher, 2016c), which gain particular significance in professional learning and development settings.

7.2.3 Summary and Recommendations

Based on the design-related, organizational, and technological implications discussed, the following recommendations for the (re-)design of MOOCs can be summarized:

Basic recommendations, applicable for re-designs:

- Implement constructive alignment
- Implement a problem-centered instructional sequence, along with opportunities for demonstration and application
- Provide diversified and meaningful assessments, including quality feedback
- Design for supporting self-directed learning

- Design for supporting motivation
- Provide contextualization

Advanced recommendation, applicable for re-conceptualizations or new projects

- Use participatory design
- Offer (additional) blended learning scenarios
- Implement modularization, i.e., provide small-scale courses
- Make use of learning analytics and AI when possible

If these measures can be adequately implemented, a significant improvement in instructional quality can be achieved, which should then lead to benefits in terms of learner engagement and outcomes. Especially the advanced recommendations have to potential to transform MOOCs to higher innovation levels in the matrix for technology-supported learning (Seufert, 2013).

7.3 Limitations and Future Research

As discussed in detail in the preceding chapters, this thesis exhibits a number of limitations. Following an exploratory approach, Study 1 relies on a convenience sample with a small sample size, operating well beyond statistical representativity. While the sample size of Study 2 surpasses that of comparable studies, it is not free of selection bias. The restricted access to various MOOC platforms and time constraints for course enrollment limited the selection of analyzed MOOCs. Study 3 and Study 4 were inherently restricted to courses from a specific MOOC platform, resulting in a case study approach with a narrow, non-statistical approach to generalizability (A. S. Lee & Baskerville, 2003). With an overall response rate of 22 % in Study 3, volunteer or survivorship bias seems likely. In Study 4, the industry partner conducted the course selection based on specific interests. Additionally, the categorization of courses according to course design approaches relied on the industry partner's assessment rather than on objectively measurable criteria. Building upon these and further limitations, the following sections discuss avenues for future research.

7.3.1 Exploring Stakeholder Views on Open Online Learning

Study 1 continues to hold relevance in the field of open online learning for professional development[1]. However, in addition to the discussed limitations concerning sampling, several arguments now support the idea of conducting an updated version.

Since the initial data collection for Study 1, MOOCs have gained prominence. The 'pandemic boost' in 2020 further increased the number of users on MOOC platforms (D. Shah, 2023). While open online learning remains important, MOOCs are being critically discussed (Billsberry & Alony, 2023) and sometimes also re-branded. At the same time, micro-degrees (Flasdick et al., 2023), micro-credentials (Tamoliune et al., 2023; Varadarajan et al., 2023), and badges (Ifenthaler et al., 2016; Newby & Cheng, 2020) have become established forms of certification for learning at scale, also in the corporate context (S. Li et al., 2023).

A replication study on stakeholder views on open online learning for professional development, building upon Study 1, should follow a *refocus* approach incorporating additional elements rather than a pure *reproduction* approach (Christensen et al., 2022). Changes should particularly be made to the conceptual framework, allowing for the exploration of nuanced forms of micro-credentials, which can be operationalized based on the various review studies and position papers now available. Whether the term MOOCs should be replaced by a more generic concept with regard to the future needs careful consideration. An expansion of the sample is also desirable, with the possibility of an international comparison across contexts, as suggested by Reich (2015). Additionally, expanding the target audience to other significant stakeholders, such as employers, seems a viable option. Potential research questions could include:

- For which learning purposes would employees use open online courses?
- For which learning purposes would employees use micro-degrees?
- Which topics are of interest to employees?
- How important are micro-credentials and badges for employees when participating in online learning?
- How important are incentives for employees when participating in online learning?

[1] as illustrated by 21 citations since 2023, out of a total of 115 (2024, January 10; Google Scholar)

7.3.2 Conducting Contextualized Design-Oriented Research

MOOC research has primarily focused on data-driven post-hoc observational studies in specific settings (Joksimović et al., 2018). Comparisons across contexts were often neglected (Reich, 2015), although context seems crucial for interventions at scale (Kizilcec et al., 2020). There is a need for more experimental designs in intervention research (Raffaghelli et al., 2015; Bozkurt et al., 2016) and for more research from a pedagogical perspective (Despujol et al., 2022).

Against this backdrop and in light of the quality issues discussed within this thesis, three research fields emerge for design-oriented research on MOOCs for professional development to conduct research for, on, and through interventions (Jacobsen & McKenney, 2023).

1. *Observational, descriptive, or explanatory design-oriented research.* The first research field involves conducting observational, descriptive, or explanatory research to identify gaps or areas for improvement that require design interventions. This research should be tailored to the specific context within the field of professional development and should be grounded in a robust learning theory foundation. An example would be the examination of instructional coherence in courses on the eGov-Campus platform. In addition to a systematic investigation of constructive alignment (Biggs et al., 2022) among intended learning outcomes, assessments, and teaching and learning activities, attention should be given to the course context (region, learner group, curricular integration, etc.). Potential research questions in this regard include:

- Are the learning outcomes adequately specified in the courses?
- Do these learning outcomes relate to competency goals?
- Are these learning outcomes sufficiently addressed in content design?
- Can the assessments adequately cover the intended learning outcomes and respective contents?
- Is the course context appropriately considered?

2. *Design-based research.* The second research area centers on the actual implementation of interventions. Design-based research, or more broadly, educational design research, can serve as a methodological framework for organizing process-oriented research that involves design and development and research activities at the

same time. The primary focus is on iteratively addressing real-world educational challenges in collaborative or co-design activities with various stakeholders (Hoadley & Campos, 2022; McKenney & Reeves, 2021). Design-based research is rigorous research based on theory and established empirical methods. It aims to develop generalizable design recommendations and theoretical frameworks from empirical evidence. Design-based research should thus be distinguished from anecdotal descriptions of design cases that provide non-generalizable episodic memories of designed instruction (S. L. Moore et al., 2023). An example of this type of research could be the implementation of modularization on the eGov-Campus platform, which has been carried out in various sub-projects involving instructional designers and practitioners from different institutions. Possible research questions could be:

- How can stakeholders help shape the modularization of eGov-Campus courses in a meaningful way?
- How do learners rate the modularized courses?
- Where should the new module series be improved?
- How does the learning success in these module series compare to the original courses?
- How does learner engagement in the module series compare to the original courses?

3. *Experimental design research.* The third research area is especially important for implementing interventions but is only rarely addressed (e.g., Borrella et al., 2022). Experimental research in the form of randomized control trials can ensure robust causal inference, which is crucial when the effects of different interventions are compared. In MOOC research, A/B-testing (Hagedorn et al., 2023) is used to implement quasi-experimental designs, randomized control trials, or more sophisticated designs (NeCamp et al., 2019). Experimental research on MOOCs for professional development should be based on learning theory, and the context should be carefully considered. An example could be the implementation of so-called guide videos into the newly developed learning modules on the eGov-Campus platform. In a design experiment, different versions of those videos could be tested against a control group without the video intervention. Possible research questions include:

- How does the use of guide videos affect the learning success of the learners?
- Which type of guide videos has the greatest effect on learning success?
- Are there interaction effects with regard to contextual learner variables?

Although all areas have their field of application, it seems vitally important for a substantial foundation of design-oriented MOOC research to strive for more experimental studies in particular.

7.3.3 Integrating Research Perspectives in Instructional Quality Assessment

As discussed in Section 7.1.2, Study 2 assessed the instructional quality of MOOCs from a specific theory-based point of view. Based on the dimensions of *learner vs. design* and *product vs. process* discussed in the categorizations by Jansen et al. (2016) and Hood and Littlejohn (2016), a research framework integrating four distinct perspectives on the assessment of instructional quality can be derived. This framework facilitates the classification of existing research approaches and the identification of research gaps. The four perspectives are delineated as follows:

1. Design-product perspective. This perspective encompasses feature-based approaches, such as educational scalability assessment (Kasch et al., 2021), and theory-based approaches, as pursued in Study 2. These approaches typically enable only a snapshot assessment at a specific point in time. To maintain clear terminology only approaches that belong to the design-product perspective should be referred to as instructional design quality assessment.

2. Design-process perspective. To address the constraints of static instructional design quality assessments, process-oriented ratings provide opportunities. Such a rating could be based on participant observation (Spradley, 1980/2016) with quantitative and qualitative ratings through a structured walkthrough. Additionally, analytical autoethnographic methods (Mao et al., 2023) could be employed. This approach can be employed to validate snapshot ratings and can provide detailed insights into optimization potentials regarding instructional design. However, the effort is comparatively high as researchers need to complete an entire MOOC.

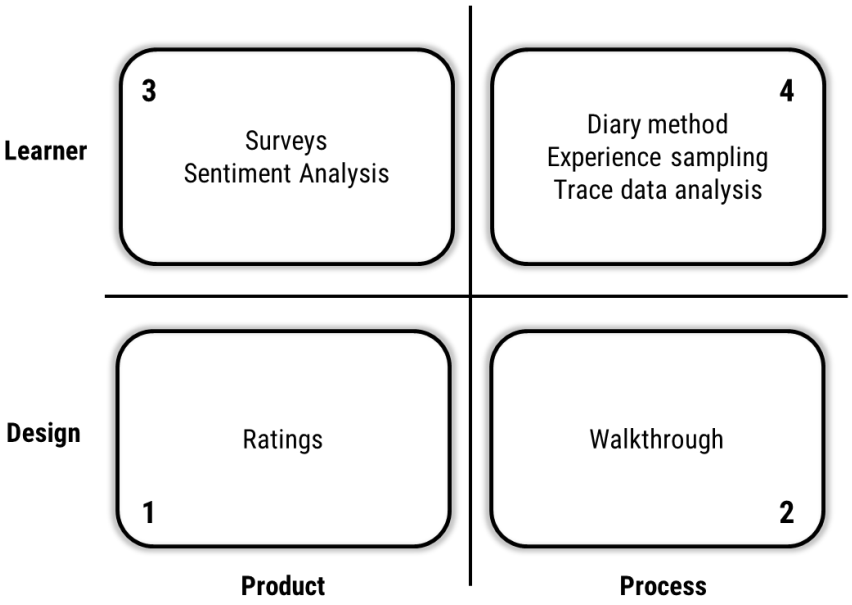
3. Learner-product perspective. Survey studies with learners (Oh et al., 2023) or sentiment analyses of learner reviews (X. Wang et al., 2021) consider instructional

quality from a static learner perspective. Such an assessment can complement design-product-oriented ratings and reveal potential discrepancies in the views of designers and learners (Stracke et al., 2018). With appropriate methodological fit, questionnaire studies could validate theory-based ratings, like, for example, through the application of the Teaching and Learning Quality (TALQ) instrument (Frick et al., 2010) for Merrill-based ratings. The retrospective approach and associated biases are subject to discussion.

4. Learner-process perspective. To capture a process perspective from the learners' point of view, process-oriented research instruments such as diary methods (Rausch, 2014) or experience sampling (Seifried & Rausch, 2022; Xie et al., 2023) can make a valuable contribution. Subjective data could then be complemented by learner trace data.

Figure 7-1 illustrates the four perspectives on instructional quality assessment and potential research methods.

Figure 7-1
Research Perspectives on Instructional Quality Assessment



The choice and combination of perspectives and corresponding methods depends on the context and objectives of the analysis. Product-oriented assessments are especially suitable for summative evaluation, focusing on benchmarking, accountability and decision-making, platform-wide improvements, or conceptual optimizations of

instructional designs. Process-oriented assessments are especially suitable for formative evaluation and detailed optimizations of instructional designs. For research purposes, the learner's perspective should always be considered (Hood & Littlejohn, 2016). Research gaps currently exist in process-oriented research from both the design and learner perspectives.

For the instructional design quality assessment in Study 2, additional data from a design-process perspective assessment could be a valuable supplement. Data obtained through a so-called deep-dive could assist in validating the approach. Possible research questions in this context could be:

- To what extent is the instructional design quality rating reflected in a process-oriented analysis?
- How do course workload and effort change over time?
- How does the implementation of instructional design criteria change during the course?
- How and in what ways is feedback provided?

In a current project evaluating MOOCs for AI education (Egloffstein & Kögler, 2023), the instructional design quality rating could be complemented with data from the regular course evaluation (learner surveys). Relevant research questions could then include:

- To what extent is the instructional design quality rating reflected in the learners' statements?
- Are highly-rated courses also well-perceived by the learners?
- Are deficiencies regarding various theory-based instructional design criteria also reflected in the learners' statements?

7.3.4 Developing Feasible Outcome Indicators

Study 3 mentioned two types of completion rates as outcome indicators for Enterprise MOOCs. Despite early criticism (Koller et al., 2013; Reich, 2014), completion rates have become the essential measure for assessing objective MOOC outcomes over the years (Jordan, 2015; Reich & Ruipérez-Valiente, 2019). However, it was evident that this basic behavioral outcome measure was insufficient to capture the diversity of usage patterns

adequately (Klobas, 2014). In relying on completion, success in MOOCs was confined to a fraction of learners. Hence, the consistently low completion and high attrition rates have significantly contributed to the criticism of MOOCs (Billsberry & Alony, 2022). Specifically in professional learning and development, the academic concept of completion rates appears inappropriate. Key performance indicators based on completion rates may fail to justify investments into MOOCs for training. Research, meanwhile, has focused on learning engagement as an outcome measure (Deng et al., 2019; R. Wang et al., 2022), often failing to provide causal linkages between the observed metrics and actual learning success (Reich, 2015). Additionally, engagement is sufficiently complex to operationalize (Abda et al., 2023; Alturkistani et al., 2020; Wei et al., 2021) and thus difficult to apply in practice.

Given the shortcomings of completion and dropout rates and the demand for learner-centered and multifaceted outcome measures (Deng et al., 2019; Littlejohn & Hood, 2018), the approach pursued in Study 3 can provide opportunities for further research and development. As there are no uniform, comparable, and manageable measures of learning success, pragmatic outcome measures could include behavioral and affective components based on subjective and objective data (Wei et al., 2021). This includes comparisons of initial intentions with their fulfillment, statements of learner satisfaction (Henderikx et al., 2017), and simple metrics of learner achievement based on course data (Hadi & Gagen, 2016), such as the percentage of learning objects accessed. Additionally, it appears feasible to differentiate between no-shows and actual dropouts (Huin et al., 2016), omitting the former in calculating key performance indicators. Looking at intention fulfillment might have particular advantages, as it includes goal setting, which has proved essential for successful self-regulated learning in MOOCs (Handoko et al., 2019; K. Li et al, 2021; Reparaz et al., 2020). Likewise, the “achievement of goals perspective” is important in professional learning and development (Harteis, 2022, p. 423). A possible field of implementation could be the eGov-Campus platform, which is currently in an organizational transition that might demand new key performance indicators. Possible implementations on the technical platform used by the eGov-Campus have already been developed and validated (Rohloff et al., 2019; Rohloff, Sauer, et al. 2020). In this context, the following research questions could be investigated:

- How can a manageable outcome measure look like for the relevant context, and which outcome indicators need to be included?
- How do these outcome indicators relate to course completion?
- What is the satisfaction level of the learners?
- To what extent were the original intentions of the learners fulfilled?
- How do learners assess the manageability of the outcome indicators?
- How do educators assess the meaningfulness of the outcome indicators?
- Can appropriate key performance indicators be derived from the outcome indicators?

7.4 Conclusion

This thesis aimed to address the question of how MOOCs can be advanced and meaningfully designed for professional learning and development. The thesis focused on open online learning from a design perspective, and four empirical studies were conducted to approach the topic from different angles. The findings shed light on the motives behind open online learning and provided insight into learners on an Enterprise MOOC platform. Further results highlighted strengths and areas for improvement in terms of instructional quality. From a research perspective, a framework was introduced to integrate various research perspectives into instructional quality assessment. The need for practical outcome measures was emphasized, as well as the importance of updating stakeholder perspectives on open online learning. Several design recommendations were derived in response to the second part of the overarching research question, aiming at the instructional coherence of open online learning. Additionally, a feasible approach for optimizing course offerings on the Enterprise MOOC platform through data analytics was presented.

As open online learning for professional development is constantly developing, this thesis can only offer a snapshot of the current state. Two developmental trends are emerging within the instructor-guided learning at scale paradigm (Reich, 2020a) regarding professional learning and development: *modularization* and *AI enrichment*. Modularization refers to the trend towards smaller, flexible offerings that align better with professional development structures and time constraints, serving as the building

blocks for individual learning paths and as elements of larger distributed learning ecosystems (Otto & Kerres, 2023). These modules may not necessarily be traditional courses but pedagogically augmented content units. AI enrichment involves the technological enhancement of courses, which could ultimately lead to a convergence with the genre of algorithm-guided learning at scale.

The type of open online learning that will be in demand in the future depends mainly on the design but also, to a large extent, on contextual factors such as employers' provision of time to complete learning (J. Lee et al., 2021). Systemic contextual factors such as acceptance among employers and employees will ultimately determine the success of corresponding offerings. Another decisive factor is the certification, which must occur between academic standards and measures compatible with training and continuing education (R. L. Moore, 2022). Certification via micro-degrees and micro-credentials, in particular, is an open field that requires at least European regulation or, even better, global standards at the macro level. Initial initiatives are underway (European Commission, 2020). As open online learning becomes more recognized and integrated into professional development contexts, openness will likely be interpreted more pragmatically. ‘Open’ may become somewhat synonymous with ‘large-scale’ without any further connotations.

To advance the evolution of open online learning, *design-oriented research to improve,* grounded in learning theory and oriented explicitly towards the context of professional learning and development, is necessary. As “improvements in education very rarely, perhaps never, come by way of dramatic transformation” (Reich, 2020a, p. 243), an incremental, partly tinkering approach might pave the way for large-scale learning technology into professional learning—whether for MOOCs or under a different label. All in all, large-scale online learning is here to stay.

References

Abda, Y., Mehenaoui, Z., Lafifi, Y., & Boudjehem, R. (2023). A new approach for assessing the quality of online courses. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-12247-w

Admiraal, W., Huisman, B., & van de Ven, M. (2014). Self- and Peer Assessment in Massive Open Online Courses. *International Journal of Higher Education, 3*(3), 119–128. https://doi.org/10.5430/ijhe.v3n3p119

Ahmad, A., Schneider, J., Griffiths, D., Biedermann, D., Schiffner, D., Greller, W., & Drachsler, H. (2022). Connecting the dots–A literature review on learning analytics indicators from a learning design perspective. *Journal of Computer Assisted Learning*, 1–39. https://doi.org/10.1111/jcal.12716

Albelbisi, N. A. (2020). Development and validation of the MOOC success scale (MOOC-SS). *Education and Information Technologies*, 25(6), 4535–4555. https://doi.org/10.1007/s10639-020-10186-4

Alexandron, G., Wiltrout, M. E., Berg, A., & Ruipérez-Valiente, J. A. (2020). Assessment that matters: Balancing reliability and learner-centered pedagogy in MOOC assessment. *Proceedings of the tenth international conference on learning analytics & knowledge* (pp. 512–517). https://doi.org/10.1145/3375462.3375464

Alturkistani, A., Lam, C., Foley, K., Stenfors, T., Blum, E. R., Van Velthoven, M. H., & Meinert, E. (2020). Massive Open Online Course Evaluation Methods: Systematic Review. *Journal of Medical Internet Research, 22*(4), e13851. https://doi.org/10.2196/13851

Anderson, T. (2003). Getting the Mix Right Again: An Updated and Theoretical Rationale for Interaction. *The International Review of Research in Open and Distributed Learning, 4(*2). https://doi.org/10.19173/irrodl.v4i2.149

Biggs, J., Tang, C., & Kennedy, G. (2022). *Teaching for Quality Learning at University* (5th ed.). Open University Press.

Billsberry, J., & Alony, I. (2022). The MOOC Post-Mortem: Bibliometric and Systematic Analyses of Research on Massive Open Online Courses (MOOCs), 2009 to 2022. *Journal of Management Education*. https://doi.org/10.1177/10525629231190840

Boelens, R., De Wever, B., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review, 22*, 1-18. https://doi.org/10.1016/j.edurev.2017.06.001

Bonk, C. J., & Zhu, M. (2023). On the Trail of Self-Directed Online Learners. *ECNU Review of Education.* https://doi.org/10.1177/2096531123116979

Borrella, I., Caballero-Caballero, S., & Ponce-Cueto, E. (2022). Taking action to reduce dropout in MOOCs: Tested interventions. *Computers & Education, 179*, 104412. https://doi.org/10.1016/j.compedu.2021.104412

Bothe, M., Renz, J., Rohloff T., & Meinel, C. (2019). From MOOCs to Micro Learning Activities. *Proceedings IEEE Global Engineering Education Conference (EDUCON)*. https://doi.org/10.1109/EDUCON.2019.8725043.

Bozkurt, A., Keskin, N. O., & de Waard, I. (2016). Research trends in Massive Open Online Course (MOOC) theses and dissertations: Surfing the tsunami wave. *Open Praxis, 8*(3), 203–221. https://doi.org/10.5944/openpraxis.8.3.287

Bralić, A., & Divjak, B. (2018). Integrating MOOCs in traditionally taught courses: achieving learning outcomes with blended learning. *International Journal of Educational Technology in Higher Education, 15*, 2. https://doi.org/10.1186/s41239-017-0085-7

Buckingham Shum, S. J., & Luckin, R. (2019). Learning analytics and AI: Politics, pedagogy and practices. *British Journal of Educational Technology, 50*(6), 2785-2793. https://doi.org/10.1111/bjet.12880

Calonge, D. S., & Shah, M. A. (2016). MOOCs, Graduate Skills Gaps, and Employability: A Qualitative Systematic Review of the Literature. *The International Review of Research in Open and Distributed Learning, 17*(5). https://doi.org/10.19173/irrodl.v17i5.2675

Castaño-Muñoz, J., Rodrigues, M., (2021). Open to MOOCs? Evidence of their impact on labour market outcomes. *Computers & Education, 173*, 104289. https://doi.org/10.1016/j.compedu.2021.104289

Cavignaux-Bros, D., & Cristol, D. (2020). Participatory design and co-design—The case of a MOOC on public innovation. In M. Schmidt, A. A. Tawfik, I. Jahnke, & Y. Earnshaw (Eds.), *Learner and User Experience Research: An Introduction for the Field of Learning Design & Technology.* EdTech Books. https://edtechbooks.org/ux/participatory_and_co_design

Celik, B., & Cagiltay, K. (2023). Did you act according to your intention? An analysis and exploration of intention–behavior gap in MOOCs. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-11859-6

Chaker, R., Bouchet, F., & Bachelet, R. (2022). How do online learning intentions lead to learning outcomes? The mediating effect of the autotelic dimension of flow in a MOOC. *Computers in Human Behavior, 134*, 107306. https://doi.org/10.1016/j.chb.2022.107306

Christensen, R., Hodges, C. B., & Spector, J. M. (2022). A Framework for Classifying Replication Studies in Educational Technologies Research. *Technology, Knowledge, and Learning, 27*(4), 1021–1038. https://doi.org/10.1007/s10758-021-09532-3

Clark, R. C., & Mayer, R. E. (2016). *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (4th ed.). John Wiley & Sons.

Condé, J., & Cisel, M. (2019). On the Use of MOOCs in Companies: A Panorama of Current Practices. In M. Calise, C. Delgado Kloos, J. Reich, J. Ruiperez-Valiente, & M. Wirsing (Eds.), *Digital Education: At the MOOC Crossroads Where the Interests of Academia and Business Converge. EMOOCs 2019* (pp. 37–46). Springer. https://doi.org/10.1007/978-3-030-19875-6_5

Cross, J. S., Keerativoranan, N., Carlon, M. K. J., Tan, Y. H., Rakhimberdina, Z., & Mori, H. (2019). Improving MOOC quality using learning analytics and tools. *Proceedings 2019 IEEE Learning With MOOCS* (LWMOOCS) (pp. 174–179). https://doi.org/10.1109/LWMOOCS47620.2019.8939617.

Dai, H. M., Teo, T., & Rappa, N. A. (2022). The role of gender and employment status in MOOC learning: An exploratory study. *Journal of Computer Assisted Learning, 38*(5), 1360–1370. https://doi.org/10.1111/jcal.12681

Dalipi, F., Zdravkova, K., & Ahlgren, F. (2021). Sentiment Analysis of Students' Feedback in MOOCs: A Systematic Literature Review. *Frontiers in Artificial Intelligence, 4*, 728708. https://doi.org/10.3389/frai.2021.728708

Davis, D., Chen, G., Hauff, C., & Houben, G. J. (2016). Gauging MOOC Learners' Adherence to the Designed Learning Path. *Proceedings of the 9th International Conference on Educational Data Mining*. https://www.educationaldatamining.org/EDM2016/proceedings/paper_63.pdf

Deng, R., & Benckendorff, P. (2021). What are the key themes associated with the positive learning experience in MOOCs? An empirical investigation of learners' ratings and reviews. *International Journal of Educational Technology in Higher Education, 18*, 9. https://doi.org/10.1186/s41239-021-00244-3

Deng, R., Benckendorff, P., & Gannaway, D. (2019). Progress and new directions for teaching and learning in MOOCs. *Computers & Education, 129*, 48–60. https://doi.org/10.1016/j.compedu.2018.10.019

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining "gamification". In A. Lugmayr (Ed.), *Proceedings of the 15th International Academic Mindtrek Conference: Envisioning Future Media Environments* (pp. 9–15). ACM. https://doi.org/10.1145/2181037.2181040.

Doo, M. Y., Zhu, M., & Bonk, C. J. (2023). Influence of self-directed learning on learning outcomes in MOOCs: A meta-analysis. *Distance Education, 44*(1), 86–105. https://doi.org/10.1080/01587919.2022.2155618

Drugova, E., Zhuravleva, I., Zakharova, U., & Latipov, A. (2023). Learning analytics driven improvements in learning design in higher education: A systematic literature review. *Journal of Computer Assisted Learning,* 1–15. https://doi.org/10.1111/jcal.12894

Du, J., Hew, K. F., & Liu, L. (2023). What can online traces tell us about students' self-regulated learning? A systematic review of online trace data analysis. *Computers & Education, 201*, 104828. https://doi.org/10.1016/j.compedu.2023.104828.

Egloffstein, M. (2018). Massive open online courses in digital workplace learning: Current state and future perspectives. In D. Ifenthaler (Ed.), *Digital workplace learning: Bridging formal and informal learning with digital technologies* (pp. 149–166). Springer. https://doi.org/10.1007/978-3-319-46215-8_

Egloffstein, M., & Ifenthaler, D. (2023). Modularizing MOOCs for Professional Learning: Prospects and Challenges for Instructional Design. *Proceedings 2023 IEEE Learning with MOOCS (LWMOOCS)* (pp. 1–4). https://doi.org/10.1109/LWMOOCS58322.2023.10305982.

Egloffstein, M., & Kögler, K. (2023). Design Review von offenen Online-Kursen zum Thema Künstliche Intelligenz [Design Review of Open Online Courses on Artificial Intelligence]. In M. Klein, D. Krupka, C. Winter & V. Wohlgemuth (Eds.), *Proceedings INFORMATIK 2023: Designing Futures: Zukünfte gestalten* (pp. 409–414). Gesellschaft für Informatik.

European Commission (2020). *A European approach to micro-credentials: Output of the micro-credentials higher education consultation group: Final report*. Publications Office of the European Union. https://data.europa.eu/doi/10.2766/30863

Flasdick, J., Mah, D.-K., Bernd, M., & Rampelt, F. (2023). *Micro-credentials and micro-degrees. Current developments and potentials for educational practice based on the example of the AI Campus*. AI Campus. https://doi.org/10.5281/zenodo.7327638

Frick, T. W., Myers, R. D., & Dagli, C. (2022). Analysis of patterns in time for evaluating effectiveness of first principles of instruction. *Educational Technology Research and Development, 70(*1), 1–29. https://doi.org/10.1007/s11423-021-10077-6

Friedl, C., Staubitz, T., & Jansen, D. (2018). Flexible, Self-Directed and Bottom-Up: Are Employees Overtaking Their Human Resource Departments with MOOCs? *Proceedings 2018 Learning With MOOCS (LWMOOCS)* (pp. 66–69). https://doi.org/10.1109/LWMOOCS.2018.8534616

Gamage, D., Staubitz, T., & Whiting, M. (2021). Peer assessment in MOOCs: Systematic literature review. *Distance Education*. https://doi.org/10.1080/01587919.2021.1911626

Gameel, B. G., & Wilkins, K. G. (2019). When it comes to MOOCs, where you are from makes a difference. *Computers & Education, 136*, 49–60. https://doi.org/10.1016/j.compedu.2019.02.014

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly, 48*(1), 18–33. https://doi.org/10.1177/074171369704800103

Glass, C. R., Shiokawa-Baklan, M. S., & Saltarelli, A. J. (2016). Who takes MOOCs? *New directions for institutional research, 167*, 41–55. https://doi.org/10.1002/ir.20153

Goglio, V., Bertolini, S., & Parigi, P. (2023). The perceived labour market value of Massive Open Online Courses (MOOCs) in Europe and the USA. *Journal of Education and Work, 36*(1), 37–51. https://doi.org/10.1080/13639080.2022.2162020

Hadi, S. M., & Gagen, P. (2016). New model for measuring MOOCs completion rates. In M. Khalil, M. Ebner, M. Koop, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the European MOOC Stakeholder Summit 2016* (pp. 95–105). BoD.

Hagedorn, C., Sauer, D., Graichen, J., & Meinel, C. (2023). Using Randomized Controlled Trials in eLearning: How to Add Content A/B Tests to a MOOC Environment. *Proceedings 2023 IEEE Global Engineering Education Conference* (pp. 1-10). IEEE. https://doi.org/10.1109/EDUCON54358.2023.10125270

Hahn, M. G., Navarro, S. M. B., Valentín, L. D. L. F., & Burgos, D. (2021). A systematic review of the effects of automatic scoring and automatic feedback in educational settings. *IEEE Access, 9*, 108190-108198. https://doi.org/10.1109/ACCESS.2021.3100890.

Hamori, M. (2021). MOOCs at work: what induces employer support for them? *The International Journal of Human Resource Management*, *32*(20), 4190–4214. https://doi.org/10.1080/09585192.2019.1616593

Hamori, M. (2023). Self-directed learning in massive open online courses and its application at the workplace: Does employer support matter? *Journal of Business Research, 157*, 113590. https://doi.org/10.1016/j.jbusres.2022.113590

Handoko, E., Gronseth, S. L., McNeil, S. G., Bonk, C. J., & Robin, B. R. (2019). Goal Setting and MOOC Completion: A Study on the Role of Self-Regulated Learning in Student Performance in Massive Open Online Courses. *The International Review of Research in Open and Distributed Learning, 20*(3), 39–58. https://doi.org/10.19173/irrodl.v20i4.4270

Harteis, C. (2022). Research on Workplace Learning in Times of Digitalisation. In C. Harteis, D. Gijbels, & E. Kyndt (Eds.), *Research Approaches on Workplace Learning* (pp. 415–428). Springer. https://doi.org/10.1007/978-3-030-89582-2_19

Henderikx, M. A., Kreijns, K., & Kalz, M. (2017). Refining success and dropout in massive open online courses based on the intention–behavior gap. *Distance Education, 38*(3), 353–368. https://doi.org/10.1080/01587919.2017.1369006

Henderikx, M. A., Kreijns, K., & Kalz, M. (2018). Intention-Behavior Dynamics in MOOC Learning: What Happens to Good Intentions Along the Way? *Proceedings 2018 Learning With MOOCS conference* (pp. 110–112). IEEE. https://doi.org/10.1109/LWMOOCS.2018.8534595

Henderikx, M., Kreijns, K., Xu, K. M., & Kalz, M. (2021). Making Barriers to Learning in MOOCs Visible: A Factor Analytical Approach. *Open Praxis, 13*(2), 143–159. https://doi.org/10.5944/openpraxis.13.2.124

Hendriks, R. A., de Jong, P. G. M., Admiraal, W. F., & Reinders, M. E. J. (2020). Instructional design quality in medical Massive Open Online Courses for integration into campus education. *Medical Teacher, 42*(2), 156–163. https://doi.org/10.1080/0142159X.2019.1665634

Hew, K. F. (2016). Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCs. *British Journal of Educational Technology*, 47(2), 320-341. https://doi.org/10.1111/bjet.12235

Hew, K. F. (2018). Unpacking the Strategies of Ten Highly Rated MOOCs: Implications for Engaging Students in Large Online Courses. *Teachers College Record, 120*(1), 1–40. https://doi.org/10.1177/016146811812000107

Hoadley, C., & Campos F. C. (2022). Design-based research: What it is and why it matters to studying online learning, *Educational Psychologist, 57*(3), 207–220, https://doi.org/10.1080/00461520.2022.2079128

Hood, N., & Littlejohn, A. (2016). MOOC Quality: the need for new measures. *Journal of Learning for Development, 3*(3). https://doi.org/10.56059/jl4d.v3i3.165

Hood, N., Littlejohn, A., & Milligan, C. (2015). Context counts: How learners' contexts influence learning in a MOOC. *Computers & Education, 91*, 83-91. https://doi.org/10.1016/j.compedu.2015.10.019

Huin, L., Bergheaud, Y., Caron, P. A., Codina, A., & Disson, E. (2016). Measuring completion and dropout in MOOCs: A learner-centered model. In M. Khalil, M. Ebner, M. Koop, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the European MOOC Stakeholder Summit 2016* (pp. 55–68). BoD.

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Ifenthaler, D. (2015). Learning analytics. In J. M. Spector (Ed.), *The SAGE encyclopedia of educational technology* (Vol. 2, pp. 447–451). SAGE. https://doi.org/10.4135/9781483346397

Ifenthaler, D. (2017a). Learning analytics design. In L. Lin & J. M. Spector (Eds.), *The sciences of learning and instructional design. Constructive articulation between communities* (pp. 202–211). Routledge. https://doi.org/10.4324/9781315684444-13

Ifenthaler, D. (2017b). Designing effective digital learning environments: Toward learning analytics design. *Technology, Knowledge and Learning, 22*(3), 401–404. https://doi.org/10.1007/s10758-017-9333-0

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (Eds.) (2016). *Foundation of Digital Badges and Micro-Credentials. Demonstrating and Recognizing Knowledge and Competencies.* Springer. https://doi.org/10.1007/978-3-319-15425-1

Ifenthaler, D., Gibson, D. C., & Dobozy, E. (2018). Informing learning design through analytics: Applying network graph analysis. *Australasian Journal of Educational Technology*, *34*(2), 117–132. https://doi.org/10.14742/ajet.3767

Ifenthaler, D., & Schumacher, C. (2016c). Student perceptions of privacy principles for learning analytics. *Educational Technology Research and Development, 64*(6), 923–938. https://doi.org/10.1007/s11423-016-9477-y

Jacobsen, M., & McKenney, S. (2023). Educational design research: grappling with methodological fit. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10282-5

Jahnke, I., Schmidt, M., Earnshaw, Y., & Tawfik, A. A. (2022). Theoretical Considerations of Learning Experience Design. In H. Leary, S. P. Greenhalgh, K. B. Staudt Willet, & M. H. Cho (Eds.), *Theories to Influence the Future of Learning Design and Technology.* EdTech Books. https://edtechbooks.org/theory_comp_2021/toward_theory_of_LXD_jahnke_earnshaw_schmidt_tawfik

Jansen, D., Rosewell, J., & Kear, K. (2017). Quality Frameworks for MOOCs. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open Education: From OERs to MOOCs* (pp. 261–281). Springer. https://doi.org/10.1007/978-3-662-52925-6_14

Jarnac de Freitas, M., & Mira da Silva, M. (2023). Systematic literature review about gamification in MOOCs. *Open Learning: The Journal of Open, Distance and e-Learning, 38*(1), 73–95. https://doi.org/10.1080/02680513.2020.1798221

Joksimović, S., Ifenthaler, D., Marrone, R., De Laat, M., & Siemens, G. (2023). Opportunities of artificial intelligence for supporting complex problem-solving: Findings from a scoping review. *Computers and Education: Artificial Intelligence, 4*, 100138. https://doi.org/10.1016/j.caeai.2023.100138.

Joksimović, S., Poquet, O., Kovanović, V., Dowell, N., Mills, C., Gašević, D., Dawson, S., Graesser, A. C., & Brooks, C. (2018). How Do We Model Learning at Scale? A Systematic Review of Research on MOOCs. *Review of Educational Research, 88*(1), 43–86. https://doi.org/10.3102/0034654317740335

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. *The International Review of Research in Open and Distance Learning, 16*(3), 341–358. https://doi.org/10.19173/irrodl.v16i3.2112

Kasch, J., van Rosmalen, P., & Kalz, M. (2017). A Framework towards Educational Scalability of Open Online Courses. *Journal of Universal Computer Science*, *23*(9), 845–867. https://doi.org/10.3217/JUCS-023-09-0845

Kasch, J., Van Rosmalen, P., & Kalz, M. (2021). Educational scalability in MOOCs: Analysing instructional designs to find best practices. *Computers & Education, 161, 104054*,1–12. https://doi.org/10.1016/j.compedu.2020.104054

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development, 10*(1), 2–10. https://doi.org/10.1007/BF02905780

Khalil, M., Wong, J., de Koning, B., Ebner, M., & Paas, F. (2018). Gamification in MOOCs: A review of the state of the art. *Proceedings 2018 IEEE Global Engineering Education Conference* (pp. 1629–1638). https://doi.org/10.1109/EDUCON.2018.8363430.

Kizilcec, R. F., Reich, J., Yeomans, M., Dann, C., Brunskill, E., Lopez, G., Turkay, S., Williams, J. J., & Tingley, D. (2020). Scaling up behavioral science interventions in online education. *Proceedings of the National Academy of Sciences, 117*(26), 14900-14905. https://doi.org/10.1073/pnas.1921417117

Klobas, J. E. (2014). Measuring the success of scalable open online courses. *Performance Measurement and Metrics, 15*(3), 145–162. https://doi.org/10.1108/PMM-10-2014-0036

Koller, D., Ng, A., Do, T., & Chen, Z. (2013). Retention and Intention in Massive Open Online Courses: In Depth. *Educause Review Online*. https://er.educause.edu/articles/2013/6/retention-and-intention-in-massive-open-online-courses-in-depth

Law, N., & Liang, L. (2020). A Multilevel Framework and Method for Learning Analytics Integrated Learning Design. *Journal of Learning Analytics, 7*(3), 98–117. https://doi.org/10.18608/jla.2020.73.8

Lee, A. S., & Baskerville, R. L. (2003). Generalizing Generalizability in Information Systems Research. *Information Systems Research, 14*(3), 221–243. https://doi.org/10.1287/isre.14.3.221.16560

Lee, D., Watson, S. L., & Watson, W. R. (2019). Systematic literature review on self-regulated learning in massive open online courses. *Australasian Journal of Educational Technology, 35*(1). https://doi.org/10.14742/ajet.3749

Lee, J., Sanders, T., Antczak, D., Parker, R., Noetel, M., Parker, P., & Lonsdale, C. (2021). Influences on User Engagement in Online Professional Learning: A Narrative Synthesis and Meta-Analysis. *Review of Educational Research, 91*(4), 518–576. https://doi.org/10.3102/0034654321997918

Li, K., Johnsen, J., & Canelas, D. A. (2021). Persistence, performance, and goal setting in massive open online courses. *British Journal of Educational Technology, 52*(3), 1215–1229. https://doi.org/10.1111/bjet.13068

Li, K., & Moore, D. R. (2018). Motivating Students in Massive Open Online Courses (MOOCs) Using the Attention, Relevance, Confidence, Satisfaction (ARCS) Model. *Journal of Formative Design in Learning, 2*, 102–113. https://doi.org/10.1007/s41686-018-0021-9

Li, L., Johnson, J., Aarhus, W., & Shah, D. (2022). Key factors in MOOC pedagogy based on NLP sentiment analysis of learner reviews: What makes a hit. *Computers & Education, 176*, 104354. https://doi.org/10.1016/j.compedu.2021.104354

Li, S., Craig, S. D., & Schroeder, N. L. (2023). Lessons Learned from Online Learning at Scale: A Study of Exemplar Learning Organizations. *TechTrends, 67*, 84–97. https://doi.org/10.1007/s11528-022-00761-6

Littenberg-Tobias, J., & Reich, J. (2020). Evaluating access, quality, and equity in online learning: A case study of a MOOC-based blended professional degree. *The Internet and Higher Education, 47*, 10759. https://doi.org/10.1016/j.iheduc.2020.100759

Littlejohn, A., & Hood, N. (2018). Designing for quality? In A. Littlejohn, & N. Hood (Eds.), *Reconceptualising learning in the digital age: The [un]democratising potential of MOOCs* (pp. 79–94). Springer. https://doi.org/10.1007/978-981-10-8893-3

Liu C., Zou D., Chen X., Xie H., Chan W. H. (2021). A bibliometric review on latent topics and trends of the empirical MOOC literature (2008–2019). *Asia Pacific Education Review, 22*(3), 515–534. https://doi.org/10.1007/s12564-021-09692-y

Liu, M., Zou, W., Shi, Y., Pan, Z., & Li, C. (2020). What do participants think of today's MOOCs: An updated look at the benefits and challenges of MOOCs designed for working professionals. *Journal of Computing in Higher Education, 32*(2), 307–329. https://doi.org/10.1007/s12528-019-09234-x

Lockyer, L., & Dawson, S. (2011). Learning designs and learning analytics. *Proceedings of the 1st International Conference on Learning Analytics and Knowledge* (pp. 153–156). ACM. https://doi.org/10.1145/2090116.2090140

Loughlin, C., Lygo-Baker, S., & Lindberg-Sand, Å. (2021). Reclaiming constructive alignment. *European Journal of Higher Education, 11*(2), 119-136. https://doi.org/10.1080/21568235.2020.1816197

Maldonado-Mahauad, J., Pérez-Sanagustín, M., Kizilcec, R. F., Morales, N., & Munoz-Gama, J. (2018). Mining theory-based patterns from Big data: Identifying self-regulated learning strategies in Massive Open Online Courses. *Computers in Human Behavior, 80*, 179-196. https://doi.org/10.1016/j.chb.2017.11.011

Mangaroska, K., & Giannakos, M. (2019). Learning Analytics for Learning Design: A Systematic Literature Review of Analytics-Driven Design to Enhance Learning. *IEEE Transactions on Learning Technologies, 12*(4), 516–534. https://doi.org/10.1109/TLT.2018.2868673

Mangaroska, K., Sharma, K., Gasevic, D., & Giannakos, M. (2020). Multimodal Learning Analytics to Inform Learning Design: *Lessons Learned from Computing Education. Journal of Learning Analytics, 7*(3), 79–97. https://doi.org/10.18608/jla.2020.73.7

Mao, J., Romero-Hall, E., & Reeves, T. C. (2023). Autoethnography as a research method for educational technology: A reflective discourse. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10281-6

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education, 80*, 77–83. https://doi.org/10.1016/j.compedu.2014.08.005

Martin, F., & Borup, J. (2022). Online learner engagement: Conceptual definitions, research themes, and supportive practices. *Educational Psychologist, 57*(3), 162–177. https://doi.org/10.1080/00461520.2022.2089147

McKenney, S., & Reeves, T. C. (2021). Educational design research: Portraying, conducting, and enhancing productive scholarship. *Medical Education, 55*(1), 82–92. https://doi.org/10.1111/medu.14280

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research* and *Development, 50*(3), 43–59. https://doi.org/10.1007/BF02505024

Merrill, M. D. (2023). Using the First Principles of Instruction to Make Instruction Effective, Efficient, and Engaging. In R. E. West & H. Leary (Eds.), *Foundations of Learning and Instructional Design Technology: Historical Roots & Current Trends*. EdTech Books. https://edtechbooks.org/foundations_of_learn/first_principles

Milligan, C., & Littlejohn, A. (2017). Why Study on a MOOC? The Motives of Students and Professionals. *The International Review of Research in Open and Distributed Learning*, *18*(2). https://doi.org/10.19173/irrodl.v18i2.3033

Milligan, S. K., & Griffin, P. (2016). Understanding Learning and Learning Design in MOOCs: A Measurement-Based Interpretation. *Journal of Learning Analytics, 3*(2), 88–115. https://doi.org/10.18608/jla.2016.32.5

Moore, R. L. (2022). Introducing mesocredentials: Connecting MOOC achievement with academic credit. *Distance Education*, *43*(2), 271–289. https://doi.org/10.1080/01587919.2022.2064823

Moore, S. L., Howard, C. D., Boling, E., Leary, H., & Hodges, C. B. (2023). Research methods for design knowledge: clarifying definitions, characteristics, and areas of confusion. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10271-8

NeCamp, T., Gardner, J., & Brooks, C. (2019). Beyond A/B testing: Sequential randomization for developing interventions in scaled digital learning environments. *Proceedings of the 9th International Conference on learning analytics & knowledge* (pp. 539-548). https://doi.org/10.1145/3303772.3303812

Newby, T. J., & Cheng, Z. (2020). Instructional digital badges: Effective learning tools. *Educational Technology Research and Development*, 68, 1053–1067. https://doi.org/10.1007/s11423-019-09719-7

Oh, E. G., Chang, Y., & Park, S. W. (2020). Design review of MOOCs: Application of e-learning design principles. *Journal of Computing in Higher Education, 32*, 455–475. https://doi.org/10.1007/s12528-019-09243-w

Oh, E. G., Cho, M. H., & Chang, Y. (2023). Learners' perspectives on MOOC design. *Distance Education, 44*(3), 476–494. https://doi.org/10.1080/01587919.2022.2150126

Otto, D., & Kerres, M. (2023). Distributed Learning Ecosystems in Education: A Guide to the Debate. In D. Otto, G. Scharnberg, M. Kerres, & O. Zawacki-Richter (Eds.), *Distributed Learning Ecosystems* (pp. 13–30). Springer VS. https://doi.org/10.1007/978-3-658-38703-7_2

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computers and Education: Artificial Intelligence, 2*, 100020. https://doi.org/10.1016/j.caeai.2021.100020

Qi, C., & Liu, S. (2021). Evaluating On-Line Courses via Reviews Mining. *IEEE Access, 9*, 35439-35451. https://doi.org/10.1109/ACCESS.2021.3062052

Paton, R. M., Fluck, A. E., & Scanlan, J. D. (2018b). A performance profile of learner completion and retention in Australian VET MOOCs. *Journal of Vocational Education & Training, 70*(4), 581–599. https://doi.org/10.1080/13636820.2018.1463278

Rabin, E., Kalman, Y. M., & Kalz, M. (2019). An empirical investigation of the antecedents of learner-centered outcome measures in MOOCs. *International Journal of Educational Technology in Higher Education, 16*, 14. https://doi.org/10.1186/s41239-019-0144-3

Raffaghelli, J. E., Cucchiara, S., & Persico, D. (2015). Methodological approaches in MOOC research: Retracing the myth of Proteus. *British Journal of Educational Technology, 46*(3), 488–509. https://doi.org/10.1111/bjet.12279

Rausch, A. (2014). Using diaries in research on work and learning. In C. Harteis, A. Rausch, & J. Seifried (Eds.), *Discourses on professional learning: On the boundary between learning and working* (pp. 341–366). Springer. https://doi.org/10.1007/978-94-007-7012-6_17

Reich, J. (2014). MOOC Completion and Retention in the Context of Student Intent. *Educause Review Online*. https://er.educause.edu/articles/2014/12/mooc-completion-and-retention-in-the-context-of-student-intent

Reich, J. (2015). Rebooting MOOC research. *Science, 347*(6217), 34-35. https://doi.org/10.1126/science.1261627

Reich, J. (2020a). *Failure to disrupt. Why technology alone can't transform education*. Harvard University Press.

Reich, J. (2022). Learning Analytics and Learning at Scale. In C. Lang, A. F. Wise, A. Merceron, D. Gašević, & G. Siemens (Eds.), *Handbook of Learning Analytics* (2nd ed., pp. 188–195). Society for Learning Analytics Research. https://doi.org/10.18608/hla22.018

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science, 363*(6423), 130–131. https://doi.org/10.1126/science.aav7958

Reparaz, C., Aznárez-Sanado, M., Mendoza, G. (2020). Self-regulation of learning and MOOC retention. *Computers in Human Behavior, 111,* 106423. https://doi.org/10.1016/j.chb.2020.106423.

Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2022). Beyond one-size-fits-all in MOOCs: Variation in learning design and persistence of learners in different cultural and socioeconomic contexts. *Computers in Human Behavior, 126*, 106973.

Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2023). Are MOOC learning designs culturally inclusive (enough)? *Journal of Computer Assisted Learning*. https://doi.org/10.1111/jcal.12883

Rohloff, T., Sauer, D., & Meinel, C. (2019). On the Acceptance and Usefulness of Personalized Learning Objectives in MOOCs. *Proceedings of the Sixth ACM Conference on Learning @ Scale* (pp. 1–10). https://doi.org/10.1145/3330430.3333624

Rohloff, T., Sauer, D., & Meinel, C. (2020). Students' Achievement of Personalized Learning Objectives in MOOCs. *Proceedings of the Seventh ACM Conference on Learning @ Scale* (pp. 147–156). https://doi.org/10.1145/3386527.3405918

Rosendale, J. A. (2017). Gauging the value of MOOCs: An examination of American employers' perceptions toward higher education change. *Higher Education, Skills and Work-Based Learning, 7*(2), 141–154. https://doi.org/10.1108/HESWBL-09-2016-0065

Ruipérez-Valiente, J. A., Staubitz, T., Jenner, M., Halawa, S., Zhang, J., Despujol, I., Maldonado-Mahauad, J., Montoro, G., Peffer, M., Rohloff, T., Lane, J., Turro, C., Li, X., Pérez-Sanagustín, M., & Reich, J. (2022). Large-scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions. *Computers & Education, 180*, 104426. https://doi.org/10.1016/j.compedu.2021.104426

Schank, R. C., Fano, A., Bell, B., & Jona, M. (1994). The design of goal-based scenarios. *Journal of the Learning Sciences, 3*(4), 305–345.

Schumacher, C., & Ifenthaler, D. (2021). Investigating prompts for supporting students' self-regulation – A remaining challenge for learning analytics approaches? *The Internet and Higher Education, 49*, 100791. https://doi.org/10.1016/j.iheduc.2020.100791

Seifried, J., & Rausch, A. (2022). Applying the Experience Sampling Method to Research on Workplace Learning. In M. Goller, E. Kyndt, S. Paloniemi, & C. Damşa (Eds.), *Methods for Researching Professional Learning and Development* (pp. 19–41). Springer. https://doi.org/10.1007/978-3-031-08518-5_2

Semenova, T. (2022). Not Only the Intention to Complete: The Role of Action-Oriented Intentions in MOOC Completion. *Technology, Knowledge and Learning, 27*(3), 707–719. https://doi.org/10.1007/s10758-021-09534-1

Serth, S., Staubitz, T., van Elten, M., & Meinel, C. (2022). Measuring the effects of course modularizations in online courses for life-long learners. *Frontiers in Education, 7*, 1008545. https://doi.org/10.3389/feduc.2022.100854

Seufert, S. (2013). *Bildungsmanagement* [Educational Management]. Schäffer-Poeschel.

Seufert, S., Meier, C., Soellner, M., & Rietsche, R. (2019). A Pedagogical Perspective on Big Data and Learning Analytics: A Conceptual Model for Digital Learning Support. *Technology, Knowledge and Learning, 24*, 599–619. https://doi.org/10.1007/s10758-019-09399-5

Spradley, J. P. (2016). *Participant Observation*. Waveland Press. (Original work published 1980)

Shah, D. (2023, January 2). *2022 Year in Review: The "New Normal" that Wasn't.* Class Central. https://www.classcentral.com/report/2022-year-in-review/

Shah, V., Murthy, S., & Iyer, S. (2023). Is My MOOC Learner-Centric? A Framework for Formative Evaluation of MOOC Pedagogy. *The International Review of Research in Open and Distributed Learning, 24*(2), 138–161. https://doi.org/10.19173/irrodl.v24i2.6898

Sonderegger, S., & Seufert, S. (2022). Chatbot-mediated Learning: Conceptual Framework for the Design of Chatbot Use Cases in Education. *Proceedings of the 14th International Conference on Computer Supported Education* (pp. 207–215). SciTePress. https://doi.org/10.5220/0010999200003182

Spector, J. M. (2014). Remarks on MOOCS and Mini-MOOCS. *Educational Technology Research and Development, 62*(3), 385–392. https://doi.org/10.1007/s11423-014-9339-4

Stracke, C. M., Tan, E., Texeira, A. M., Pinto, M., Kameas, A., Vassiliadis, B., & Sgouropoulou, C. (2018). Gap between MOOC designers' and MOOC learners' perspectives on interaction and experiences in MOOCs: Findings from the Global MOOC Quality Survey. In M. Chang, N.-S. Chen, R. Huang, Kinshuk, K. Moudgalya, S. Murthy, & D. G. Sampson (Eds.), *Proceedings 18th IEEE International Conference on Advanced Learning Technologies* (pp. 1–5). https://doi.org/10.1109/ICALT.2018.0000

Stracke, C. M., & Trisolini, G. (2021). A Systematic Literature Review on the Quality of MOOCs. *Sustainability, 13*(11), 5817. https://doi.org/10.3390/su13115817

Staubitz, T., Petrick, D., Bauer, M., Renz, J., & Meinel, C. (2016). Improving the Peer Assessment Experience on MOOC Platforms. *Proceedings of ACM Learning at Scale Conference (L@S)* (pp. 389–398). https://doi.org/10.1145/2876034.2876043

Sun, W., Schumacher, C., Chen, L., & Pinkwart, N. (2021). What Do MOOC Dashboards Present to Learners? In M. Sahin & D. Ifenthaler (Eds.), *Visualizations and Dashboards for Learning Analytics* (pp. 67–78). Springer. https://doi.org/10.1007/978-3-030-81222-5_6

Tamoliune, G., Greenspon, R., Tereseviciene, M., Volungeviciene, A., Trepule, E., & Dauksiene, E. (2023). Exploring the potential of micro-credentials: A systematic literature review. *Frontiers in Education, 7*. https://doi.org/10.3389/feduc.2022.1006811

Tang, H., & Xing, W. (2021). Massive open online courses for professional certificate programs? Perspectives on professional learners' longitudinal participation patterns. *Australasian Journal of Educational Technology, 38*(1), 136–147. https://doi.org/10.14742/ajet.5768

Taylor, A., & Hung, W. (2022). The Effects of Microlearning: A Scoping Review. *Educational Technology Research and Development, 70*(2), 363–395. https://doi.org/10.1007/s11423-022-10084-1

Verstegen, D., Spruijt, A., Fonteijn, H., & van Merriënboer, J. (2023). MOOCs and Problem-Based Learning: A Happy Marriage? In S. Goundar (Ed.), *Massive Open Online Courses - Current Practice and Future Trends*. InTech Open. https://doi.org/10.5772/intechopen.1001472

Walsh, A. (2007). An exploration of Biggs' constructive alignment in the context of work-based learning. *Assessment & Evaluation in Higher Education, 32*(1), 79-87. https://doi.org/10.1080/02602930600848309

Wang, R., Cao, J., Xu, Y., & Li, Y. (2022). Learning engagement in massive open online courses: A systematic review. *Frontiers in Education, 7*. https://doi.org/10.3389/feduc.2022.1074435

Wang, X., Lee, Y., Lin, L., Mi, Y., & Yang, T. (2021). Analyzing instructional design quality and students' reviews of 18 courses out of the Class Central Top 20 MOOCs through systematic and sentiment analyses. *The Internet and Higher Education, 50,* 100810. https://doi.org/10.1016/j.iheduc.2021.100810

Wang, Y. (2023). Where and what to improve? Design and application of a MOOC evaluation framework based on effective teaching practices. *Distance Education, 44*(3), 458-475. https://doi.org/10.1080/01587919.2023.2226601

Wang, Y., & Baker, R. (2018). Grit and Intention: Why Do Learners Complete MOOCs? *The International Review of Research in Open and Distributed Learning, 19*(3). https://doi.org/10.19173/irrodl.v19i3.3393

Watted, A., & Barak, M. (2018). Motivating factors of MOOC completers: Comparing between university-affiliated students and general participants. *The Internet and Higher Education, 37*, 11–20. https://doi.org/10.1016/j.iheduc.2017.12.001

Wei, X., Saab, N., & Admiraal, W. (2021). Assessment of cognitive, behavioral, and affective learning outcomes in massive open online courses: A systematic literature review. *Computers & Education, 163*, 104097. https://doi.org/10.1016/j.compedu.2020.104097

Whitaker, J., New, J. R., & Ireland, R. D. (2016). MOOCs and the Online Delivery of Business Education: What's new? What's not? What now? *Academy of Management Learning & Education, 15*(2), 345–365. https://doi.org/10.5465/amle.2013.0021

Wong, J., Baars, M., Davis, D., Van Der Zee, T., Houben, G. J., & Paas, F. (2019). Supporting self-regulated learning in online learning environments and MOOCs: A systematic review. *International Journal of Human–Computer Interaction, 35*(4-5), 356–373. https://doi.org/10.1080/10447318.2018.1543084

Xie, K., Vongkulluksn, V. W., Heddy, B. C., & Jiang, Z. (2023). Experience sampling methodology and technology: An approach for examining situational, longitudinal, and multi-dimensional characteristics of engagement. *Educational Technology Research and Development.* https://doi.org/10.1007/s11423-023-10259-4

Yilmaz, R., Yurdugül, H., Yilmaz, F. G. K., Şahïn, M., Sulak, S., Aydin, F., Tepgeç, M., Terzi Müftüoğlu, C., & ORAL, Ö. (2022). Smart MOOC integrated with intelligent tutoring: A system architecture and framework model proposal. *Computers and Education: Artificial Intelligence, 3*, 100092. https://doi.org/10.1016/j.caeai.2022.100092.

Yu, H., Miao, C., Leung, C., & White, T. J. (2017). Towards AI-powered personalization in MOOC learning. *npj Science Learning, 2*, 15. https://doi.org/10.1038/s41539-017-0016-3

Zhu, M., & Bonk, C. J. (2022). Guidelines and strategies for fostering and enhancing self-directed online learning. *Open Learning: The Journal of Open, Distance and e-Learning*. https://doi.org/10.1080/02680513.2022.2141105

Żur, A., & Friedl, C. (2021). Transforming Workplace Learning: A Qualitative Inquiry into Adopting Massive Open Online Courses into Corporate Learning and Development. *Education Sciences, 11*(6), 295. https://doi.org/10.3390/educsci11060295

Complete List of References

Abda, Y., Mehenaoui, Z., Lafifi, Y., & Boudjehem, R. (2023). A new approach for assessing the quality of online courses. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-12247-w

Admiraal, W., Huisman, B., & van de Ven, M. (2014). Self- and Peer Assessment in Massive Open Online Courses. *International Journal of Higher Education, 3*(3), 119–128. https://doi.org/10.5430/ijhe.v3n3p119

Ahmad, A., Schneider, J., Griffiths, D., Biedermann, D., Schiffner, D., Greller, W., & Drachsler, H. (2022). Connecting the dots–A literature review on learning analytics indicators from a learning design perspective. *Journal of Computer Assisted Learning*, 1–39. https://doi.org/10.1111/jcal.12716

Alario-Hoyos, C., Pérez-Sanagustín, M., Cormier, D., & Delgado-Kloos, C. (2014). Proposal for a Conceptual Framework for Educators to Describe and Design MOOCs. *Journal of Universal Computer Science, 20*(1), 6–23. https://doi.org/10.3217/jucs-020-01-0006

Albelbisi, N. A. (2020). Development and validation of the MOOC success scale (MOOC-SS). *Education and Information Technologies*, 25(6), 4535–4555. https://doi.org/10.1007/s10639-020-10186-4

Alemayehu, L., & Chen, H.-L. (2023). Learner and instructor-related challenges for learners' engagement in MOOCs: A review of 2014–2020 publications in selected SSCI indexed journals. *Interactive Learning Environments, 31*(5), 3172–3194. https://doi.org/10.1080/10494820.2021.1920430

Alexandron, G., Wiltrout, M. E., Berg, A., & Ruipérez-Valiente, J. A. (2020). Assessment that matters: Balancing reliability and learner-centered pedagogy in MOOC assessment. *Proceedings of the tenth international conference on learning analytics & knowledge* (pp. 512–517). https://doi.org/10.1145/3375462.3375464

Alturkistani, A., Lam, C., Foley, K., Stenfors, T., Blum, E. R., Van Velthoven, M. H., & Meinert, E. (2020). Massive Open Online Course Evaluation Methods: Systematic Review. *Journal of Medical Internet Research, 22*(4), e13851. https://doi.org/10.2196/13851

Anderson, T. (2003). Getting the Mix Right Again: An Updated and Theoretical Rationale for Interaction. *The International Review of Research in Open and Distributed Learning, 4(*2). https://doi.org/10.19173/irrodl.v4i2.149

Anderson, V., Gifford, J., & Wildman, J. (2020). An evaluation of social learning and learner outcomes in a massive open online course (MOOC): A healthcare sector case study. *Human Resource Development International, 23*(3), 208–237. https://doi.org/10.1080/13678868.2020.1721982

Babori, A. (2020). Trends in MOOCs Research: Analysis of Educational Technology Journals. *International Journal of Emerging Technologies in Learning, 15*(17), pp. 47–68. https://doi.org/10.3991/ijet.v15i17.14637

Bakeman, R., & Gottman, J. (1997). *Observing interaction: An introduction to sequential analysis* (2nd ed.). Cambridge University Press.

Baker, F. W. (2017). An alternative approach: Openness in education over the last 100 years. *TechTrends, 61*, 130–140. https://doi.org/10.1007/s11528-016-0095-7.

Baldwin, S., Ching, Y.-H., & Hsu, Y.-C. (2018). Online course design in higher education: A review of national and statewide evaluation instruments. *TechTrends, 62*(1), 46–57. https://doi.org/10.1007/s11528-017-0215-z

Berland, M., Baker, R. S., & Bilkstein, P. (2014). Educational data mining and learning analytics: Applications to constructionist research. *Technology, Knowledge and Learning, 19*(1–2), 205–220. https://doi.org/10.1007/s10758-014-9223-7

Biggs, J. (1993). From theory to practice: A cognitive systems approach. *Higher Education Research & Development*, *12*(1), 73–85. https://doi.org/10.1080/0729436930120107

Biggs, J., Tang, C., & Kennedy, G. (2022). *Teaching for Quality Learning at University* (5th ed.). Open University Press.

Billett, S. (2022). Learning in and Through Work: Positioning the Individual. In C. Harteis, D. Gijbels, & E. Kyndt (Eds.), *Research Approaches on Workplace Learning* (pp. 157–175). Springer. https://doi.org/10.1007/978-3-030-89582-2_7

Billsberry, J., & Alony, I. (2022). The MOOC Post-Mortem: Bibliometric and Systematic Analyses of Research on Massive Open Online Courses (MOOCs), 2009 to 2022. *Journal of Management Education*. https://doi.org/10.1177/10525629231190840

Blackmon, S. J., & Major, C. H. (2017). Wherefore art thou MOOC? Defining massive open online courses. *Online Learning Journal, 21*(4), 195–221. https://doi.org/10.24059/olj.v21i4.1272

Boelens, R., De Wever, B., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review, 22*, 1-18. https://doi.org/10.1016/j.edurev.2017.06.001

Bonk, C. J., Lee, M. M., Reeves, T. C., & Reynolds, T. H. (Eds.) (2015). *MOOCs and open education around the world.* Taylor and Francis. https://doi.org/10.4324/9781315751108

Bonk, C. J., Lee M. M., Reeves, T. C., & Reynolds, T. H. (2018). The emergence and design of massive open online courses. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design & technology* (4th Ed., pp. 250–258). Pearson.

Bonk, C. J., & Zhu, M. (2023). On the Trail of Self-Directed Online Learners. *ECNU Review of Education.* https://doi.org/10.1177/2096531123116979

Bonk, C. J., Zhu, M., Kim, M., Xu, S., Sabir, N., & Sari, A. R. (2018). Pushing toward a more personalized MOOC: Exploring instructor selected activities, resources, and technologies for MOOC design and implementation. *The International Review of Research in Open and Distributed Learning, 19*(4), 92–115. https://doi.org/10.19173/irrodl.v19i4.3439

Boroujeni, M., & Dillenbourg, P. (2019). Discovery and temporal analysis of MOOC study patterns. *Journal of Learning Analytics, 6*(1), 16–33. https://doi.org/10.18608/jla.2019.61.2

Borrella, I., Caballero-Caballero, S., & Ponce-Cueto, E. (2022). Taking action to reduce dropout in MOOCs: Tested interventions. *Computers & Education, 179*, 104412. https://doi.org/10.1016/j.compedu.2021.104412

Bothe, M., Renz, J., Rohloff T., & Meinel, C. (2019). From MOOCs to Micro Learning Activities. *Proceedings IEEE Global Engineering Education Conference*. https://doi.org/10.1109/EDUCON.2019.8725043.

Bozkurt, A. (2021). Surfing on three waves of MOOCs: An examination and snapshot of research in massive open online courses. *Open Praxis, 13*(3), 296–311. https://doi.org/10.5944/openpraxis.13.3.132

Bozkurt, A., Keskin, N. O., & de Waard, I. (2016). Research trends in Massive Open Online Course (MOOC) theses and dissertations: Surfing the tsunami wave. *Open Praxis, 8*(3), 203–221. https://doi.org/10.5944/openpraxis.8.3.287

Bralić, A., & Divjak, B. (2018). Integrating MOOCs in traditionally taught courses: achieving learning outcomes with blended learning. *International Journal of Educational Technology in Higher Education, 15*, 2. https://doi.org/10.1186/s41239-017-0085-7

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Branch, R. M., & Kopcha, T. J. (2014). Instructional Design Models. In J. M. Spector, M. D. Merrill, J. Elen, & M. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* (pp. 77–87). Springer. https://doi.org/10.1007/978-1-4614-3185-5_7

Brookshire, R. G., Lybarger, K. M., & Keane, L. B. (2011). Virtual workplace learning: Promises met? In M. Malloch, L. Cairns, K. Evans, & B. O'Connor (Eds.), *The SAGE handbook of workplace learning* (pp. 331–340). SAGE.

Buchem, I., & Okatan, E. (2021). Using the ADDIE Model to Produce MOOCs: Experiences from the Oberred Project. In C. Meinel, T. Staubitz, S. Schweiger, C. Friedl, J. Kiers, M. Ebner, A. Lorenz, G. Ubachs, C. Mongenet, J. A. Ruipérez, M. C. Mendez, A. Merceron, & K. von Schmieden (Eds.), *Proceedings of EMOOCs 2021* (pp. 249–259). Universitätsverlag Potsdam.https://doi.org/10.25932/publishup-51030

Buckingham Shum, S. J., & Luckin, R. (2019). Learning analytics and AI: Politics, pedagogy and practices. *British Journal of Educational Technology, 50*(6), 2785-2793. https://doi.org/10.1111/bjet.12880

Cagiltay, N. E., Toker, S., & Cagiltay, K. (2023). Exploring the Influence of Countries' Economic Conditions on Massive Open Online Course (MOOC) Participation: A Study of 3.5 Million MITx Learners. *The International Review of Research in Open and Distributed Learning, 24*(2), 1–17. https://doi.org/10.19173/irrodl.v24i2.7123

Calonge, D. S., & Shah, M. A. (2016). MOOCs, Graduate Skills Gaps, and Employability: A Qualitative Systematic Review of the Literature. *The International Review of Research in Open and Distributed Learning, 17*(5). https://doi.org/10.19173/irrodl.v17i5.2675

Castaño Muñoz, J., Kalz, M., Kreijns, K., & Punie, Y. (2016). Influence of employer support for professional development on MOOCs enrolment and completion: Results from a cross-course survey. In M. Khalil, M. Ebner, M. Kopp, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the EUROPEAN STAKEHOLDER SUMMIT on experiences and best practices in and around MOOCs - EMOOOCS 2016* (pp. 251–263). Graz: University of Graz.

Castaño-Muñoz, J., Kalz, M., Kreijns, K., & Punie, Y. (2018). Who is taking MOOCs for teachers' professional development on the use of ICT? A cross-sectional study from Spain. *Technology, Pedagogy and Education, 27*(5), 607–624. https://doi.org/10.1080/1475939X.2018.1528997

Castaño-Muñoz, J., Kreijns, K., Kalz, M., & Punie, Y. (2017). Does digital competence and occupational setting influence MOOC participation? Evidence from a cross-course survey. *Journal of Computing in Higher Education, 29*(1), 28–46. https://doi.org/10.1007/s12528-016-9123-z

Castaño-Muñoz, J., Rodrigues, M., (2021). Open to MOOCs? Evidence of their impact on labour market outcomes. *Computers & Education, 173*, 104289. https://doi.org/10.1016/j.compedu.2021.104289

Cavignaux-Bros, D., & Cristol, D. (2020). Participatory design and co-design—The case of a MOOC on public innovation. In M. Schmidt, A. A. Tawfik, I. Jahnke, & Y. Earnshaw (Eds.), *Learner and User Experience Research: An Introduction for the Field of Learning Design & Technology.* EdTech Books. https://edtechbooks.org/ux/participatory_and_co_design

Celik, B., & Cagiltay, K. (2023). Did you act according to your intention? An analysis and exploration of intention–behavior gap in MOOCs. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-11859-6

Chaker, R., Bouchet, F., & Bachelet, R. (2022). How do online learning intentions lead to learning outcomes? The mediating effect of the autotelic dimension of flow in a MOOC. *Computers in Human Behavior, 134*, 107306. https://doi.org/10.1016/j.chb.2022.107306

Chew, S. W., Cheng, I-L., & Chen, N.-S. (2017). Yet another perspective about designing and implementing a MOOC. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open education: From OERs to MOOCs. Lecture Notes in Educational Technology* (pp. 117–133). Springer. https://doi.org/10.1007/978-3-662-52925-6_6

Chickering, A. W., & Gamson, Z. F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin, 39*(7), 3–7.

Cho, M. H., Yang, T., Niu, Z., & Kim, J. K. (2022). Investigating what learners value in marketing MOOCs: A content analysis. *Journal of Computing in Higher Education*. Advance online publication. https://doi.org/10.1007/s12528-022-09347-w

Christensen, R., Hodges, C. B., & Spector, J. M. (2022). A Framework for Classifying Replication Studies in Educational Technologies Research. *Technology, Knowledge, and Learning, 27*(4), 1021–1038. https://doi.org/10.1007/s10758-021-09532-3

Chukwuemeka, E. J., Yoila, A. O., & Iscioglu, E. (2015). Instructional design quality: An evaluation of open education Europa networks' open courses using the first principles of instruction. *International Journal of Science and Research, 4*(11), 878–882.

Clark, R. C., & Mayer, R. E. (2016). *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (4th ed.). John Wiley & Sons.

Collis, B., & Margaryan, A. (2005). Design criteria for work-based learning. Merrill's first principles of instruction expanded. *British Journal of Educational Technology, 36*(5), 725–739. https://doi.org/10.1111/j.1467-8535.2005.00507.x

Condé, J., & Cisel, M. (2019). On the Use of MOOCs in Companies: A Panorama of Current Practices. In M. Calise, C. Delgado Kloos, J. Reich, J. Ruiperez-Valiente, & M. Wirsing (Eds.), *Digital Education: At the MOOC Crossroads Where the Interests of Academia and Business Converge. EMOOCs 2019* (pp. 37–46). Springer. https://doi.org/10.1007/978-3-030-19875-6_5

Conole, G. (2013). MOOCs as disruptive technologies: Strategies for enhancing the learner experience and quality of MOOCs. *Revista de Educación a Distancia, 39*, 1–17. http://dx.doi.org/10.6018/red/50/2

Conole, G. (2015). Designing effective MOOCs. *Educational Media International, 52*(4), 239–252. https://doi.org/10.1080/09523987.2015.1125989

Cortes Mendez, M. (2020, September 15). *Georgia Tech's Computer Science Online Master's Leaves Udacity*. Class Central. https://www.classcentral.com/report/georgia-tech-omscs-leaves-udacity/

Cross, J. S., Keerativoranan, N., Carlon, M. K. J., Tan, Y. H., Rakhimberdina, Z., & Mori, H. (2019). Improving MOOC quality using learning analytics and tools. *Proceedings 2019 IEEE Learning With MOOCS* (pp. 174–179). https://doi.org/10.1109/LWMOOCS47620.2019.8939617.

Crosslin, M., & Wakefield, J. S. (2016). What's Cooking in the MOOC Kitchen: Layered MOOCs. *TechTrends, 60*, 98–101. https://doi.org/10.1007/s11528-016-0036-5

Czerniewicz L., Deacon A., Glover M., Walji S. (2017). MOOC—making and open educational practices. *Journal of Computing in Higher Education, 29*(1), 81–97. https://doi.org/10.1007/s12528-016-9128-7

Dai, H. M., Teo, T., & Rappa, N. A. (2022). The role of gender and employment status in MOOC learning: An exploratory study. *Journal of Computer Assisted Learning, 38*(5), 1360–1370. https://doi.org/10.1111/jcal.12681

Dalipi, F., Zdravkova, K., & Ahlgren, F. (2021). Sentiment Analysis of Students' Feedback in MOOCs: A Systematic Literature Review. *Frontiers in Artificial Intelligence, 4*, 728708. https://doi.org/10.3389/frai.2021.728708

Daniel, J. (2012). Making Sense of MOOCs: Musings in a Maze of Myth, Paradox and Possibility. *Journal of Interactive Media in Education, 2012*(3), Art. 18. https://doi.org/10.5334/2012-18

Davis, D., Chen, G., Hauff, C., & Houben, G. J. (2016). Gauging MOOC Learners' Adherence to the Designed Learning Path. *Proceedings of the 9th International Conference on Educational Data Mining*. https://www.educationaldatamining.org/EDM2016/proceedings/paper_63.pdf

Deimann, M. (2017). Open Education, An Overview of. In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1696–1700). Springer. https://doi.org/10.1007/978-981-287-588-4_213

Delgado Kloos, C., Muñoz-Merino, P. J., Alario-Hoyos, C., Estévez Ayres, I., & Fernández-Panadero, C. (2015). Mixing and blending MOOC technologies with face-to-face pedagogies. *Proceedings of the 2015 IEEE Global Engineering Education Conference* (pp. 967–971). https://doi.org/10.1109/EDUCON.2015.7096090

Deng, R., & Benckendorff, P. (2021). What are the key themes associated with the positive learning experience in MOOCs? An empirical investigation of learners' ratings and reviews. *International Journal of Educational Technology in Higher Education, 18*, 9. https://doi.org/10.1186/s41239-021-00244-3

Deng, R., Benckendorff, P., & Gannaway, D. (2019). Progress and new directions for teaching and learning in MOOCs. *Computers & Education, 129*, 48–60. https://doi.org/10.1016/j.compedu.2018.10.019

Despujol, I., Castañeda, L., Marín, V. I., & Turró, C. (2022). What do we want to know about MOOCs? Results from a machine learning approach to a systematic literature mapping review. *International Journal of Educational Technology in Higher Education*, *19*(53). https://doi.org/10.1186/s41239-022-00359-1

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining "gamification". In A. Lugmayr (Ed.), *Proceedings of the 15th International Academic Mindtrek Conference: Envisioning Future Media Environments* (pp. 9–15). ACM. https://doi.org/10.1145/2181037.2181040.

Dodson, M. N., Kitburi, K., & Berge, Z. L. (2015). Possibilities for MOOCs in Corporate Training and Development. *Performance Improvement, 54*(10), 14–21. https://doi.org/10.1002/pfi.21532

Doo, M. Y., Zhu, M., & Bonk, C. J. (2023). Influence of self-directed learning on learning outcomes in MOOCs: A meta-analysis. *Distance Education, 44*(1), 86–105. https://doi.org/10.1080/01587919.2022.2155618

Dousay, T. A., & Janak, E. (2018). All things considered: Educational radio as the first MOOCs. *TechTrends, 62*(6), 555–562. https://doi.org/10.1007/s11528-018-0257-x

Drugova, E., Zhuravleva, I., Zakharova, U., & Latipov, A. (2023). Learning analytics driven improvements in learning design in higher education: A systematic literature review. *Journal of Computer Assisted Learning,* 1–15. https://doi.org/10.1111/jcal.12894

Du, J., Hew, K. F., & Liu, L. (2023). What can online traces tell us about students' self-regulated learning? A systematic review of online trace data analysis. *Computers & Education, 201*, 104828. https://doi.org/10.1016/j.compedu.2023.104828.

Ebben, M., & Murphy, J. S. (2014). Unpacking MOOC scholarly discourse: A review of nascent MOOC scholarship. *Learning, Media and Technology, 39*(3), 328–345. https://doi.org/10.1080/17439884.2013.878352

Ebner, M., Lorenz, A., Lackner, E., Kopp, M., Kumar, S., Schön, S., & Wittke, A. (2017). How OER Enhances MOOCs—A Perspective from German-Speaking Europe. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open Education: from OERs to MOOCs* (pp. 205–220). Springer. https://doi.org/10.1007/978-3-662-52925-6_11

Egloffstein, M. (2018). Massive open online courses in digital workplace learning: Current state and future perspectives. In D. Ifenthaler (Ed.), *Digital workplace learning: Bridging formal and informal learning with digital technologies* (pp. 149–166). Springer. https://doi.org/10.1007/978-3-319-46215-8

Egloffstein, M., Ebner, B., & Ifenthaler, D. (2019). Digital learning from scratch: Initiating MOOCs within a business school. In M. Calise, C. Delgado-Klos, C. Mongenet, J. Reich, J. A. Ruipérez-Valiente, G. Shimshon, T. Staubitz, & M. Wirsing (Eds.), *EMOOCs-WIP 2019: Proceedings of Work in Progress Papers of the Research, Experience and Business Tracks* (pp. 121–127). CEUR Workshop Proceedings. https://ceur-ws.org/Vol-2356/experience_short7.pdf

Egloffstein, M., & Ifenthaler, D. (2017). Employee perspectives on MOOCs for workplace learning. *TechTrends, 61*(1), 65–70. https://doi.org/10.1007/s11528-016-0127-3

Egloffstein, M., & Ifenthaler, D. (2023). Modularizing MOOCs for Professional Learning: Prospects and Challenges for Instructional Design. *Proceedings 2023 IEEE Learning with MOOCS* (pp. 1-4). https://doi.org/10.1109/LWMOOCS58322.2023.10305982.

Egloffstein, M., & Kögler, K. (2023). Design Review von offenen Online-Kursen zum Thema Künstliche Intelligenz [Design Review of Open Online Courses on Artificial Intelligence]. In M. Klein, D. Krupka, C. Winter & V. Wohlgemuth (Eds.), *Proceedings INFORMATIK 2023: Designing Futures: Zukünfte gestalten* (pp. 409–414). Gesellschaft für Informatik.

Egloffstein, M., Koegler, K., & Ifenthaler, D. (2019). Instructional quality of business MOOCs: Indicators and initial findings. *Online Learning Journal*, *23*(4), 85–105. https://doi.org/10.24059/olj.v23i4.2091

Egloffstein, M., & Schwerer, F. (2019). Participation and achievement in enterprise MOOCs for professional development: Initial findings from the openSAP University. In D. Sampson, J. M. Spector, D. Ifenthaler, P. Isaías, & S. Sergis (Eds.), *Learning technologies for transforming large-scale teaching, learning, and assessment* (pp. 91–103). Springer. https://doi.org/10.1007/978-3-030-15130-0_6

Eraut, M. (2000). Non-formal learning and tacit knowledge in professional work. *British Journal of Educational Psychology, 70*, 113–136. https://doi.org/10.1348/000709900158001

Ertmer, P. A., & Newby, T. J. (1996). The expert learner: Strategic, self-regulated, and reflective*. Instructional Science, 24*(1), 1–24. https://doi.org/10.1007/BF00156001

European Commission (2020). *A European approach to micro-credentials: Output of the micro-credentials higher education consultation group: Final report*. Publications Office of the European Union. https://data.europa.eu/doi/10.2766/30863

Fan, Y. (2017). Use the AMP tool to characterize pedagogical approaches taken by MOOC courses in Mainland China. *International Journal for Educational Media and Technology, 11*(1), 141–146. https://ijemt.org/index.php/journal/article/view/257

Fischer, G. (2014). Beyond Hype and Underestimation: Identifying Research Challenges for the Future of MOOCs. *Distance Education Journal, 35*(2), 149–158. https://doi.org/10.1080/01587919.2014.920752

Flasdick, J., Mah, D.-K., Bernd, M., & Rampelt, F. (2023). *Micro-credentials and micro-degrees. Current developments and potentials for educational practice based on the example of the AI Campus*. AI Campus. https://doi.org/10.5281/zenodo.7327638

Fox, A. (2013). From MOOCs to SPOCs: Supplementing the classroom experience with small private online courses. *Communications of the ACM, 56*, 36–40. https://doi.org/10.1145/2535918

Frick, T. W., Myers, R. D., & Dagli, C. (2022). Analysis of patterns in time for evaluating effectiveness of first principles of instruction. *Educational Technology Research and Development, 70(*1), 1–29. https://doi.org/10.1007/s11423-021-10077-6

Friedl, C., Staubitz, T., & Jansen, D. (2018). Flexible, Self-Directed and Bottom-Up: Are Employees Overtaking Their Human Resource Departments with MOOCs? *Proceedings 2018 Learning With MOOCS* (pp. 66–69). https://doi.org/10.1109/LWMOOCS.2018.8534616

Gamage, D., Staubitz, T., & Whiting, M. (2021). Peer assessment in MOOCs: Systematic literature review. *Distance Education*. https://doi.org/10.1080/01587919.2021.1911626

Gameel, B. G., & Wilkins, K. G. (2019). When it comes to MOOCs, where you are from makes a difference. *Computers & Education, 136*, 49–60. https://doi.org/10.1016/j.compedu.2019.02.014

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly, 48*(1), 18–33. https://doi.org/10.1177/074171369704800103

Gaskell, A. (2017). Open Distance Learning. In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1688–1693). Springer. https://doi.org/10.1007/978-981-287-588-4_215

Gibbons, A. S. (2014). Eight Views of Instructional Design and What They Should Mean to Instructional Designers. In B. Hokanson & A. Gibbons (Eds.), *Design in Educational Technology* (pp. 15–36). Springer. https://doi.org/10.1007/978-3-319-00927-8_2

Glass, C. R., Shiokawa-Baklan, M. S., & Saltarelli, A. J. (2016). Who takes MOOCs? *New directions for institutional research, 167*, 41–55. https://doi.org/10.1002/ir.20153

Goglio, V., & Parigi, P. (2020). The Social Dimension of Participation and Completion in MOOCs. *Educational Technology & Society, 23*(4), 106–123. https://doi.org/10.30191/ETS.202010_23(4).0008

Goglio, V., Bertolini, S., & Parigi, P. (2023). The perceived labour market value of Massive Open Online Courses (MOOCs) in Europe and the USA. *Journal of Education and Work, 36*(1), 37–51. https://doi.org/10.1080/13639080.2022.2162020

Goller, M., Kyndt, E., Paloniemi, S., & Damşa, C. (2022). Addressing Methodological Challenges in Research on Professional Learning and Development. In M. Goller, E. Kyndt, S. Paloniemi, & C. Damşa (Eds.), *Methods for Researching Professional Learning and Development* (pp. 1–16). Springer. https://doi.org/10.1007/978-3-031-08518-5_1

Guggemos, J., Moser, L., & Seufert, S. (2022). Learners don't know best: Shedding light on the phenomenon of the K-12 MOOC in the context of information literacy. *Computers & Education*, *188*, 104552. https://doi.org/10.1016/j.compedu.2022.104552

Hadi, S. M., & Gagen, P. (2016). New model for measuring MOOCs completion rates. In M. Khalil, M. Ebner, M. Koop, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the European MOOC Stakeholder Summit 2016* (pp. 95–105). BoD.

Hagedorn, C., Sauer, D., Graichen, J., & Meinel, C. (2023). Using Randomized Controlled Trials in eLearning: How to Add Content A/B Tests to a MOOC Environment. *Proceedings 2023 IEEE Global Engineering Education Conference* (pp. 1-10). IEEE. https://doi.org/10.1109/EDUCON54358.2023.10125270

Hahn, M. G., Navarro, S. M. B., Valentín, L. D. L. F., & Burgos, D. (2021). A systematic review of the effects of automatic scoring and automatic feedback in educational settings. *IEEE Access, 9*, 108190-108198. https://doi.org/10.1109/ACCESS.2021.3100890.

Hamori, M. (2017). The drivers of employer support for professional skill development in MOOCs. In C. Delgado Kloos, P. Jermann, M. Pérez-Sanagustín, D. Seaton, & S. White (Eds.), *Digital education: Out to the world and back to the campus. EMOOCs 2017* (pp. 203–209). Springer. https://doi.org/10.1007/978-3-319-59044-8_24

Hamori, M. (2021). MOOCs at work: what induces employer support for them? *The International Journal of Human Resource Management*, *32*(20), 4190–4214. https://doi.org/10.1080/09585192.2019.1616593

Hamori, M. (2023). Self-directed learning in massive open online courses and its application at the workplace: Does employer support matter? *Journal of Business Research, 157*, 113590. https://doi.org/10.1016/j.jbusres.2022.113590

Handoko, E., Gronseth, S. L., McNeil, S. G., Bonk, C. J., & Robin, B. R. (2019). Goal Setting and MOOC Completion: A Study on the Role of Self-Regulated Learning in Student Performance in Massive Open Online Courses. *The International Review of Research in Open and Distributed Learning, 20*(3), 39–58. https://doi.org/10.19173/irrodl.v20i4.4270

Hansen, J. D., & Reich, J. (2015). Democratizing education? Examining access and usage patterns in massive open online courses. *Science, 350*(6265), 1245–1248. https://doi.org/10.1126/science.aab3782

Harteis, C. (2022). Research on Workplace Learning in Times of Digitalisation. In C. Harteis, D. Gijbels, & E. Kyndt (Eds.), *Research Approaches on Workplace Learning* (pp. 415–428). Springer. https://doi.org/10.1007/978-3-030-89582-2_19

Henderikx, M. A., Kreijns, K., & Kalz, M. (2017). Refining success and dropout in massive open online courses based on the intention–behavior gap. *Distance Education, 38*(3), 353–368. https://doi.org/10.1080/01587919.2017.1369006

Henderikx, M. A., Kreijns, K., & Kalz, M. (2018). Intention-Behavior Dynamics in MOOC Learning: What Happens to Good Intentions Along the Way? *Proceedings 2018 Learning With MOOCS conference* (pp. 110–112). IEEE. https://doi.org/10.1109/LWMOOCS.2018.8534595

Henderikx, M., Kreijns, K., Xu, K. M., & Kalz, M. (2021). Making Barriers to Learning in MOOCs Visible: A Factor Analytical Approach. *Open Praxis, 13*(2), 143–159. https://doi.org/10.5944/openpraxis.13.2.124

Hendriks, R. A., de Jong, P. G. M., Admiraal, W. F., & Reinders, M. E. J. (2020). Instructional design quality in medical Massive Open Online Courses for integration into campus education. *Medical Teacher, 42*(2), 156–163. https://doi.org/10.1080/0142159X.2019.1665634

Hew, K. F. (2016). Promoting engagement in online courses: What strategies can we learn from three highly rated MOOCs. *British Journal of Educational Technology*, 47(2), 320-341. https://doi.org/10.1111/bjet.12235

Hew, K. F. (2018). Unpacking the Strategies of Ten Highly Rated MOOCs: Implications for Engaging Students in Large Online Courses. *Teachers College Record, 120*(1), 1–40. https://doi.org/10.1177/016146811812000107

Hoadley, C., & Campos F. C. (2022). Design-based research: What it is and why it matters to studying online learning, *Educational Psychologist, 57*(3), 207–220, https://doi.org/10.1080/00461520.2022.2079128

Honebein, P. C., Reigeluth, C. M. (2021). To prove or improve, that is the question: The resurgence of comparative, confounded research between 2010 and 2019. *Educational Technology Research and Development, 69*, 465–496. https://doi.org/10.1007/s11423-021-09988-1

Hood, N., & Littlejohn, A. (2016). MOOC Quality: the need for new measures. *Journal of Learning for Development, 3*(3). https://doi.org/10.56059/jl4d.v3i3.165

Hood, N., Littlejohn, A., & Milligan, C. (2015). Context counts: How learners' contexts influence learning in a MOOC. *Computers & Education, 91*, 83-91. https://doi.org/10.1016/j.compedu.2015.10.019

Hou, H. T., Chang, K. E., & Sung, Y. T. (2010). Applying lag sequential analysis to detect visual behavioural patterns of online learning activities. *British Journal of Educational Technology, 41*(2), E25–E27. https://doi.org/10.1111/j.1467-8535.2009.00935.x

Huang, H., Jew, L., & Qi, D. (2023). Take a MOOC and then drop: A systematic review of MOOC engagement pattern and dropout factor. *Heliyon 9*(4), e15220. https://doi.org/10.1016/j.heliyon.2023.e15220

Huin, L., Bergheaud, Y., Caron, P. A., Codina, A., & Disson, E. (2016). Measuring completion and dropout in MOOCs: A learner-centered model. In M. Khalil, M. Ebner, M. Koop, A. Lorenz, & M. Kalz (Eds.), *Proceedings of the European MOOC Stakeholder Summit 2016* (pp. 55–68). BoD.

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 1*, 100001. https://doi.org/10.1016/j.caeai.2020.100001

Ifenthaler, D. (2010). Learning and Instruction in the Digital Age. In J. M. Spector, D. Ifenthaler, P. Isaias, Kinshuk, & D. G. Sampson (Eds.), *Learning and Instruction in the Digital Age* (pp. 3–10). Springer. https://doi.org/10.1007/978-1-4419-1551-1_1

Ifenthaler, D. (2012). Design of Learning Environments. In N. M. Seel (Ed.), *Encyclopedia of the Sciences of Learning* (pp. 929–931). Springer. https://doi.org/10.1007/978-1-4419-1428-6_186

Ifenthaler, D. (2015). Learning analytics. In J. M. Spector (Ed.), *The SAGE encyclopedia of educational technology* (Vol. 2, pp. 447–451). SAGE. https://doi.org/10.4135/9781483346397

Ifenthaler, D. (2017a). Learning analytics design. In L. Lin, & J. M. Spector (Eds.), *The sciences of learning and instructional design: Constructive articulation between communities* (pp. 202–211). Routledge. https://doi.org/10.4324/9781315684444-13

Ifenthaler, D. (2017b). Designing effective digital learning environments: Toward learning analytics design. *Technology, Knowledge and Learning, 22*(3), 401–404. https://doi.org/10.1007/s10758-017-9333-0

Ifenthaler, D. (2018). How We Learn at the Digital Workplace. In D. Ifenthaler (Ed.*), Digital Workplace Learning* (pp. 3–8). Springer. https://doi.org/10.1007/978-3-319-46215-8_1

Ifenthaler, D., & Schumacher, C. (2016a). Connectivism. In S. Danver (Ed.), *The SAGE encyclopedia of online education (*pp. 242–244). SAGE. http://dx.doi.org/10.4135/9781483318332.n82

Ifenthaler, D., & Schumacher, C. (2016b). Udacity. In S. Danver (Ed.), *The SAGE encyclopedia of online education* (pp. 1149–1151). SAGE. https://doi.org/10.4135/9781483318332.n372

Ifenthaler, D., & Schumacher, C. (2016c). Student perceptions of privacy principles for learning analytics. *Educational Technology Research and Development, 64*(6), 923–938. https://doi.org/10.1007/s11423-016-9477-y

Ifenthaler, D., & Widanapathirana, C. (2014). Development and validation of a learning analytics framework: Two case studies using support vector machines. *Technology, Knowledge and Learning, 19*(1–2), 221–240. https://doi.org/10.1007/s10758-014-9226-4.

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (2015). Internet: Its impact and its potential for learning and instruction. In J. M. Spector (Ed.), *The SAGE encyclopedia of educational technology* (pp. 416–422). SAGE. https://doi.org/10.4135/9781483346397.n176

Ifenthaler, D., Bellin-Mularski, N., & Mah, D.-K. (Eds.) (2016). *Foundation of Digital Badges and Micro-Credentials. Demonstrating and Recognizing Knowledge and Competencies.* Springer. https://doi.org/10.1007/978-3-319-15425-1

Ifenthaler, D., Gibson, D. C., & Dobozy, E. (2018). Informing learning design through analytics: Applying network graph analysis. *Australasian Journal of Educational Technology*, *34*(2), 117–132. https://doi.org/10.14742/ajet.3767

Ifenthaler, D., Gibson, D. C., Prasse, D., Shimada, A., & Yamada, M. (2021). Putting learning back into learning analytics: Actions for policy makers, researchers, and practitioners. *Educational Technology Research and Development*, *69*(4), 2131–2150. https://doi.org/10.1007/s11423-020-09909-8

Illinois Online Network. (2018). *Quality Online Course Initiative (QOCI) Rubric*. https://www.uis.edu/ion/resources/qoci/

Jacobsen, M., & McKenney, S. (2023). Educational design research: grappling with methodological fit. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10282-5

Jahnke, I., Schmidt, M., Earnshaw, Y., & Tawfik, A. A. (2022). Theoretical Considerations of Learning Experience Design. In H. Leary, S. P. Greenhalgh, K. B. Staudt Willet, & M. H. Cho (Eds.), *Theories to Influence the Future of Learning Design and Technology.* EdTech Books. https://edtechbooks.org/theory_comp_2021/toward_theory_of_LXD_jahnke_earnshaw_schmidt_tawfik

Jansen, D., Rosewell, J., & Kear, K. (2017). Quality Frameworks for MOOCs. In M. Jemni, Kinshuk, & M. Khribi (Eds.), *Open Education: From OERs to MOOCs* (pp. 261–281). Springer. https://doi.org/10.1007/978-3-662-52925-6_14

Jarnac de Freitas, M., & Mira da Silva, M. (2023). Systematic literature review about gamification in MOOCs. *Open Learning: The Journal of Open, Distance and e-Learning, 38*(1), 73–95. https://doi.org/10.1080/02680513.2020.1798221

Joksimović, S., Ifenthaler, D., Marrone, R., De Laat, M., & Siemens, G. (2023). Opportunities of artificial intelligence for supporting complex problem-solving: Findings from a scoping review. *Computers and Education: Artificial Intelligence, 4*, 100138. https://doi.org/10.1016/j.caeai.2023.100138.

Joksimović, S., Poquet, O., Kovanović, V., Dowell, N., Mills, C., Gašević, D., Dawson, S., Graesser, A. C., & Brooks, C. (2018). How Do We Model Learning at Scale? A Systematic Review of Research on MOOCs. *Review of Educational Research, 88*(1), 43–86. https://doi.org/10.3102/0034654317740335

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. *The International Review of Research in Open and Distance Learning, 16*(3), 341–358. https://doi.org/10.19173/irrodl.v16i3.2112

Jordan, K., & Goshtasbpour, F. (2022). JIME Virtual Special Collection – 2012 to 2022: The Decade of the MOOC. *Journal of Interactive Media in Education, 2022*(1), 1. https://doi.org/10.5334/jime.757

Jovanovic, J., & Devedzic, V. (2015). Open badges: Novel means to motivate, scaffold and recognize learning. *Technology, Knowledge and Learning, 20*(1), 115–119. https://doi.org/10.1007/s10758-014-9232-6.

Kalz, M. (2015). Lifelong learning and its support with new technologies. In J. D. Wright (Ed.), *International encyclopedia of the social & behavioral sciences* (2nd ed., Vol. 14, pp. 93–99). Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.92006-3

Kalz, M., & Specht, M. (2013). *If MOOCs are the answer, did we ask the right questions? Implications for the design of large-scale online courses.* Working paper 2013/25. Maastricht School of Management.

Kasch, J., van Rosmalen, P., & Kalz, M. (2017). A Framework towards Educational Scalability of Open Online Courses. *Journal of Universal Computer Science*, *23*(9), 845–867. https://doi.org/10.3217/JUCS-023-09-0845

Kasch, J., Van Rosmalen, P., & Kalz, M. (2021). Educational scalability in MOOCs: Analysing instructional designs to find best practices. *Computers & Education, 161, 104054*,1–12. https://doi.org/10.1016/j.compedu.2020.104054

Kelkar, S. (2018). Engineering a platform: The construction of interfaces, users, organizational roles, and the division of labor. *New Media & Society*, *20*(7), 2629–2646. https://doi.org/10.1177/1461444817728682

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development, 10*(1), 2–10. https://doi.org/10.1007/BF02905780

Khalil, M., Brunner, H., & Ebner, M. (2015). Evaluation grid for xMOOCs. *International Journal of Emerging Technologies in Learning, 10*(4), 40–45. https://doi.org/10.3991/ijet.v10i4.4653

Khalil, M., Wong, J., de Koning, B., Ebner, M., & Paas, F. (2018). Gamification in MOOCs: A review of the state of the art. *Proceedings 2018 IEEE Global Engineering Education Conference* (pp. 1629–1638). https://doi.org/10.1109/EDUCON.2018.8363430.

Kimmons, R., Graham, C. R., & West, R. E. (2020). The PICRAT model for technology integration in teacher preparation. *Contemporary Issues in Technology and Teacher Education, 20*(1), 176–198. https://citejournal.org/volume-20/issue-1-20/general/the-picrat-model-for-technology-integration-in-teacher-preparation/

King, I., & Lee, W. I. (2023). *A Decade of MOOCs and Beyond: Platforms, Policies, Pedagogy, Technology, and Ecosystems with an Emphasis on Greater China*. Springer. https://doi.org/10.1007/978-3-031-15241-2

Kizilcec, R. F., Reich, J., Yeomans, M., Dann, C., Brunskill, E., Lopez, G., Turkay, S., Williams, J. J., & Tingley, D. (2020). Scaling up behavioral science interventions in online education. *Proceedings of the National Academy of Sciences, 117*(26), 14900-14905. https://doi.org/10.1073/pnas.1921417117

Kizilcec, R. F., Saltarelli, A. J., Reich, J., & Cohen, G. L. (2017). Closing global achievement gaps in MOOCs: Brief interventions address social identity threat at scale. *Science, 355*(6322), 251–252. https://doi.org/10.1126/science.aag2063

Klahr, D. (2019). Learning Sciences Research and Pasteur's Quadrant. *Journal of the Learning Sciences, 28*(2), 153–159. https://doi.org/10.1080/10508406.2019.1570517

Klobas, J. E. (2014). Measuring the success of scalable open online courses. *Performance Measurement and Metrics, 15*(3), 145–162. https://doi.org/10.1108/PMM-10-2014-0036

Knight, S., Wise, A., & Chen, B. (2017). Time for change: Why learning analytics needs temporal analysis. *Journal of Learning Analytics*, *4*(3), 7–17. https://doi.org/10.18608/jla.2017.43.2

Knox, J. (2017). Massive Open Online Courses (MOOCs). In M. A. Peters (Ed.), *Encyclopedia of Educational Philosophy and Theory* (pp. 1372–1378). Springer. https://doi.org/10.1007/978-981-287-588-4_219

Kocdar, S., Okur, M., & Bozkurt, A. (2017). An examination of xMOOCs: An embedded single case study based on Conole's 12 dimensions. *The Turkish Online Journal of Distance Education, 18*(4), 52–65. https://doi.org/10.17718/tojde.340381

Kögler, K., Egloffstein, M., & Schönberger, B. (2020). Openness in MOOCs for training and professional development – An exploration of entry and participation barriers. In E. Wuttke, J. Seifried, & H. M. Niegemann (Eds.), *Vocational education and training in the age of digitization: Challenges and opportunities* (pp. 205–223). Barbara Budrich. https://doi.org/10.3224/84742432

Koller, D., Ng, A., Do, T., & Chen, Z. (2013). Retention and Intention in Massive Open Online Courses: In Depth. *Educause Review Online*. https://er.educause.edu/articles/2013/6/retention-and-intention-in-massive-open-online-courses-in-depth

Lambert, S. R. (2020). Do MOOCs contribute to student equity and social inclusion? A systematic review 2014–18. *Computers & Education, 145*, 103693. https://doi.org/10.1016/j.compedu.2019.103693

Laurillard, D. (2016). The educational problem that MOOCs could solve: professional development for teachers of disadvantaged students. *Research in Learning Technology, 24*. https://doi.org/10.3402/rlt.v24.29369

Law, N. (2017). Instructional design and learning design. In L. Lin & J. M. Spector (Eds.), *The sciences of learning and instructional design. Constructive articulation between communities* (pp. 186-201). Routledge.

Law, N., & Liang, L. (2020). A Multilevel Framework and Method for Learning Analytics Integrated Learning Design. *Journal of Learning Analytics, 7*(3), 98–117. https://doi.org/10.18608/jla.2020.73.8

Lee, A. S., & Baskerville, R. L. (2003). Generalizing Generalizability in Information Systems Research. *Information Systems Research, 14*(3), 221–243. https://doi.org/10.1287/isre.14.3.221.16560

Lee, D., Watson, S. L., & Watson, W. R. (2019). Systematic literature review on self-regulated learning in massive open online courses. *Australasian Journal of Educational Technology, 35*(1). https://doi.org/10.14742/ajet.3749

Lee, J., Sanders, T., Antczak, D., Parker, R., Noetel, M., Parker, P., & Lonsdale, C. (2021). Influences on User Engagement in Online Professional Learning: A Narrative Synthesis and Meta-Analysis. *Review of Educational Research, 91*(4), 518–576. https://doi.org/10.3102/0034654321997918

Lee, S., & Chung, J. Y. (2019). Lessons learned from two years of K-MOOC experience. *Educational Media International, 56*(2), 134–148. https://doi.org/10.1080/09523987.2019.1614245

Lee, W.C., & Tan, B.C.Y. (2023). Workplace learning strategies, enablers, and challenges in the context of digital innovation. *Journal of Workplace Learning, 35*(2), 192–209. https://doi.org/10.1108/JWL-04-2022-0045

Lehmann, T., Haehnlein, I., & Ifenthaler, D. (2014). Cognitive, metacognitive, and motivational perspectives on preflection in self-regulated online learning. *Computers in Human Behavior, 32*, 313–323. https://doi.org/10.1016/j.chb.2013.07.051

Li, K., & Moore, D. R. (2018). Motivating Students in Massive Open Online Courses (MOOCs) Using the Attention, Relevance, Confidence, Satisfaction (ARCS) Model. *Journal of Formative Design in Learning, 2*, 102–113. https://doi.org/10.1007/s41686-018-0021-9

Li, K., Johnsen, J., & Canelas, D. A. (2021). Persistence, performance, and goal setting in massive open online courses. *British Journal of Educational Technology, 52*(3), 1215–1229. https://doi.org/10.1111/bjet.13068

Li, L., Johnson, J., Aarhus, W., & Shah, D. (2022). Key factors in MOOC pedagogy based on NLP sentiment analysis of learner reviews: What makes a hit. *Computers & Education, 176*, 104354. https://doi.org/10.1016/j.compedu.2021.104354

Li, N., Kidziński, Ł., Jermann, P., & Dillenbourg, P. (2015). MOOC video interaction patterns: What do they tell us? In G. Conole, T. Klobučar, C. Rensing, J. Konert, & É. Lavoué (Eds.), *Design for teaching and learning in a networked world. LNCS Vol. 9307* (pp. 197–210). Springer. https://doi.org/10.1007/978-3-319-24258-3_15

Li, S., Craig, S. D., & Schroeder, N. L. (2023). Lessons Learned from Online Learning at Scale: A Study of Exemplar Learning Organizations. *TechTrends, 67*, 84–97. https://doi.org/10.1007/s11528-022-00761-6

Li, S., Du, J., & Sun, J. (2022). Unfolding the learning behaviour patterns of MOOC learners with different levels of achievement. *International Journal of Educational Technology in Higher Education, 19*(1). https://doi.org/10.1186/s41239-022-00328-8

Li, S., Wang, S., Du, J., Pei, Y., & Shen, X. (2021). MOOC learners' time-investment patterns and temporal-learning characteristics. *Journal of Computer Assisted Learning, 38*(1), 152–166. https://doi.org/10.1111/jcal.12597

Littenberg-Tobias, J., & Reich, J. (2020). Evaluating access, quality, and equity in online learning: A case study of a MOOC-based blended professional degree. *The Internet and Higher Education, 47*, 10759. https://doi.org/10.1016/j.iheduc.2020.100759

Littlejohn, A. (2023). Challenges of Digital Professional Learning: Digital Technology Systems Are No Substitute for Human Agency. In K. Evans, W. O. Lee, J. Markowitsch, & M. Zukas (Eds.), *Third International Handbook of Lifelong Learning* (pp. 1201–1218). Springer. https://doi.org/10.1007/978-3-031-19592-1_56

Littlejohn, A., & Hood, N. (2018). Designing for quality? In A. Littlejohn, & N. Hood (Eds.), *Reconceptualising learning in the digital age: The [un]democratising potential of MOOCs* (pp. 79–94). Springer. https://doi.org/10.1007/978-981-10-8893-3

Littlejohn, A., & Margaryan, A. (2014). Technology-enhanced professional learning. In S. Billett, C. Harteis, & H. Gruber (Eds.), *International Handbook of Research in Professional and Practice-based Learning* (pp. 1187–1212). Springer. https://doi.org/10.1007/978-94-017-8902-8_43

Littlejohn, A., & Pammer-Schindler, V. (2022). Technologies for Professional Learning. In C. Harteis, D. Gijbels, & E. Kyndt (Eds.), *Research Approaches on Workplace Learning* (pp. 321–346). Springer. https://doi.org/10.1007/978-3-030-89582-2_15

Liu C., Zou D., Chen X., Xie H., Chan W. H. (2021). A bibliometric review on latent topics and trends of the empirical MOOC literature (2008–2019). *Asia Pacific Education Review, 22*(3), 515–534. https://doi.org/10.1007/s12564-021-09692-y

Liu, B., Wu, Y., Xing, W., Cheng, G., & Guo, S. (2021). Exploring behavioural differences between certificate achievers and explorers in MOOCs. *Asia Pacific Journal of Education, 42*(4), 802–814. https://doi.org/10.1080/02188791.2020.1868974

Liu, M., Zou, W., Shi, Y., Pan, Z., & Li, C. (2020). What do participants think of today's MOOCs: An updated look at the benefits and challenges of MOOCs designed for working professionals. *Journal of Computing in Higher Education, 32*(2), 307–329. https://doi.org/10.1007/s12528-019-09234-x

Lockyer, L., & Dawson, S. (2011). Learning designs and learning analytics. *Proceedings of the 1st International Conference on Learning Analytics and Knowledge* (pp. 153–156). ACM. https://doi.org/10.1145/2090116.2090140

Loizzo, J., & Ertmer, P. A. (2016). MOOCocracy: The learning culture of massive open online courses. *Educational Technology Research & Development, 64*(6), 1013–1032. https://doi.org/10.1007/s11423-016-9444-7

Loughlin, C., Lygo-Baker, S., & Lindberg-Sand, Å. (2021). Reclaiming constructive alignment. *European Journal of Higher Education, 11*(2), 119-136. https://doi.org/10.1080/21568235.2020.1816197

Lowenthal, P. R., & Hodges, C. B. (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), 83–101. https://doi.org/10.19173/irrodl.v16i5.2348

Mah, D.-K. (2016). Learning analytics and digital badges: Potential impact on student retention in higher education. *Technology, Knowledge and Learning, 21*(3), 285–305. https://doi.org/10.1007/s10758-016-9286-8

Maldonado-Mahauad, J., Pérez-Sanagustín, M., Kizilcec, R. F., Morales, N., & Munoz-Gama, J. (2018). Mining theory-based patterns from Big data: Identifying self-regulated learning strategies in Massive Open Online Courses. *Computers in Human Behavior, 80*, 179-196. https://doi.org/10.1016/j.chb.2017.11.011

Mangaroska, K., & Giannakos, M. (2019). Learning Analytics for Learning Design: A Systematic Literature Review of Analytics-Driven Design to Enhance Learning. *IEEE Transactions on Learning Technologies, 12*(4), 516–534. https://doi.org/10.1109/TLT.2018.2868673

Mangaroska, K., Sharma, K., Gasevic, D., & Giannakos, M. (2020). Multimodal Learning Analytics to Inform Learning Design: *Lessons Learned from Computing Education. Journal of Learning Analytics, 7*(3), 79–97. https://doi.org/10.18608/jla.2020.73.7

Mao, J., Romero-Hall, E., & Reeves, T. C. (2023). Autoethnography as a research method for educational technology: A reflective discourse. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10281-6

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education, 80*, 77–83. https://doi.org/10.1016/j.compedu.2014.08.005

Martin, F., & Bolliger, D. U. (2023). Designing Online Learning in Higher Education. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 1217–1236). Springer. https://doi.org/10.1007/978-981-19-2080-6_72

Martin, F., & Borup, J. (2022). Online learner engagement: Conceptual definitions, research themes, and supportive practices. *Educational Psychologist, 57*(3), 162–177. https://doi.org/10.1080/00461520.2022.2089147

Martindale, T. (2015). Massive Open Online Courses. In J. M. Spector (Ed.), *Encyclopedia of Educational Technology* (pp. 486–488). SAGE. https://doi.org/10.4135/9781483346397

McKenney, S., & Reeves, T. C. (2021). Educational design research: Portraying, conducting, and enhancing productive scholarship. *Medical Education, 55*(1), 82–92. https://doi.org/10.1111/medu.14280

Meaney, M., & Fikes, T. (2023). The Promise of MOOCs Revisited? Demographics of Learners Preparing for University. *Journal of Learning Analytics, 10*(1), 113–132. https://doi.org/10.18608/jla.2023.7807

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research* and *Development, 50*(3), 43–59. https://doi.org/10.1007/BF02505024

Merrill, M. D. (2013). *First principles of instruction: Identifying and designing effective, efficient and engaging instruction*. Pfeiffer.

Merrill, M. D. (2023). Using the First Principles of Instruction to Make Instruction Effective, Efficient, and Engaging. In R. E. West & H. Leary (Eds.), *Foundations of Learning and Instructional Design Technology: Historical Roots & Current Trends*. EdTech Books. https://edtechbooks.org/foundations_of_learn/first_principles

Milligan, C., & Littlejohn, A. (2014). Supporting professional learning in a massive open online course. *The International Review of Research in Open and Distance Learning, 15*(5), 197–213. https://doi.org/10.19173/irrodl.v15i5.1855

Milligan, C., & Littlejohn, A. (2016). How health professionals regulate their learning in massive open online courses. *The Internet and Higher Education, 31*, 113–121. https://doi.org/10.1016/j.iheduc.2016.07.005

Milligan, C., & Littlejohn, A. (2017). Why Study on a MOOC? The Motives of Students and Professionals. *The International Review of Research in Open and Distributed Learning*, *18*(2). https://doi.org/10.19173/irrodl.v18i2.3033

Milligan, S. K., & Griffin, P. (2016). Understanding Learning and Learning Design in MOOCs: A Measurement-Based Interpretation. *Journal of Learning Analytics, 3*(2), 88–115. https://doi.org/10.18608/jla.2016.32.5

Molenda, M. (2015). In Search of the Elusive ADDIE Model. *Performance Improvement, 54*(2), 40–42. https://doi.org/10.1002/pfi.21461

Molenda, M. H. (2023). History and Development of Instructional Design and Technology. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 57–74). Springer. https://doi.org/10.1007/978-981-19-2080-6_4

Moore, R. L. (2022). Introducing mesocredentials: Connecting MOOC achievement with academic credit. *Distance Education*, *43*(2), 271–289. https://doi.org/10.1080/01587919.2022.2064823

Moore, R. L., & Blackmon, S. J. (2022). From the learner's perspective: A systematic review of MOOC learner experiences (2008–2021). *Computers & Education 190*, 104596. https://doi.org/10.1016/j.compedu.2022.104596

Moore, S. L., Howard, C. D., Boling, E., Leary, H., & Hodges, C. B. (2023). Research methods for design knowledge: clarifying definitions, characteristics, and areas of confusion. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-023-10271-8

NeCamp, T., Gardner, J., & Brooks, C. (2019). Beyond A/B testing: Sequential randomization for developing interventions in scaled digital learning environments. *Proceedings of the 9th International Conference on learning analytics & knowledge* (pp. 539-548). https://doi.org/10.1145/3303772.3303812

Newby, T. J., & Cheng, Z. (2020). Instructional digital badges: Effective learning tools. *Educational Technology Research and Development*, 68, 1053–1067. https://doi.org/10.1007/s11423-019-09719-7

Noe, R. A., Clarke, A. D. M., & Klein, H. J. (2014). Learning in the twenty-first-century workplace. *Annual Review of Organizational Psychology and Organizational* Behavior, *1*, 245–275. https://doi.org/10.1146/annurev-orgpsych-031413-091321

Ogunyemi, A. A., Quaicoe, J. S., & Bauters, M. (2022). Indicators for enhancing learners' engagement in massive open online courses: A systematic review. *Computers and Education Open*, 100088. https://doi.org/10.1016/j.caeo.2022.100088

Oh, E. G., Chang, Y., & Park, S. W. (2018). *Design review of MOOCs: Application of e-learning design principles*. Paper presented at the 2018 AECT Convention. Kansas City, MO.

Oh, E. G., Chang, Y., & Park, S. W. (2020). Design review of MOOCs: Application of e-learning design principles. *Journal of Computing in Higher Education, 32*, 455–475. https://doi.org/10.1007/s12528-019-09243-w

Oh, E. G., Cho, M. H., & Chang, Y. (2023). Learners' perspectives on MOOC design. *Distance Education, 44*(3), 476–494. https://doi.org/10.1080/01587919.2022.2150126

Oktavia, T., Prabowo, H., Meyliana, & Supangkat, S. H. (2018). The Comparison of MOOC (Massive Open Online Course) Platforms of edX and Coursera (Study Case: Student of Programming Courses). *Proceedings of the 2018 International Conference on Information Management and Technology* (pp. 339–344). https://doi.org/10.1109/ICIMTech.2018.8528178.

Olsson, U. (2016). Open courses and MOOCs as professional development – is the openness a hindrance? *Education + Training, 58*(2), 229–243. https://doi.org/10.1108/ET-01-2015-0006

Otto, D., & Kerres, M. (2023). Distributed Learning Ecosystems in Education: A Guide to the Debate. In D. Otto, G. Scharnberg, M. Kerres, & O. Zawacki-Richter (Eds.), *Distributed Learning Ecosystems* (pp. 13–30). Springer VS. https://doi.org/10.1007/978-3-658-38703-7_2

Ou, C., Joyner, D. A., & Goel, A. K. (2019). Designing and developing video lessons for online learning: A seven-principle model. *Online Learning Journal, 23*(2), 82–104. https://doi.org/10.24059/olj.v23i2.1449

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computers and Education: Artificial Intelligence, 2*, 100020. https://doi.org/10.1016/j.caeai.2021.100020

Pappano, L. (2012, November 13). *The Year of the MOOC*. The New York Times.

Pardos, Z. A., Whyte, A., & Kao, K. (2016). moocRP: An open learning analytics platform. *Technology, Knowledge and Learning, 21*(1), 75–98. https://doi.org/10.1007/s10758-015-9268-2

Park, S. (2021). MOOCs in the workplace: An intervention for strategic human resource development. *Human Resource Development International, 24*(3), 329. https://doi.org/10.1080/13678868.2018.1516062

Paton, R. M., Fluck, A. E., & Scanlan, J. D. (2018a). Engagement and retention in VET MOOCs and online courses: A systematic review of literature from 2013 to 2017. *Computers & Education, 125*, 191–201. https://doi.org/10.1016/j.compedu.2018.06.013

Paton, R. M., Fluck, A. E., & Scanlan, J. D. (2018b). A performance profile of learner completion and retention in Australian VET MOOCs. *Journal of Vocational Education & Training, 70*(4), 581–599. https://doi.org/10.1080/13636820.2018.1463278

Qi, C., & Liu, S. (2021). Evaluating On-Line Courses via Reviews Mining. *IEEE Access, 9*, 35439-35451. https://doi.org/10.1109/ACCESS.2021.3062052

Quintana, R., & Tan, Y. (2019). *Characterizing MOOC pedagogies: Exploring new tools and methods for learning designers and researchers*. Paper presented at the 2019 AERA Annual Meeting. Toronto, Ontario.

Rabin, E., Kalman, Y. M., & Kalz, M. (2019). An empirical investigation of the antecedents of learner-centered outcome measures in MOOCs. *International Journal of Educational Technology in Higher Education, 16*, 14. https://doi.org/10.1186/s41239-019-0144-3

Radford, A. W., Robles, J., Cataylo, S., Horn, L., Thornton, J., & Whitfield, K. (2014). The employer potential of MOOCs: A mixed-methods study of human resource professionals' thinking on MOOCs. *The International Review of Research in Open and Distributed Learning, 15*(5), 1–25. https://doi.org/10.19173/irrodl.v15i5.1842

Raffaghelli, J. E., Cucchiara, S., & Persico, D. (2015). Methodological approaches in MOOC research: Retracing the myth of Proteus. *British Journal of Educational Technology, 46*(3), 488–509. https://doi.org/10.1111/bjet.12279

Rampelt, F., & Bernd, M. (2021). AI Campus – Co-Creating Instructional Design Standards for an Open AI Learning Ecosystem. *Proceedings EDULEARN21*, 8373. https://doi.org/10.21125/edulearn.2021.1693

Ramsey, J. L., & West, R. E. (2023). A recent history of learning design and technology. *TechTrends, 67*(11), 781–791. https://doi.org/10.1007/s11528-023-00883-5

Rausch, A. (2014). Using diaries in research on work and learning. In C. Harteis, A. Rausch, & J. Seifried (Eds.), *Discourses on professional learning: On the boundary between learning and working* (pp. 341–366). Springer. https://doi.org/10.1007/978-94-007-7012-6_17

Reeves, T. (1996). *Evaluating what really matters in computer-based education*. https://www.eduworks.com/Documents/Workshops/EdMedia1998/docs/reeves.html

Reeves, T. C., & Oh, E. G. (2017). The goals and methods of educational technology research over a quarter century (1989–2014). *Educational Technology Research and Development, 65*, 325–339. https://doi.org/10.1007/s11423-016-9474-1

Reich, J. (2014). MOOC Completion and Retention in the Context of Student Intent. *Educause Review Online*. https://er.educause.edu/articles/2014/12/mooc-completion-and-retention-in-the-context-of-student-intent

Reich, J. (2015). Rebooting MOOC research. *Science, 347*(6217), 34-35. https://doi.org/10.1126/science.1261627

Reich, J. (2020a). *Failure to disrupt. Why technology alone can't transform education*. Harvard University Press.

Reich, J. (2020b). Two Stances, Three Genres, and Four Intractable Dilemmas for the Future of Learning at Scale. *Proceedings of the Seventh ACM Conference on Learning @ Scale (L@S '20)* (pp. 3–13). https://doi.org/10.1145/3386527.3405929

Reich, J. (2022). Learning Analytics and Learning at Scale. In C. Lang, A. F. Wise, A. Merceron, D. Gašević, & G. Siemens (Eds.), *Handbook of Learning Analytics* (2nd ed., pp. 188–195). Society for Learning Analytics Research. https://doi.org/10.18608/hla22.018

Reich, J., & Ruipérez-Valiente, J. A. (2019). The MOOC pivot. *Science, 363*(6423), 130–131. https://doi.org/10.1126/science.aav7958

Reigeluth, C. M., & An, Y. (2023). What's the Difference Between Learning Experience Design and Instructional Design? *The Journal of Applied Instructional Design, 12*(3). https://doi.org/10.59668/515.12897

Reiser, R. A. (2001). A history of instructional design and technology: Part I: A history of instructional media. *Educational Technology Research and Development, 49*(1), 53–64. https://doi.org/10.1007/BF02504506

Renz, J., Meinel, C., & Link, C. (2019). openSAP: Why are enterprise MOOCs working? *International Journal of Advanced Corporate Learning, 12*(3), 59–69. https://doi.org/10.3991/ijac.v12i3.11262

Renz, J., Schwerer, F., & Meinel, C. (2016). openSAP: Evaluating xMOOC Usage and Challenges for Scalable and Open Enterprise Education. *International Journal of Advanced Corporate Learning, 9*(2), 34–39. https://doi.org/10.3991/ijac.v9i2.6008

Reparaz, C., Aznárez-Sanado, M., Mendoza, G. (2020). Self-regulation of learning and MOOC retention. *Computers in Human Behavior, 111,* 106423. https://doi.org/10.1016/j.chb.2020.106423.

Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2022). Beyond one-size-fits-all in MOOCs: Variation in learning design and persistence of learners in different cultural and socioeconomic contexts. *Computers in Human Behavior, 126*, 106973.

Rizvi, S., Rienties, B., Rogaten, J., & Kizilcec, R. F. (2023). Are MOOC learning designs culturally inclusive (enough)? *Journal of Computer Assisted Learning*. https://doi.org/10.1111/jcal.12883

Rohloff, T., Sauer, D., & Meinel, C. (2019). On the Acceptance and Usefulness of Personalized Learning Objectives in MOOCs. *Proceedings of the Sixth ACM Conference on Learning @ Scale* (pp. 1–10). https://doi.org/10.1145/3330430.3333624

Rohloff, T., Sauer, D., & Meinel, C. (2020). Students' Achievement of Personalized Learning Objectives in MOOCs. *Proceedings of the Seventh ACM Conference on Learning @ Scale* (pp. 147–156). https://doi.org/10.1145/3386527.3405918

Rohloff, T., Schwerer, F., Schenk, N., & Meinel, C. (2020). openSAP: Learner behavior and activity in self-paced enterprise MOOCs. *International Journal of Advanced Corporate Learning, 13*(2), 30–40. https://doi.org/10.3991/ijac.v13i2.16531

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). https://doi.org/10.19173/irrodl.v16i6.2033

Rosendale, J. A. (2017). Gauging the value of MOOCs: An examination of American employers' perceptions toward higher education change. *Higher Education, Skills and Work-Based Learning, 7*(2), 141–154. https://doi.org/10.1108/HESWBL-09-2016-0065

Ruipérez-Valiente, J. A., Staubitz, T., Jenner, M., Halawa, S., Zhang, J., Despujol, I., Maldonado-Mahauad, J., Montoro, G., Peffer, M., Rohloff, T., Lane, J., Turro, C., Li, X., Pérez-Sanagustín, M., & Reich, J. (2022). Large-scale analytics of global and regional MOOC providers: Differences in learners' demographics, preferences, and perceptions. *Computers & Education, 180*, 104426. https://doi.org/10.1016/j.compedu.2021.104426

Şahin, M., Egloffstein, M., Bothe, M., Rohloff, T., Schenk, N., Schwerer, F., & Ifenthaler, D. (2021). Behavioral patterns in enterprise MOOCs at openSAP. In C. Meinel, T. Staubitz, S. Schweiger, C. Friedl, J. Kiers, M. Ebner, A. Lorenz, G. Ubachs, C. Mongenet, J. A. Ruipérez-Valiente, & M. Cortes Mendez (Eds.), *EMOOCs 2021* (pp. 281–288). Universitätsverlag Potsdam. https://doi.org/10.25932/publishup-51030

Şahin, M., Keskin, S., & Yurdugül H. (2020). Sequential analysis of online learning behaviors according to e-learning readiness. In P. Isaias, D. G. Sampson, & D. Ifenthaler (Eds.), *Online Teaching and Learning in Higher Education* (pp. 117–131). Springer. https://doi.org/10.1007/978-3-030-48190-2_7

Saint, J., Gaševic, D., Matcha, W., Uzir, N. A., & Pardo, A. (2020). Combining analytic methods to unlock sequential and temporal patterns of self-regulated learning. In V. Kovanović, M. Scheffel, N. Pinkwart, & K. Verbert (Eds.), *LAK 2020 Conference Proceedings* (pp. 402–411). https://doi.org/10.1145/3375462.3375487

Schank, R. C., Fano, A., Bell, B., & Jona, M. (1994). The design of goal-based scenarios. *Journal of the Learning Sciences, 3*(4), 305–345.

Schmidt, M., & Huang, R. (2022). Defining Learning Experience Design: Voices from the Field of Learning Design & Technology. *TechTrends, 66*(2), 141–158. https://doi.org/10.1007/s11528-021-00656-y

Schulmeister, R. (2014). The position of xMOOCs in educational systems. *eleed, 10*(1). https://www.eleed.de/archive/10/4074

Schumacher, C., & Ifenthaler, D. (2021). Investigating prompts for supporting students' self-regulation – A remaining challenge for learning analytics approaches? *The Internet and Higher Education, 49*, 100791. https://doi.org/10.1016/j.iheduc.2020.100791

Schwerer, F., & Egloffstein, M. (2016). Participation and achievement in enterprise MOOCs for professional learning. In D. G. Sampson (Ed.), *Proceedings of the 13th International Conference on Cognition and Exploratory Learning in the Digital Age (CELDA 2016)* (pp. 269–276). https://files.eric.ed.gov/fulltext/ED571404.pdf

Seel, N. M., Blumschein, P., Lehmann, T., & Podolskiy, O. (2017). *Instructional Design for Learning – Theoretical Foundations*. Sense. https://doi.org/10.1007/978-94-6300-941-6

Seel, N. M., Ifenthaler, D., & Pirnay-Dummer, P. (2013). Mental models and their role in learning by insight and creative problem solving. In J. M. Spector, B. B. Lockee, S. E. Smaldino, & M. Herring (Eds.), *Learning, Problem Solving, and Mind Tools: Essays in Honor of David H. Jonassen* (pp. 10–34). Routledge. https://doi.org/10.4324/9780203111062

Seifried, J., & Rausch, A. (2022). Applying the Experience Sampling Method to Research on Workplace Learning. In M. Goller, E. Kyndt, S. Paloniemi, & C. Damşa (Eds.), *Methods for Researching Professional Learning and Development* (pp. 19–41). Springer. https://doi.org/10.1007/978-3-031-08518-5_2

Seifried, J., Sembill, D., Nickolaus, R., & Schelten, A. (2005). Analysen systemischer Wechselwirkungen beruflicher Bildungsprozesse: Forschungsstand und Forschungsperspektiven beruflicher Bildung. [Analyses of systemic interactions in vocational education processes: State of research and research perspectives in vocational education]. *Zeitschrift für Berufs- und Wirtschaftspädagogik, 101*(4), 229–245.

Semenova, T. (2022). Not Only the Intention to Complete: The Role of Action-Oriented Intentions in MOOC Completion. *Technology, Knowledge and Learning, 27*(3), 707–719. https://doi.org/10.1007/s10758-021-09534-1

Semenova, T., Vilkova, K., & Shcheglova, I. (2018). The MOOC market: Prospects for Russia. *Educational Studies Moscow, 2018*(2), 173–197. https://doi.org/10.17323/1814-9545-2018-2-173-197

Sergis, S., Sampson, D. G., & Pelliccione, L. (2017). Educational Design for MOOCs: Design Considerations for Technology-Supported Learning at Large Scale. In M. Jemni, Kinshuk, & M. K. Khribi (Eds.), *Open Education: from OER to MOOCs* (pp. 39–71). Springer. https://doi.org/10.1007/978-3-662-52925-6_3

Serth, S., Staubitz, T., van Elten, M., & Meinel, C. (2022). Measuring the effects of course modularizations in online courses for life-long learners. *Frontiers in Education, 7*, 1008545. https://doi.org/10.3389/feduc.2022.1008545

Seufert, S. (2013). *Bildungsmanagement* [Educational Management]. Schäffer-Poeschel.

Seufert, S., Meier, C., Soellner, M., & Rietsche, R. (2019). A Pedagogical Perspective on Big Data and Learning Analytics: A Conceptual Model for Digital Learning Support. *Technology, Knowledge and Learning, 24*, 599–619. https://doi.org/10.1007/s10758-019-09399-5

Shah, D. (2018, December 12). *By the numbers: MOOCS in 2018*. Class Central. https://www.class-central.com/report/mooc-stats-2018/

Shah, D. (2019, January 6). *Year of MOOC-based degrees: A review of MOOC stats and trends in 2018.* Class Central. https://www.class-central.com/report/moocs-stats-and-trends-2018/

Shah, D. (2020, February 4). *Capturing the Hype: Year of the MOOC Timeline Explained*. Class Central. https://www.classcentral.com/report/mooc-hype-year-1/

Shah, D. (2021, December 14). *A Decade of MOOCs: A Review of MOOC Stats and Trends in 2021*. Class Central. https://www.classcentral.com/report/moocs-stats-and-trends-2021

Shah, D. (2023, January 2). *2022 Year in Review: The "New Normal" that Wasn't.* Class Central. https://www.classcentral.com/report/2022-year-in-review/

Shah, V., Murthy, S., & Iyer, S. (2023). Is My MOOC Learner-Centric? A Framework for Formative Evaluation of MOOC Pedagogy. *The International Review of Research in Open and Distributed Learning, 24*(2), 138–161. https://doi.org/10.19173/irrodl.v24i2.6898

Shah, V., Murthy, S., Warriem, J., Sahasrabudhe, S., Banerjee, G., & Iyer, S. (2022). Learner-centric MOOC model: A pedagogical design model towards active learner participation and higher completion rates. *Educational Technology Research and Development 70*, 263–288. https://doi.org/10.1007/s11423-022-10081-4

Shang, J., Xiao, R., & Zhang, Y. (2020). A sequential analysis on the online learning behaviors of Chinese adult learners: Take the KGC learning platform as an example. In S. Cheung, R. Li, K. Phusavat, N. Paoprasert, & L. Kwok (Eds.), *Blended Learning. Education in a Smart Learning Environment. ICBL 2020*. *Lecture Notes in Computer Science, vol 12218* (pp. 61–76). Springer. https://doi.org/10.1007/978-3-030-51968-1_6

Sonderegger, S., & Seufert, S. (2022). Chatbot-mediated Learning: Conceptual Framework for the Design of Chatbot Use Cases in Education. *Proceedings of the 14th International Conference on Computer Supported Education* (pp. 207–215). SciTePress. https://doi.org/10.5220/0010999200003182

Spector, J. M. (2014). Remarks on MOOCS and Mini-MOOCS. *Educational Technology Research and Development, 62*(3), 385–392. https://doi.org/10.1007/s11423-014-9339-4

Spector, J. M. (2017). A critical look at MOOCs. In M. Jemni, Kinshuk, & M. K. Khribi (Eds.), *Open education: from OER to MOOCs* (pp. 135–147). Springer. https://doi.org/10.1007/978-3-662-52925-6_7

Spradley, J. P. (2016). *Participant Observation*. Waveland Press. (Original work published 1980)

Staubitz, T., Petrick, D., Bauer, M., Renz, J., & Meinel, C. (2016). Improving the Peer Assessment Experience on MOOC Platforms. *Proceedings of ACM Learning at Scale Conference 2016 (L@S)* (pp. 389–398). https://doi.org/10.1145/2876034.2876043

Stefaniak, J., & Xu, M. (2020). An Examination of the Systemic Reach of Instructional Design Models: a Systematic Review. *TechTrends, 64*(6), 710–719. https://doi.org/10.1007/s11528-020-00539-8

Stich, A. E., & Reeves, T. D. (2017). Massive open online courses and underserved students in the United States. *The Internet and Higher Education, 32*, 58–71. https://doi.org/10.1016/j.iheduc.2016.09.001

Stokes, D. E. (1997). *Pasteur's quadrant: Basic science and technological innovation.* Brookings Institution Press.

Storme, T., Vansieleghem, N., Devleminck, S., Masschelein, J., & Simons, M. (2016). The emerging pedagogy of MOOCs, the educational design of technology and practices of study. *Journal of Computers in Education, 3*(3), 309–328. https://doi.org/10.1007/s40692-016-0070-5

Stracke, C. M. (2019). The Quality Reference Framework for MOOC Design. In M. Scheffel, J. Broisin, V. Pammer-Schindler, A. Ioannou, & J. Schneider (Eds.), *Transforming Learning with Meaningful Technologies. EC-TEL 2019*. LCNS, Vol. 11722 (pp. 673–677). Springer. https://doi.org/10.1007/978-3-030-29736-7_64

Stracke, C. M., Burgos, D., & Tlili, A. (2023). Instructional Quality and Learning Design of Massive Open Online Courses. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 1391–1412). Springer. https://doi.org/10.1007/978-981-19-2080-6_95

Stracke, C. M., Downes, S., Conole, G., & Burgos, D. (2019). Are MOOCs Open Educational Resources? A literature review on history, definitions, and typologies of OER and MOOCs. *Open Praxis, 11*(4), 331–341. https://doi.org/10.5944/openpraxis.11.4.1010

Stracke, C. M., Tan, E., Texeira, A. M., Pinto, M., Kameas, A., Vassiliadis, B., & Sgouropoulou, C. (2018). Gap between MOOC designers' and MOOC learners' perspectives on interaction and experiences in MOOCs: Findings from the Global MOOC Quality Survey. In M. Chang, N.-S. Chen, R. Huang, Kinshuk, K. Moudgalya, S. Murthy, & D. G. Sampson (Eds.), *Proceedings 18th IEEE International Conference on Advanced Learning Technologies* (pp. 1–5). https://doi.org/10.1109/ICALT.2018.0000

Stracke, C. M., & Trisolini, G. (2021). A Systematic Literature Review on the Quality of MOOCs. *Sustainability, 13*(11), 5817. https://doi.org/10.3390/su13115817

Sun, W., Schumacher, C., Chen, L., & Pinkwart, N. (2021). What Do MOOC Dashboards Present to Learners? In M. Sahin & D. Ifenthaler (Eds.), *Visualizations and Dashboards for Learning Analytics* (pp. 67–78). Springer. https://doi.org/10.1007/978-3-030-81222-5_6

Swan, K., Day, S., & Bogle, L. (2016). Metaphors for learning & MOOC pedagogies. *Proceedings of Third ACM Conference on Learning at Scale* (L@S) (pp. 125–128). https://doi.org/10.1145/2876034.2893385

Swan, K., Day, S., Bogle, L., & van Prooyen, T. (2015). AMP: A tool for characterizing the pedagogical approaches of MOOCs. In C. J. Bonk, M. M. Lee, T. C. Reeves, & T. H. Reynolds (Eds.), *MOOCs and open education around the world* (pp. 105–118). Routledge.

Taib, T. M., Chuah, K. M., & Aziz, N. A. (2017). Understanding pedagogical approaches of Unimas MOOCs in encouraging globalized learning community. *International Journal of Business and Society, 18*, 838–844.

Tamoliune, G., Greenspon, R., Tereseviciene, M., Volungeviciene, A., Trepule, E., & Dauksiene, E. (2023). Exploring the potential of micro-credentials: A systematic literature review. *Frontiers in Education, 7*. https://doi.org/10.3389/feduc.2022.1006811

Tang, H., & Xing, W. (2021). Massive open online courses for professional certificate programs? Perspectives on professional learners' longitudinal participation patterns. *Australasian Journal of Educational Technology, 38*(1), 136–147. https://doi.org/10.14742/ajet.5768

Taylor, A., & Hung, W. (2022). The Effects of Microlearning: A Scoping Review. *Educational Technology Research and Development, 70*(2), 363–395. https://doi.org/10.1007/s11423-022-10084-1

Terzi Müftüoglu, C., Sahin, M., & Yurdugül, H. (2023). Cellwise residual testing in two-way contingency tables: Post-hoc tests for chi-square analysis. *Educational Technology Theory and Practice, 13*(1), 304–328. https://doi.org/10.17943/etku.1075830

Trust, T., & Pektas, E. (2018). Using the ADDIE Model and Universal Design for Learning Principles to Develop an Open Online Course for Teacher Professional Development. *Journal of Digital Learning in Teacher Education, 34*(4), 219–233. https://doi.org/10.1080/21532974.2018.1494521

Tu, C. H., & Sujo-Montes, L. E. (2015). MOOCs. In R. Papa (Ed.), *Media Rich Instruction. Connecting Curriculum to All Learners.* (pp. 287–304). Springer. https://doi.org/10.1007/978-3-319-00152-4_18

Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research Review, 3*(2), 130–154. https://doi.org/10.1016/j.edurev.2007.12.001

Tynjälä, P. (2013). Toward a 3-P Model of Workplace Learning: A Literature Review. *Vocations and Learning, 6*, 11–36. https://doi.org/10.1007/s12186-012-9091-z

Tynjälä, P., Häkkinen, P., & Hämäläinen, R. (2014). TEL@work – towards integration of theory and practice. *British Journal of Educational Technology, 45*(6), 990–1000. https://doi.org/10.1111/bjet.12164

United Nations Educational, Scientific and Cultural Organization. (2022, May). *Higher education global data report (Working Document).* A contribution to the 3rd UNESCO World Higher Education Conference. https://unesdoc.unesco.org/ark:/48223/pf0000389859

Van de Oudeweetering, K., & Agirdag, O. (2018). MOOCs as Accelerators of Social Mobility? A Systematic Review. *Educational Technology & Society, 21*(1), 1–11. https://doi.org/10.30191/ETS.201801_21(1).0001

Van der Klink, M., Drachsler, H., & Sloep, P. (2013). Technology-enhanced learning in the workplace. In D.Derks, & A. Bakker (Eds.), *The Psychology of Digital Media at Work* (pp. 145–165). Psychology Press.

Verstegen, D., Spruijt, A., Fonteijn, H., & van Merriënboer, J. (2023). MOOCs and Problem-Based Learning: A Happy Marriage? In S. Goundar (Ed.), *Massive Open Online Courses - Current Practice and Future Trends*. InTech Open. https://doi.org/10.5772/intechopen.1001472

Wald, A. (1973). *Sequential analysis*. Dover Publications.

Walsh, A. (2007). An exploration of Biggs' constructive alignment in the context of work-based learning. *Assessment & Evaluation in Higher Education, 32*(1), 79-87. https://doi.org/10.1080/02602930600848309

Wang, R., Cao, J., Xu, Y., & Li, Y. (2022). Learning engagement in massive open online courses: A systematic review. *Frontiers in Education, 7*. https://doi.org/10.3389/feduc.2022.1074435

Wang, X., Lee, Y., Lin, L., Mi, Y., & Yang, T. (2021). Analyzing instructional design quality and students' reviews of 18 courses out of the Class Central Top 20 MOOCs through systematic and sentiment analyses. *The Internet and Higher Education, 50,* 100810. https://doi.org/10.1016/j.iheduc.2021.100810

Wang, Y. (2023). Where and what to improve? Design and application of a MOOC evaluation framework based on effective teaching practices. *Distance Education, 44*(3), 458-475. https://doi.org/10.1080/01587919.2023.2226601

Wang, Y., & Baker, R. (2018). Grit and Intention: Why Do Learners Complete MOOCs? *The International Review of Research in Open and Distributed Learning, 19*(3). https://doi.org/10.19173/irrodl.v19i3.3393

Warburton, S., & Mor, Y. (2015). A set of patterns for the structured design of MOOCs. *Open Learning, 30*(3), 206–220. https://doi.org/10.1080/02680513.2015.1100070

Wasson, B., & Kirschner, P. A. (2020). Learning Design: European Approaches. *TechTrends, 64*(9), 815–827. https://doi.org/10.1007/s11528-020-00498-0

Watson, W. R., Watson, S. L., & Janakiraman, S. (2017). Instructional quality of massive open online courses: A review of attitudinal change MOOCs. *International Journal of Learning Technology, 12*(3), 219–240. https://doi.org/10.1504/IJLT.2017.088406

Watted, A., & Barak, M. (2018). Motivating factors of MOOC completers: Comparing between university-affiliated students and general participants. *The Internet and Higher Education, 37*, 11–20. https://doi.org/10.1016/j.iheduc.2017.12.001

Wei, X., & Taecharungroj, V. (2022). How to improve learning experience in MOOCs an analysis of online reviews of business courses on Coursera. *The International Journal of Management Education, 20*(3), 100675. https://doi.org/10.1016/J.IJME.2022.100675

Wei, X., Saab, N., & Admiraal, W. (2021). Assessment of cognitive, behavioral, and affective learning outcomes in massive open online courses: A systematic literature review. *Computers & Education, 163*, 104097. https://doi.org/10.1016/j.compedu.2020.104097

Weller, M. (2018). Twenty Years of EdTech. *Educause Review, 53*(4), 34–48.

Whitaker, J., New, J. R., & Ireland, R. D. (2016). MOOCs and the Online Delivery of Business Education: What's new? What's not? What now? *Academy of Management Learning & Education, 15*(2), 345–365. https://doi.org/10.5465/amle.2013.0021

White B. (2014). Is “MOOC-Mania” over? In: S. K. S. Cheung, J. Fong, J. Zhang, R. Kwan, & L. F. Kwok (Eds.), *Hybrid Learning. Theory and Practice. ICHL 2014.* (pp. 11–15). Springer. https://doi.org/10.1007/978-3-319-08961-4_2

Wiley, D. (2015). The MOOC misstep and the open education infrastructure. In C. J. Bonk, M. M. Lee, T. C. Reeves, & T. H. Reynolds (Eds.), *MOOCs and open education around the world* (pp. 3–11). Routledge.

Wong, J., Baars, M., Davis, D., Van Der Zee, T., Houben, G. J., & Paas, F. (2019). Supporting self-regulated learning in online learning environments and MOOCs: A systematic review. *International Journal of Human–Computer Interaction, 35*(4-5), 356–373. https://doi.org/10.1080/10447318.2018.1543084

Xie, K., Vongkulluksn, V. W., Heddy, B. C., & Jiang, Z. (2023). Experience sampling methodology and technology: An approach for examining situational, longitudinal, and multi-dimensional characteristics of engagement. *Educational Technology Research and Development.* https://doi.org/10.1007/s11423-023-10259-4

Yılmaz, A. B., Ünal, M., & Çakır, H. (2017). Evaluating MOOCs according to instructional design principles. *Journal of Learning and Teaching in Digital Age, 2*(2), 26–35. https://dergipark.org.tr/en/download/article-file/1175608

Yilmaz, R., Yurdugül, H., Yilmaz, F. G. K., Şahïn, M., Sulak, S., Aydin, F., Tepgeç, M., Terzi Müftüoğlu, C., & ORAL, Ö. (2022). Smart MOOC integrated with intelligent tutoring: A system architecture and framework model proposal. *Computers and Education: Artificial Intelligence, 3*, 100092. https://doi.org/10.1016/j.caeai.2022.100092.

Yoila, A. O., & Chukwuemeka, E. J. (2015). Instructional design quality evaluation of Eastern Mediterranean University open courses. *International Journal of Scientific Research in Science, Engineering and Technology, 1(*6), 1–7. https://ijsrset.com/paper/562.pdf

Yoon, M., Lee, J., & Jo, I-H. (2021). Video learning analytics: Investigating behavioral patterns and learner clusters in video-based online learning. *The Internet and Higher Education 50*, 100806. https://doi.org/10.1016/j.iheduc.2021.100806

Yousef, A. M. F., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2014). What Drives a Successful MOOC? An Empirical Examination of Criteria to Assure Design Quality of MOOCs. *Proceedings of the 2014 IEEE 14th International Conference on Advanced Learning Technologie*s (pp. 44–48). https://doi.org/10.1109/ICALT.2014.23.

Yu, H., Miao, C., Leung, C., & White, T. J. (2017). Towards AI-powered personalization in MOOC learning. *npj Science Learning, 2*, 15. https://doi.org/10.1038/s41539-017-0016-3

Yuan, L., & Powell, S. (2015). Partnership Model for Entrepreneurial Innovation in Open Online Learning. *eLearning Papers, 41*, 1–9.

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), 242–259. https://doi.org/10.19173/irrodl.v19i1.3356

Zawacki-Richter, O., Conrad, D., Bozkurt, A., Aydin, C. H., Bedenlier, S., Jung, I., Stöter, J., Veletsianos, G., Blaschke, L. M., Bond, M., Broens, A., Bruhn, E., Dolch, C., Kalz, M., Kerres, M., Kondakci, Y, Marin, V., Mayrberger, K., Müskens, W., … , Xiao, J. (2020). Elements of Open Education: An Invitation to Future Research. *The International Review of Research in Open and Distributed Learning, 21*(3), 319–334. https://doi.org/10.19173/irrodl.v21i3.4659

Zawacki-Richter, O., & Jung, I. (2023). Shaping the Field of Open, Distance, and Digital Education. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 3–12). Springer. https://doi.org/10.1007/978-981-19-2080-6_94

Zhu, M., & Bonk, C. J. (2019). Designing MOOCs to facilitate participant self-monitoring for self-directed learning. *Online Learning Journal, 23*(4), 106–134. https://doi.org/10.24059/olj.v23i4.2037

Zhu, M., & Bonk, C. J. (2022). Guidelines and strategies for fostering and enhancing self-directed online learning. *Open Learning: The Journal of Open, Distance and e-Learning*. https://doi.org/10.1080/02680513.2022.2141105

Zhu, M., Sari, A., & Lee, M. M. (2018). A systematic review of research methods and topics of the empirical MOOC literature (2014–2016). *The Internet and Higher Education, 37*, 31–39. https://doi.org/10.1016/j.iheduc.2018.01.002

Zhu M., Sari A., & Lee M. M. (2020). A comprehensive systematic review of MOOC research: Research techniques, topics, and trends from 2009 to 2019. *Educational Technology Research and Development*, 68, 1685–1710. https://doi.org/10.1007/s11423-020-09798-x

Żur, A., & Friedl, C. (2021). Transforming Workplace Learning: A Qualitative Inquiry into Adopting Massive Open Online Courses into Corporate Learning and Development. *Education Sciences, 11*(6), 295. https://doi.org/10.3390/educsci11060295

Appendix A

MOOCs Included in Study 2

No.	Course title	Course topic	Platform/ provider	Authoring institution
1	Business Ethics for the Real World	General & Strategic Management	Canvas Network	Santa Clara University
2	Ethics for Managers	General & Strategic Management	Canvas Network	Santa Clara University
3	Global Human Capital Trends	Human Resources & Organization	Canvas Network	Columbia University
4	Increase Your Tips: Success in the Service Industry?	General & Strategic Management	Canvas Network	Ocean County College
5	Asset Pricing	Accounting & Finance	Canvas Network	University of Chicago Booth School of Business
6	Biobased Economy Introduction	General & Strategic Management	Canvas Network	Avans University of Applied Sciences
7	Green Marketing	Marketing	Canvas Network	Heliopolis University
8	Business Start-Up: Turn your Entrepreneurship Dreams into Reality	Entrepreneurship	Canvas Network	Southern Alberta Institute of Technology
9	The Art of Negotiation	Management Skills & Leadership	Coursera	University of California, Irvine
10	Operations Management	Operations Management	Coursera	University of Illinois at Urbana-Champaign
11	Intercultural Management	Management Skills & Leadership	Coursera	ESCP Europe
12	Brand and Product Management	Marketing	Coursera	IE Business School
13	Building High-Performing Teams	Human Resources & Organization	Coursera	University of Pennsylvania
14	Leadership and Emotional Intelligence	Management Skills & Leadership	Coursera	Indian School of Business
15	Global Impact: Cultural Psychology	Marketing	Coursera	University of Illinois at Urbana-Champaign
16	International Business Environment	General & Strategic Management	Coursera	University of London International Programmes
17	Intro to International Marketing	Marketing	Coursera	Yonsei University
18	Critical Perspectives on Management	Management Skills & Leadership	Coursera	IE Business School

No.	Course title	Course topic	Platform/ provider	Authoring institution
19	Evidence-Based Global Management	General & Strategic Management	edX	Australian National University
20	Buyer Behaviour and Analysis	Marketing	edX	Curtin University
21	Introduction to Inclusive Talent Acquisition	Human Resources & Organization	edX	Perkins School for the Blind
22	Supply Chain Technology and Systems	Operations Management	edX	Massachusetts Institute of Technology
23	Business Foundations	General & Strategic Management	edX	The University of British Columbia
24	Introduction to Corporate Finance	Accounting & Finance	edX	Columbia University
25	Fundamentals of Manufacturing Processes	Operations Management	edX	Massachusetts Institute of Technology
26	Business Model Implementation	General & Strategic Management	edX	Delft University of Technology
27	Six Sigma: Analyse, Improve, Control	Human Resources & Organization	edX	Technical University of Munich
28	Becoming an Effective Leader	Management Skills & Leadership	edX	University of Queensland
29	Business Fundamentals: Customer Engagement	Marketing	FutureLearn	The Open University
30	Finance Fundamentals: Investment Theory and Practice	Accounting & Finance	FutureLearn	European Union Committee of the Regions
31	The Digital Economy: Finance for Business Growth	Accounting & Finance	FutureLearn	The Open University
32	Leading and Managing People-Centred Change	Management Skills & Leadership	FutureLearn	Durham University
33	Foundation of Innovation and Entrepreneurship in China	Entrepreneurship	FutureLearn	City University of Hong Kong
34	Innovation Management: Winning in the Age of Disruption	General & Strategic Management	FutureLearn	University of Leeds
35	Construction Ethics and Compliance	General & Strategic Management	FutureLearn	Chartered Institute of Building (CIOB)
36	Modern Empowerment in the Workplace	Human Resources & Organization	FutureLearn	The Open University
37	Time Management Strategies for Project Management	Project Management	FutureLearn	Purdue University
38	Innovation: the World's Greatest	Entrepreneurship	FutureLearn	University of Leeds
39	Social Innovation MOOC (EN)	Entrepreneurship	iversity	EBS Business School

No.	Course title	Course topic	Platform/ provider	Authoring institution
40	Corporate Digital Learning	Human Resources & Organization	iversity	KPMG
41	New Business Models - Working Together on Value Creation	Entrepreneurship	iversity	Radboud University Nijmegen
42	eTourism: Communication Perspectives	General & Strategic Management	iversity	Università della Svizzera italiana
43	Decent Work in Global Supply Chains	Operations Management	iversity	Pennsylvania State University
44	Managing Innovation	General & Strategic Management	iversity	LUISS Rome
45	Competitive Strategy	General & Strategic Management	Coursera	LMU Munich
46	Interest Rate Models	Accounting & Finance	Coursera	Ecole Polytechnique Lausanne
47	Introduction to Operations Management	Operations Management	Coursera	University of Pennsylvania
48	Supply Chain Management: A Learning Perspective	Operations Management	Coursera	Korea Advanced Institute of Science
49	Supply Chain Planning	Operations Management	Coursera	Rutgers University
50	Accounting and Finance	Accounting & Finance	edX	Indian Institute of Management Bangalore
51	An Introduction to Credit Risk Management	Accounting & Finance	edX	Delft University of Technology
52	Fundamentals of Microeconomics	Management Skills & Leadership	edX	University Carlos III Madrid
53	Marketing Management	Marketing	edX	Indian Institute of Management Bangalore
54	Supply Chain Design	Operations Management	edX	Massachusetts Institute of Technology
55	Commercialization of Social Enterprises: Stemming the Tide of Mission Drift	General & Strategic Management	FutureLearn	Free University of Bruxelles
56	Fundamentals of Project Planning and Management	Project Management	FutureLearn	University of Virginia
57	Starting a Business 1: Vision and Opportunity	Entrepreneurship	FutureLearn	University of Leeds
58	App Marketing	Marketing	Udacity	Google
59	Classification Models	Marketing	Udacity	Udacity
60	How to Build a Startup	Entrepreneurship	Udacity	Udacity
61	Problem Solving with Advanced Analytics	Marketing	Udacity	Udacity
62	Segmentation and Clustering	Marketing	Udacity	Udacity

No.	Course title	Course topic	Platform/ provider	Authoring institution
63	Digital.Me: Managing your Digital Self	Management Skills & Leadership	Canvas Network	University of Derby
64	Entrepreneurship and Innovation	Entrepreneurship	Canvas Network	University of Greenwich
65	Marketing in a Digital World	Marketing	Coursera	University of Illinois at Urbana-Champaign
66	Managing the Organization: From Organizational Design to Execution	Human Resources & Organization	Coursera	University of Illinois at Urbana-Champaign
67	How to Finance and Grow Your Startup – Without VC	Accounting & Finance	Coursera	University of London, London Business School
68	Corporate Finance I: Measuring and Promoting Value Creation	Accounting & Finance	Coursera	University of Illinois at Urbana-Champaign
69	Business Growth Strategy	General & Strategic Management	Coursera	University of Virginia
70	Preparing to Manage Human Resources	Human Resources & Organization	Coursera	University of Minnesota
71	Budgeting and Scheduling Projects	Project Management	Coursera	University of California, Irvine
72	The Importance of Listening	Marketing	Coursera	Northwestern University
73	Project Management: The Basics for Success	Project Management	Coursera	University of California, Irvine
74	Supply Chain Fundamentals	Operations Management	edX	Massachusetts Institute of Technology
75	Entrepreneurship: DO Your Venture	Entrepreneurship	edX	Indian Institute of Management Bangalore
76	Reputation Management in a Digital World	Management Skills & Leadership	edX	Curtin University
77	Digital Strategy and Action	General & Strategic Management	edX	Babson College
78	Corporate Finance	Accounting & Finance	edX	Indian Institute of Management Bangalore
79	Project Management Techniques for Development Professionals	Project Management	edX	Banco Interamericano de Desarrollo
80	Entrepreneurship 103: Show Me The Money	Entrepreneurship	edX	Massachusetts Institute of Technology
81	Creativity & Entrepreneurship	Entrepreneurship	edX	Berklee College of Music
82	Risk Management for Projects	Project Management	edX	University of Adelaide
83	Finance Fundamentals: Financial Planning and Budgeting	Accounting & Finance	FutureLearn	The Open University
84	The Digital Economy: Selling Through Customer Insight	Marketing	FutureLearn	The Open University

No.	Course title	Course topic	Platform/ provider	Authoring institution
85	Social Enterprise: Turning Ideas into Action	General & Strategic Management	FutureLearn	Middlesex University Business School
86	What Is Leadership?	Management Skills & Leadership	FutureLearn	Deakin University
87	Management and Leadership: Leading a Team	Management Skills & Leadership	FutureLearn	The Open University
88	Business Process Management: An Introduction to Process Thinking	Management Skills & Leadership	FutureLearn	Queensland University of Technology
89	New Business Models	Entrepreneurship	iversity	Radboud University Nijmegen
90	Innovation for Powerful Outcomes	Entrepreneurship	Open2Study	Swinburne University of Technology
91	Entrepreneurship and Family Business	Entrepreneurship	Open2Study	RMIT University
92	Human Resources	Human Resources & Organization	Open2Study	Open2Study (Industry) courses
93	Online Advertising	Marketing	Open2Study	Open2Study (Industry) courses
94	Financial Planning	Accounting & Finance	Open2Study	Sydney TAFE
95	Leadership: Identity, Influence and Power	Management Skills & Leadership	Open2Study	Macquarie Graduate School of Management
96	Sports and Recreation Management	General & Strategic Management	Open2Study	Sydney TAFE
97	Principles of Project Management	Project Management	Open2Study	Polytechnic West
98	Strategic Management	General & Strategic Management	Open2Study	Open2Study (Industry) courses
99	Financial Literacy	Accounting & Finance	Open2Study	Macquarie University
100	New Models of Business	General & Strategic Management	Coursera	University of Virginia
101	Industrie 4.0	General & Strategic Management	iversity	Fraunhofer IAP

Appendix B

MOOCs Included in Study 4

#	Course code[1]	Course title
1	xm1	The Power of Experience Management
2	leo2	SAP Leonardo IoT for the Intelligent Enterprise
3	sbw1	Enabling Entrepreneurs to Shape a Better World
4	build1	Design Your First App with Build
5	ieux1	Intelligent Enterprise User Experience with SAP Fiori 3
6	java1	Object-Oriented Programming in Java
7	mobile3	Build Mobile Applications with SAP Cloud Platform Mobile Services
8	s4h15	Key Functional Topics in a System Conversion to SAP S/4HANA
9	sps2	Introduction to SAP Screen Personas
10	sps3	Using SAP Screen Personas for Advanced Scenarios
11	cwr1-1	Copywriting: Improve User Experience One Word at a Time (Repeat)
12	dafie1	Design-Led Approach for the Intelligent Enterprise
13	pa1-tl	People Analytics and Evidence-Based Management

Note. [1] The courses can be accessed via: https://open.sap.com/courses/<*course_code*>

Appendix C

Interaction Level Transactions in Study 4

	Lecture-oriented courses	**System interaction-oriented courses**	**Discussion-oriented courses**
Announcement	→ Announcement → Discussion visit → Progress → Survey submit → Textual discussion prompt visit → Textual instructional visit	→ Announcement → Assignment submit → Discussion visit → Post subscribe → Progress → Textual discussion prompt visit → Textual hands on visit → Textual instructional visit	→ Announcement → Discussion visit → Final exam submit → Progress → Textual instructional visit
Assignment submit	→ Assignment submit → Progress → Survey submit → Textual discussion prompt visit → Textual download visit → Textual instructional visit → Video download	→ Announcement → Assignment submit → Progress → Textual discussion prompt visit → Textual download visit → Textual instructional visit	→ Assignment submit → Progress → Textual discussion prompt visit → Textual download visit → Textual instructional visit → Video visit
Audio download	→ Audio download → Presentation download → Video visit	→ Audio download → Presentation download → Video download → Video visit	→ Audio download → Presentation download → Video download
Discussion visit	→ Announcement → Discussion visit → Post create → Post visit → Progress → Textual discussion prompt visit → Textual instruction visit	→ Announcement → Discussion visit → Post create → Post reply → Post subscribe → Post visit → Progress → Textual discussion prompt visit → Textual instructional visit	→ Announcement → Discussion visit → Post create → Post visit → Progress

Final exam submit	→	Final exam submit	→	Final exam submit	→	Final exam submit
	→	Progress	→	Progress	→	Progress
	→	Survey submit	→	Survey submit	→	Survey submit
	→	Textual instructional visit	→	Textual discussion prompt visit	→	Textual instructional visit
	→	Textual discussion prompt visit	→	Textual instructional visit	→	Textual discussion prompt visit
Post comment	→	Post comment	→	Post comment	→	Audio download
	→	Post visit	→	Post subscribe	→	Post comment
			→	Post visit	→	Post visit
					→	Presentation download
					→	Video download
Post create	→	Discussion visit	→	Discussion visit	→	Discussion visit
	→	Post create	→	Post create	→	Post comment
	→	Post visit	→	Post subscribe	→	Post create
			→	Post visit		
Post reply	→	Post reply	→	Discussion visit	→	Audio download
	→	Post visit	→	Post reply	→	Post comment
			→	Post subscribe	→	Post create
			→	Post visit	→	Post reply
					→	Post visit
					→	Presentation download
					→	Video download
Post visit	→	Announcement	→	Announcement	→	Announcement
	→	Discussion visit	→	Discussion visit	→	Discussion visit
	→	Post comment	→	Post comment	→	Post comment
	→	Post create	→	Post create	→	Post create
	→	Post reply	→	Post reply	→	Post reply
	→	Post visit	→	Post subscribe	→	Post visit
	→	Progress	→	Post visit		
Presentation download	→	Audio download	→	Announcement	→	Presentation download
	→	Presentation download	→	Audio download	→	Self-test submit
	→	Video download	→	Presentation download		
	→	Video visit	→	Textual discussion prompt visit		
			→	Textual hands on visit		
			→	Video download		
			→	Video visit		

Progress	→	Announcement	→	Announcement	→	Announcement		
	→	Assignment submit	→	Assignment submit	→	Final exam submit		
	→	Discussion visit	→	Discussion visit	→	Post reply		
	→	Final exam submit	→	Final exam submit	→	Post visit		
	→	Progress	→	Progress	→	Progress		
	→	Survey submit	→	Survey submit	→	Survey submit		
	→	Textual discussion prompt visit	→	Textual discussion prompt visit	→	Textual discussion prompt visit		
	→	Textual download visit	→	Textual download visit	→	Textual download visit		
	→	Textual instructional visit	→	Textual instructional visit	→	Textual instructional visit		
	→	Video download						
Self-test submit	→	Self-test submit	→	Self-test submit	→	Self-test submit		
	→	Video visit	→	Video visit	→	Video visit		
Survey submit	→	Announcement	→	Final exam submit	→	Final exam submit		
	→	Assignment submit	→	Progress	→	Progress		
	→	Final exam submit	→	Survey submit	→	Survey submit		
	→	Progress	→	Textual instructional visit	→	Textual discussion prompt visit		
	→	Survey submit	→	Video visit	→	Textual download visit		
	→	Textual discussion prompt visit						
Textual discussion prompt visit	→	Announcement	→	Announcement	→	Discussion visit		
	→	Discussion visit	→	Assignment submit	→	Final exam submit		
	→	Progress	→	Discussion visit	→	Self-test submit		
	→	Textual discussion prompt visit	→	Presentation download	→	Survey submit		
	→	Textual instructional visit	→	Progress	→	Textual discussion prompt visit		
	→	Textual download visit	→	Survey submit	→	Textual download visit		
			→	Textual discussion prompt visit	→	Textual instructional visit		
			→	Textual hands on visit	→	Video visit		
			→	Textual instructional visit				
Textual download visit	→	Assignment submit	→	Assignment submit	→	Assignment submit		
	→	Progress	→	Progress	→	Discussion visit		
	→	Textual download visit	→	Survey submit	→	Progress		
	→	Textual instructional visit	→	Textual discussion prompt visit	→	Survey submit		
	→	Video download	→	Textual download visit	→	Textual discussion prompt visit		

		→ Textual instructional visit	→ Textual download visit → Textual instructional visit
Textual hands on visit	→ N/A	→ Announcement → Discussion visit → Textual discussion prompt visit → Textual hands on visit → Textual instruction visit	→ N/A
Textual instructional visit	→ Announcement → Assignment submit → Final exam submit → Progress → Textual download visit → Textual instructional visit → Video visit	→ Announcement → Assignment submit → Final exam submit → Survey submit → Textual discussion prompt visit → Textual download visit → Textual instructional visit → Video visit	→ Final exam submit → Textual discussion prompt visit → Textual download visit → Textual instructional visit → Video visit
Video download	→ Audio download → Presentation download → Survey submit → Textual download visit → Video download → Video visit	→ Audio download → Post subscribe → Presentation download → Progress → Video download	→ Audio download → Presentation download → Video download
Video play	→ Video play	→ Video play	→ Video play
Video visit	→ Audio download → Presentation download → Video download → Video play → Video visit	→ Audio download → Presentation download → Video download → Video play → Video visit	→ Self-test submit → Textual discussion prompt visit → Textual instructional visit → Video download → Video visit