

Digital Elements for SAP ERP Education and Training

Results from a Systematic Literature Review

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Abstract—SAP ERP knowledge is becoming more and more important and the demand for corresponding education and training is constantly increasing. Nowadays, curricula around SAP ERP typically include face-to-face instruction by a lecturer as well as hands-on practice phases with the SAP system to apply and reinforce theoretical knowledge. In the era of COVID-19, this has created challenges, since courses needed to be redesigned to be fully digital within a very short amount of time. The purpose of this paper is to identify existing digital elements around SAP ERP education and training that could help lecturers to design engaging hybrid or fully digital learning offerings. To achieve this goal, a systematic literature review was conducted, and the results show that the identified offerings are either infrastructural offerings or simulations. Furthermore, SAP S/4HANA is hardly addressed in prior research, even though it is supposed to become the industry standard by 2027. Consequently, future research should focus on developing digital elements for education and training around SAP S/4HANA. Existing simulations might be adapted, but research should also try to explore further digital elements beyond simulations.

Keywords—E-learning, technology-mediated learning, SAP e-learning, SAP curriculum, SAP online training, SAP education, innovations in SAP education, innovations in SAP e-learning

1 Introduction

The global enterprise resource planning (ERP) software market is expected to grow from \$35.81 billion in 2018 by an average of 10.2% per year, reaching \$78.40 billion in 2026 [1]. SAP ERP is one of the most used ERP systems worldwide and the most used one in Europe [2]. Consequently, the dissemination of SAP ERP will most likely increase within the next years, and related knowledge as well as education and training will likely become increasingly important. Suitable offerings can be found for every target group: for students, the SAP University Alliance, together with many universities, offers various courses such as SAP ERP Integration of Business Processes (TERP10) [3] and Integrated Business Processes in SAP S/4HANA (TS410) [4]. For newcomers to the job market and for those who would like to continue their education in general, there are many companies that offer continuing education, both in

the form of traditional courses as well as in the form of e-learning. In addition, many companies offer their own continuing education programs for their employees, and more and more school curricula include the teaching of ERP-related skills to students. Accordingly, it can be stated that SAP ERP knowledge is important for many different target groups [5]. At the same time, SAP has announced its goal of migrating all customers to S/4HANA by 2025 or by 2027 at the latest [6], which means that the need for SAP education and training can be expected to continue to increase both in the short term and in the medium term.

For many education and training offerings and in particular the offerings for students, e.g., the most widespread course offerings SAP TERP10 and the follow-up course TS410, a curriculum exists that is typically created by SAP University Competence Centers (UCC) and made available to partner universities. As of today, these curricula typically include the face-to-face instruction of about 25 students by a lecturer as well as hands-on practice phases with the SAP system to apply and reinforce theoretical knowledge. These learning scenarios come with several different challenges. First, the lecturer can hardly address the individual needs of all learners due to the 1:25 ratio. Second, the practical parts of the trainings are becoming leaner to create time for additional theoretical content, which hinders the consolidation of the learned content. In the era of COVID-19, the rather traditional learning setting created further challenges [7]. Teaching activities had to be converted to fully digital teaching at short notice, and many teachers were unsure how this could be done while maintaining the students' learning success. After some delay, some tips were formulated [see, e.g., 8], but it was announced that no separate digital curriculum would be developed, and reference was also made to general literature on digital teaching and learning. However, the need for rapid digitalization due to COVID could also turn out to have a positive effect, since integrating digital elements more systematically into SAP education and training might help to solve existing challenges. This circumstance was the trigger for starting research on current findings around the digitalization of SAP education and training.

Consequently, this paper seeks to answer the following research question: *Which digital elements are used in SAP education and training in hybrid or fully digital learning scenarios?*

To answer this research question, a systematic literature review was conducted following the methodology of vom Brocke et al. [9].

The remainder of the paper is structured as follows. First, some conceptual foundations of SAP education and training as well as e-learning are presented. This is followed by a description of the methodology. Afterwards, the results of the systematic literature review are presented. The paper concludes with a discussion of the results as well as future research needs.

2 Conceptual Background

Knowledge around SAP ERP is becoming increasingly important for future employees. To be able to impart as much basic knowledge as possible about SAP ERP at

an early stage, SAP has launched the SAP University Alliance with the aim of supporting universities in the integration of SAP content into teaching. As part of the SAP University Alliance, the UCCs host SAP software for universities for teaching purposes, provide curricula, and generally offer help with questions related to SAP teaching. According to the current curricula, SAP courses take place as physical face-to-face courses in classrooms, and there are no officially provided curricula for hybrid or purely digital delivery of the corresponding content. However, several academics are researching topics related to SAP teaching and may have already conducted initial research on digital elements in SAP teaching or even developed full digital curricula for selected SAP courses.

E-learning and web-based training have become even more important in times of COVID-19. According to a survey, every third company has provided its employees with further training [10, 11], which is of course only possible with the help of e-learning.

An umbrella term for digital learning offerings, often used synonymously with e-learning in scientific literature [12], is technology-mediated learning. In the remainder of the paper, the term e-learning will be used, and it follows the definition by Alavi and Leidner [13]. Accordingly, e-learning describes “environments in which the learner’s interactions with learning materials (readings, assignments, exercises, etc.), peers, and/or instructors are mediated through advanced information technologies” [13, p. 2]. In practice, oftentimes different combinations of different learning modes and methods are blended in e-learning scenarios. These combinations can be [14]:

- Web- or computer-based approaches
- Asynchronous or synchronous
- Led by an instructor or self-paced, and
- Individual or team-based learning modes.

Accordingly, the systematic review conducted in this paper follows a comparably broad approach and seeks to include all e-learning offerings that are in line with this definition. Examples of popular e-learning formats are: computer-based training, web-based training, game-based learning, serious games, micro content, mobile content, simulations and business games, augmented reality, mixed reality, virtual reality, and learning videos.

3 Methodology

The literature review is essential for every field of research because it consolidates prior research and highlights gaps in the current body of knowledge that should be filled. It can conceptually develop and outline interesting future areas for research in a certain domain [15]. Thus, they often form the basis for novel research projects [16].

The methodology used in this paper is based on vom Brocke et al [9] who point out the challenges of literature reviews in an increasingly dynamic research environment and explain how to proceed accordingly. A systematic literature review is typically divided into three phases: 1) searching, 2) analyzing and synthesizing, and 3) writing.

In this section, the focus of the description is on the first step of this process. In defining the search scope, four characteristics of the review need to be defined: process, sources, coverage, and techniques. Table 1 illustrates the strategy chosen in this paper.

Table 1. Definition of the search scope of the paper [based on 9, 17].

1	Process	Sequential		Iterative
2	Source	Citation indexing services	Bibliographic databases	Publications
3	Coverage	Comprehensive	Representative	Seminal works
4	Techniques	Keyword search	Backward search	Forward search

The systematic literature review in this paper follows a sequential process. This means that the procedure is described in this section and is carried out as the first activity at the beginning of the systematic literature search. This approach is suitable because it is not expected that the search procedure needs to be continuously adjusted in the search process in order to achieve robust results. Rather, the relevant search terms and the procedure for this paper can be well defined in advance. The following word combinations were used for the systematic literature analysis: "SAP R/3 education", "SAP ERP education", "SAP S/4HANA education", "SAP curriculum online", "SAP online teaching", "SAP online training", "SAP web-based training", "SAP e-learning", "erp simulation game", "sap erp game", "sap erp serious game", "sap erp gamification". Moreover, these combinations were also used in plural and connected with hyphens.

As sources, the paper focuses on so-called citation indexing services like Google Scholar. This approach was chosen because some publications related to SAP teaching were only published as white papers or working papers and therefore cannot be identified by a bibliographic database search. Nevertheless, this approach is more systematic than one based on individual publications.

Regarding the coverage, a representative approach is chosen, as it is hardly possible to achieve a comprehensive coverage due to the above-mentioned abundance of publications. At the same time, the results should not only be based on a selection of individual seminal works but should have a representative character.

For the techniques, all available possibilities are exhausted to be able to identify as many relevant works as possible. First, a keyword search is conducted, and the hits classified as relevant are then used for the backward and forward search. In the keyword search, a total of 178 papers were identified, and after a more detailed analysis 128 were classified as relevant for the analysis. Nonrelevant papers are, for example, papers in which the searched groups of words were merely mentioned, but the papers dealt with a different topic in essence. In addition, contributions were removed that could not be analyzed due to language barriers (e.g., Korean contributions). The backward and forward search identified 16 additional articles that were included in the review.

4 Results

4.1 Thematic foci in the literature

In a first step, the thematic foci of the analyzed articles are presented. First, it can be stated that the majority of the articles that were reviewed deal with the current system version SAP ERP. This result was to be expected since SAP ERP has been the productive SAP version for many years. More unexpected, however, is the fact that only 6% of the articles deal with SAP S/4HANA [e.g., 4, 8, 18]. This very low number is surprising, as SAP is striving to convert all customers to S/4HANA in a timely manner. Originally, this was planned for 2025 at the latest, but the deadline was recently extended to 2027 [6]. It is also the case that the SAP UCCs are aligning their training offerings with the new S/4HANA system. For example, by the end of 2021, the current SAP TERP10 courses are being replaced across the board by the new TS410 courses, which focus on the new S/4HANA system. Against this background, studies that focus on S/4HANA would be particularly relevant and thus represent an important future research direction. The need for further research around S/4HANA is also reinforced by the fact that the articles that address S/4HANA only provide information about the new version, discuss differences between the new version and SAP ERP, or emphasize module-specific features [e.g., 19–21]. Only one short study around S/4HANA deals with SAP teaching especially in times of COVID-19, and it also contains a few e-learning tips [22].

Furthermore, it can be stated that only 19,4% of the identified articles deal with the topic of e-learning [e.g., 23–25]. These include studies that deal with web-based or hybrid training, gamification [26–28], or serious gaming [29, 30]. However, one article on the latter topic addresses an interesting approach that can enrich SAP teaching [25]. This approach will be explained in greater detail later in this section.

The third thematic focus of the articles analyzed is on SAP teaching at universities. 22% of the articles discuss various curricula, e.g., for specific countries, selected SAP modules, or curricular innovations in general, or report on case studies [e.g., 31–33]. The articles in this focus area also show that the studies typically address the teaching at business schools, and topics such as business process management or integration are in the foreground, as expected. However, there are also articles that deal with business simulation, for example. A popular example in this area is ERPsim by the HEC Montreal from Canada, which has developed different business games to convey SAP content in a more interactive way [34]. Like the gamification approach mentioned above, ERPsim represents an exciting opportunity to enrich traditional SAP teaching and will be discussed separately later in this section.

4.2 Digital elements in SAP education and training

A first e-learning offering that could be identified during the review is the e-learning format G-learning [35], which has been developed in 2013 and is provided by SAP AG itself. This new learning format was developed to increase learner suc-

cess (70% success rate) and to motivate employees around the world to learn something new. G-learning works as follows: all participants are divided into groups, preferences can be considered, mostly regional teams but also cross-regional teams can be formed. Each team is assigned supervisors or experts with whom the weekly tasks can be discussed, who give feedback and answer questions or are available for discussions. For the duration of the course, communication and collaboration tools are enabled to facilitate communication between team members, mostly through a chat function.



Fig. 1. Screenshot of the user interface of G-learning [35].

Gamification elements play a major role in G-learning and, from the participants' point of view, this course is designed like a big trip around the world (see Fig 1) in which each participant can decide for him- or herself where the journey should take her or him. In order to increase motivation, there are multiple other gamification elements as well as different feedback options.

A second offering provided by SAP AG is called SAP Roadwarrior [36]. Roadwarrior is a simulation game that is supposed to keep the external sales team of SAP up to date. It was shown to increase learner motivation as well as the sales success of external sales members.

In SAP Roadwarrior (see Fig. 2 for a screenshot of the interface), the players can simulate meetings with potential customers to train their sales skills. First, they receive information about the fictional company they will meet. Afterwards, they answer different multiple-choice questions in preparation for the upcoming sales meeting. During this stage, the players can earn points as well as badges. Furthermore, the game automatically prepares a cheat sheet that can be used during the sales meeting. Additionally, each player has three jokers that can be used during the sales meeting. In the meeting, a so-called lifeline illustrates how well the players are performing.

The players need to convince representatives of the fictional company holding different positions until they finally reach the decision maker that needs to be convinced.



Fig. 2. User Interface of SAP Roadwarrior [37].

In addition to SAP AG itself, further groups of scientists have been identified who have developed eLearning offerings around SAP. Among them are the researchers from HEC Montreal's ERPsim lab. This group developed different simulations (for manufacturing, logistics, retail, and distribution) using the label ERPsim, which is used by more than 170 universities as well as global companies [34]. The goal is to provide a more engaging and practice-oriented learning experience that illustrates the theoretical concepts and shows how ERP systems can support business processes. Using different groups of students playing together, they also aim to emphasize the advantages of integrating different parts of a company through ERP systems.

During the simulation, players are supposed to get deeper insights into consumer goods markets to understand the different success factors existent in these markets. Each team consists of four players who are responsible for their own company – a company that produces and sells different types of water bottles. The team can create and access predefined reports from the SAP system that serve as the basis for their business decisions. The goal is to ensure the profitability of the company. Each round consists of 20 business days (30 minutes in total), and the stock at the end of one round is transferred to the next round. The number of rounds to be played can be defined individually at the start of the simulation. Only the products that are in stock can be sold in the respective round. Typically, multiple student teams compete against each other, as well as against importers (computer teams). The team with the highest profit wins the simulation. Fig. 3 illustrates the prototypical procedure of a round of ERPsim.

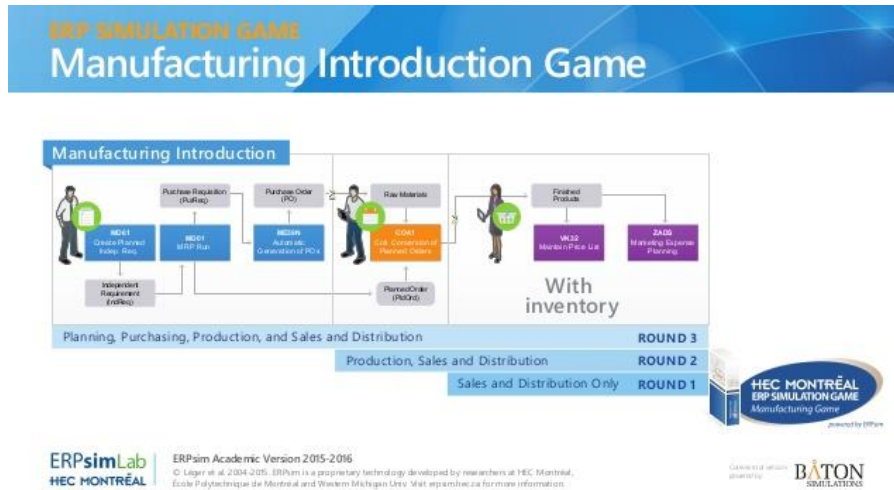


Fig. 3. Introduction to the ERPsim manufacturing simulation [38].

Another e-learning offering was developed from a group of authors from TU Dresden [25]. The authors developed what they call an ERP gamification prototype, which also follows the logic of a simulation. In an evaluation of their prototype, the authors show that their prototype improved factors such as enjoyment and flow experience among the participants. They further state the propositions that gamification can increase the quality of the job later and might even improve organizational outcomes, such as job performance or organizational commitment.

The ERP gamification prototype focuses on a manufacturing scenario and covers the SAP modules material management (MM), sales and distribution (SD), and production planning and control (PP). Furthermore, in the prototype, only a small subset of transactions as well as the most important parameters are realized (e.g., create sales order, VA01, or display purchase order, ME23N). Each user controls his or her own company with two production plants that produce products for two customers using the materials of two suppliers. The user has a budget of 10,000 USD and needs to complete six missions around purchasing, sales, and production that increase in difficulty and need to be completed within a timeframe of 13.5 minutes.

The authors combine different game mechanics within their prototype: a virtual reality (illustrated in Fig. 4), the missions as challenges that need to be completed, different ranks that serve as levels, and rewards for completing missions successfully in the form of stars and in the form of money. The reward structure (stars and money) created an atmosphere in which the students repeated the game multiple times to first compete in receiving all possible stars and then in earning the most money during one round.



Fig. 4. Screenshot of the user interface of the ERP gamification prototype by [25].

Another business simulation offering was developed by a group of authors from HES Amsterdam [23]. This simulation focuses on business processes and process integration. The student evaluation shows that the simulation helps students to understand the complexity of process integration and helps them to balance their expectations regarding how fast they can become SAP experts.

During the simulation, the customers of each company are simulated by the lecturers. The customers then regularly ask for quotations for different kinds of products, and the student responsible for the sales department must first come up with a good quotation. Once the quotation is converted into a sales order, the students overseeing the logistics control department calculate the material necessary to carry out the sales order. Once this is completed, the workflows for purchasing, and production are started. The students responsible for the finance administration need to make sure that the invoices are paid, and their colleagues in the warehouse department need to handle the reception and distribution of the goods. The authors state that they typically give about 10 sales orders to each company (student team) per semester, since this number proved to be a good balance between establishing routines and irritating the students.

Besides assigning students to existing companies with established processes, a variation of the simulation can also begin with having a group of students set up the necessary processes in the SAP system. In this scenario, the students receive the product they are supposed to sell, an approximate sales volume, the structure of the company as well as the number of employees. Afterwards, groups of students collaborate to establish the core processes around human resources and sales. Following this logic,

students can learn the basics of setting up their own company in SAP within a three-day workshop.

Another recent study by Damberg [8] addresses the challenge of developing and providing an online course around SAP in times of COVID-19. The author relies on a model by Salmon [39] that includes five stages that should be considered when developing an active learning format: 1) access and motivation, 2) online socialization, 3) information exchange, 4) knowledge construction, and 5) development.

The concept has been piloted at Hamburg University of Technology in cooperation with the SAP UCC in Magdeburg. Students were divided into groups to complete case studies that were supposed to be presented in the course as well as form the basis for a seminar paper. Fig. 5 illustrates the elements of the course. The evaluation of the pilot study showed that the students were happy with how the course was designed, resulting in a very good overall evaluation.



Fig. 5. The four elements of the online module [8].

A last group of researchers that could be identified in this systematic literature review conducts research at Victoria University in Australia and has already achieved several successes [40]. As ERP systems become more prevalent in the Southeast Asian region, the need for training will increase accordingly. Based on this observation, researchers at Victoria University have developed an e-learning model and curriculum specifically for the Southeast Asian region. The core of the offering consists of three interrelated components:

Virtual Classroom: This component uses virtual classroom technology to provide access to a virtual curriculum.

iTutor: This tool can be used to develop interactive tutorials in a simulated SAP environment, which can then be made available to learners.

Central Point: This tool can store different learning materials to support learners in their ERP education.

The three technologies are not unique on their own, but in combination they form a versatile e-learning offering. They can also be adapted to the individual needs of each student [40]. Victoria University researchers also plan to develop additional e-learning offerings. A visit to review the current eLearning offerings may therefore be worthwhile for interested researchers and lecturers.

Despite the increasing demand for e-learning offerings related to SAP and despite the initial offerings identified in this area, it can be noted that comparatively few e-learning offerings exist for SAP. Hawking and McCarthy [40] give a possible reason for this observation. They describe SAP as a very complex system, which makes it difficult for lecturers to reach the necessary level to be able to further develop the

given curriculum or to integrate eLearning elements into SAP teaching in a targeted manner. The transition to S/4HANA offers the opportunity to counteract this observation if SAP succeeds in reducing complexity and thus encouraging more lecturers to pilot innovations in SAP teaching.

5 Discussion

The aim of this systematic literature review was to answer the following research question: Which digital elements are used in SAP education and training in hybrid or fully digital learning scenarios? The initial impetus for this paper was the COVID-19 pandemic and the associated immediate shift to digital-only teaching. However, the paper also provides researchers and lecturers with information for the post-corona period on various digital elements that can enrich different teaching formats (from face-to-face training and hybrid formats to fully digital offerings).

A key finding of the paper is that only few studies could be found that focus on the use of digital elements in SAP teaching. While some digital elements could be identified, they are either infrastructural offerings (e.g., iTutor, which offer opportunities to create digital content yourself) or simulations (e.g., ERPsim, G-learning, SAP Road-warrior) of which some are associated with additional licensing costs for use (e.g., ERPsim and probably also G-learning, although no information could be found on the latter). Consequently, digital elements besides simulations are scarce.

Another key finding is that only few identified studies address teaching in the S/4HANA era. Particularly because S/4HANA is expected to become the dominant SAP installation by 2027, this is to be considered critical, as students or learners in general will primarily be confronted with this version (or any successor versions) in their later working lives and not with SAP ERP. Therefore, regardless of the topic of digital teaching, future research should place a stronger focus on teaching with SAP S/4HANA in general, and digital teaching with S/4HANA in particular.

Regarding the challenges related to SAP education and teaching, especially at universities, outlined in the introduction, the identified digital tools can only partially help to overcome these challenges. The infrastructural offerings, e.g., allowing learners to follow a more self-paced learning process, invite to engage in practice-oriented learning activities outside the classroom. However, hardly any individual support is provided. Simulations, on the other hand, also focus on engaging learners in more practice-oriented learning activities, and, depending on the design of the simulation, also foster peer learning and interaction among the learners. Again, individual support based on the individual needs of every single learner is usually not provided during these simulations.

6 Conclusion

This paper provides an overview of different digital elements that are available to enrich traditional education and training in the context of SAP. However, this study is not without limitations. As all literature reviews, the results presented are limited by

the selected methodological approach. Consequently, future research could expand the search space beyond the approach taken in this paper to further validate or enrich the findings. Beyond addressing limitations of this paper, further interesting areas for future research emerged during the review. The simulations resemble serious games [41] that resonate well with a current trend in game-based learning. However, other components related to this trend could also be investigated. Gamification, for example, relates to using game elements in non-game contexts [42] and could be used to enrich traditional education and training scenarios [43, 44].

A last area of future research emerges from the observation that few studies focus on SAP S/4HANA. Consequently, future research should focus on developing digital elements suitable for education and training in SAP S/4HANA. Existing simulations or simulation games might be suitable for adaptation, but digital elements beyond simulations or simulation games should also be explored to support lecturers in designing engaging hybrid or fully digital e-learning offerings. This would also support the idea of providing education as a service [45] comparable to other cloud computing services.

7 References

- [1] Allied Market Research, “ERP Software Market: Global Opportunity Analysis and Industry Forecast 2018-2026,” 2019. Accessed: April 15th 2021. [Online]. Available: <https://www.alliedmarketresearch.com/erp-market>
- [2] Statista, ERP-Software - Marktanteile der Anbieter weltweit 2017 | Statista. [Online]. Available: <https://de.statista.com/statistik/daten/studie/262342/umfrage/marktanteile-der-anbieter-von-erp-software-weltweit/> (accessed: Jan. 31 2021).
- [3] R. MacKinnon, K. L. Elder, and H.-J. Kung, “SAP Certifications,” in Proceedings of 2010 SOBIE Annual Meetings, V. Bhargava, Ed., 2010, pp. 98–103.
- [4] A. N. Ambraji, N. M. Golovin, A. V. Valyukhova, N. A. Rybakova, and V. Y. Zorin, “Use of hybrid learning model for SAP-related technology education,” Proceedings of the ICID-2019 Conference, pp. 1–9, 2019.
- [5] K. A. Alshare and P. L. Lane, “Predicting Student-Perceived Learning Outcomes and Satisfaction in ERP Courses: An Empirical Investigation,” CAIS, vol. 28, 2011, <https://doi.org/10.17705/1cais.02834>.
- [6] SAP, “SAP gibt erweiterte Innovationszusage für SAP S/4HANA und bietet Klarheit und Wahlmöglichkeiten für SAP Business Suite 7,” SAP News Germany, 04 Feb., 2020. <https://news.sap.com/germany/2020/02/wartung-s4hana-sap-business-suite-7/> (accessed: Jan. 31 2021). https://doi.org/10.1007/978-1-4842-1383-4_2
- [7] S. Jacques, A. Ouahabi, and T. Lequeu, “Remote Knowledge Acquisition and Assessment During the COVID-19 Pandemic,” Int. J. Eng. Ped., vol. 10, no. 6, p. 120, 2020, <https://doi.org/10.3991/ijep.v10i6.16205>.
- [8] S. Damberg, “Über den Einsatz von SAP S/4HANA in der digitalen, internationalen Lehre,” in Proceedings of the SAP Academic Community Conference D-A-CH 2020, K. Gräslund, D. Kilian, H. Krömer, K. Turowski, and H. Wittges, Eds.: Technical University of Munich, 2020, 2-8.
- [9] J. vom Brocke, A. Simons, K. Riemer, B. Niehaves, R. Plattfaut, and A. Cleven, “Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in Information Systems Research,” CAIS, vol. 37, 2015, <https://doi.org/10.17705/1cais.03709>.

- [10] Baden-Württemberg.de, Aus- und Weiterbildung in Zeiten von Corona und der Digitalisierung. [Online]. Available: <https://www.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/aus-und-weiterbildung-in-zeiten-von-corona-und-der-digitalisierung/> (accessed: Feb. 6 2021). https://doi.org/10.1007/978-3-662-56551-3_3
- [11] S. Dümig, Bildungspolitik aktuell: Weiterbildung in Corona-Zeiten heißt Zukunftssicherung. [Online]. Available: <https://www.ihk-berlin.de/blueprint/servlet/resource/blob/4768106/b7f62e86416fb712c4946cf481820e25/weiterbildung-in-corona-zeiten-ist-zukunftssicherung-data.pdf> (accessed: Feb. 6 2021).
- [12] S. Gupta and R. Bostrom, “Research Note —An Investigation of the Appropriation of Technology-Mediated Training Methods Incorporating Enactive and Collaborative Learning,” *Information Systems Research*, vol. 24, no. 2, pp. 454–469, 2013, <https://doi.org/10.1287/isre.1120.0433>
- [13] M. Alavi and D. E. Leidner, “Research Commentary: Technology-Mediated Learning—A Call for Greater Depth and Breadth of Research,” *Information Systems Research*, vol. 12, no. 1, pp. 1–10, 2001, <https://doi.org/10.1287/isre.12.1.1.9720>.
- [14] S. Gupta and R. Bostrom, “Technology-Mediated Learning: A Comprehensive Theoretical Model,” *J AIS*, vol. 10, no. 9, pp. 686–714, 2009, <https://doi.org/10.17705/1jais.00207>.
- [15] J. Webster and R. T. Watson, “Analyzing the Past to Prepare for the Future: Writing a Literature Review,” *MIS Quarterly*, vol. 26, no. 2, pp. xiii–xxiii, 2002.
- [16] N. D. Faizan, A. Löffler, R. Heining, M. Utesch, and H. Krcmar, “Classification of Evaluation Methods for the Effective Assessment of Simulation Games: Results from a Literature Review,” *Int. J. Eng. Ped.*, vol. 9, no. 1, p. 19, 2019, <https://doi.org/10.3991/ijep.v9i1.9948>.
- [17] H. M. Cooper, “Organizing knowledge syntheses: A taxonomy of literature reviews,” *Knowledge in Society*, vol. 1, no. 1, pp. 104–126, 1988, <https://doi.org/10.1007/bf03177550>.
- [18] A. Brückner, D. Kretz, T. Neumann, T. Teich, and C. Zölsmann, “Computergestützter Demonstrator als digitale Lernmethode für SAP S/4HANA,” in *Proceedings of the SAP Academic Community Conference D-A-CH 2020*, K. Gräslund, D. Kilian, H. Krcmar, K. Turowski, and H. Wittges, Eds.: Technical University of Munich, 2020.
- [19] S. Kulkarni, “Fiori in S/4HANA,” in *Implementing SAP S/4HANA: A Framework for Planning and Executing SAP S/4HANA Projects*, S. Kulkarni, Ed., 1st ed., Berkeley, CA: Apress, 2019, pp. 137–150. https://doi.org/10.1007/978-1-4842-4520-0_9
- [20] M. Tadic, “SAP ERP – SAP S/4HANA Unterschiede in den Bereichen Reports, Queries und Workflows,” *Haute Ecole de Gestion & Tourisme*, 2018. Accessed: Feb. 6 2021. [Online]. Available: <https://doc.rero.ch/record/324554>
- [21] B. Warnecke, “Vom Customizing zurück zum SAP-Standard – Möglichkeiten und Grenzen bei der Migration auf SAP S/4HANA,” *HMD*, vol. 55, no. 1, pp. 151–162, 2018, <https://doi.org/10.1365/s40702-017-0358-6>.
- [22] C. Fleig, D. Augenstein, and A. Mädche, “Process Mining for Business Process Standardization in ERP Implementation Projects – An SAP S/4 HANA Case Study from Manufacturing,” 2018.
- [23] C. Draijer and D.-J. Schenk, “Best Practices of Business Simulation with SAP R/3,” *Journal of Information Systems Education (JISE)*, vol. 15, no. 3, pp. 261–266, 2004.
- [24] S. Foster and J. Hopkins, “ERP Simulation Game: Establishing Engagement, Collaboration and Learning,” *PACIS 2011 Proceedings*, Paper 62, 2011.
- [25] P. Herzig, S. Strahinger, and M. Amerling, “Gamification of ERP Systems – Exploring Gamification Effects on User Acceptance Constructs,” 2012, doi: <http://doi.org/10.24355/dbbs.084-201301111159-0>.

- [26] J. Kumar, M. Herger, S. Deterding, S. Schnaars, M. Landes, and E. Webb, “Gamification @ work,” in CHI '13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA '13, Paris, France, 2013, p. 2427. <https://doi.org/10.1145/2468356.2468793>
- [27] D. Basten, “Gamification,” *IEEE Softw.*, vol. 34, no. 5, pp. 76–81, 2017, doi: 10.1109/MS.2017.3571581.
- [28] I. Furdu, C. Tomozei, and U. Kose, “Pros and cons gamification and gaming in classroom,” *Broad Research in Artificial Intelligence and Neuroscience*. [Online]. Available: <http://arxiv.org/pdf/1708.09337v1>
- [29] M. Utesch, R. Heining, and H. Krcmar, “Strengthening study skills by using ERPsim as a new tool within the Pupils' academy of serious gaming,” in *Proceedings of 2016 IEEE Global Engineering Education Conference (EDUCON): Date and venue: 10-13 April 2016, Abu Dhabi, UAE, Abu Dhabi, 2016*, pp. 592–601. <https://doi.org/10.1109/educon.2016.7474611>
- [30] M. Utesch, R. Heining, and H. Krcmar, “The pupils' academy of serious gaming: Strengthening study skills with ERPsim,” in *2016 13th International Conference on Remote Engineering and Virtual Instrumentation (REV), Madrid, 2016*, pp. 93–102. <https://doi.org/10.1109/rev.2016.7444446>
- [31] I. Becerra-Fernandez, K. E. Murphy, and S. J. Simon, “Enterprise resource planning: integrating ERP in the business school curriculum,” *Commun. ACM*, vol. 43, no. 4, pp. 39–41, 2000. <https://doi.org/10.1145/332051.332066>.
- [32] T. Johnson, A. C. Lorents, J. Morgan, and J. Ozmun, “A Customized ERP/SAP Model for Business Curriculum Integration,” *Journal of Information Systems Education (JISE)*, vol. 15, no. 3, pp. 245–254, 2004.
- [33] D. K. McCann and D. Grey, “SAP/ERP Technology in a Higher Education Curriculum and the University Alliance Program,” *IIS, X*, no. 1, pp. 176–182, 2009, https://doi.org/10.48009/1_iis_2009_176-182.
- [34] P.-M. Leger, J. Robert, G. Babin, D. Lyle, P. Cronan, and Charland. Paul, “ERP Simulation Game: A Distribution Game to Teach the Value of Integrated Systems,” *Development in Business Simulation and Experiential Learning*, vol. 37, pp. 329–334, 2010.
- [35] B. Heilbrunn and I. Sammet, “G-Learning – Gamification im Kontext von betrieblichem eLearning,” *HMD*, vol. 52, no. 6, pp. 866–877, 2015, <https://doi.org/10.1365/s40702-015-0178-5>.
- [36] A. Uskov and B. Sekar, “Serious games, gamification and game engines to support framework activities in engineering: Case studies, analysis, classifications and outcomes,” in *IEEE International Conference on Electro/Information Technology, Milwaukee, WI, USA, 2014*, pp. 618–623. <https://doi.org/10.1109/eit.2014.6871836>
- [37] S. Kim, “Recent Advances in Gamification Application,” *Advances in Information Sciences and Service Sciences (AISS)*, vol. 5, no. 13, pp. 93–99, 2013. [Online]. Available: https://www.researchgate.net/profile/sangkyun_kim3/publication/310465687_recent_advances_in_gamification_application/links/582efc6808aef19cb8155622/recent-advances-in-gamification-application.pdf
- [38] P.-M. Leger and J.-F. Michon, “ERPsim Academic Version 2015-2016 : What's New?” *SAP Academic Conference 2015*, 2015.
- [39] G. Salmon, *E-tivities*: Routledge, 2013.
- [40] Paul Hawking and Brendan McCarthy, “Delivering Enterprise Resource Planning (SAP R/3) Curriculum Using eLearning Resources,” *PACIS 2001 Proceedings*. Paper 18, 2001.
- [41] M. C. Utesch, “The Pupils' Academy of Serious Gaming: Strengthening Study Skills,” *Int. J. Eng. Ped.*, vol. 5, no. 3, p. 25, 2015, <https://doi.org/10.3991/ijep.v5i3.4660> .

- [42] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, “From game design elements to gamefulness,” in Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11, Tampere, Finland, 2011, p. 9. <https://doi.org/10.1145/2181037.2181040>
- [43] H. A. Yamani, “A Conceptual Framework for Integrating Gamification in eLearning Systems Based on Instructional Design Model,” *Int. J. Emerg. Technol. Learn.*, vol. 16, no. 04, p. 14, 2021, <https://doi.org/10.3991/ijet.v16i04.15693>.
- [44] T. Tsiatsos, “Virtual University and Gamification to Support Engineering Education,” *Int. J. Eng. Ped.*, vol. 10, no. 2, p. 4, 2020, <https://doi.org/10.3991/ijep.v10i2.13771>.
- [45] L. Prifti, M. Knigge, A. Löffler, S. Hecht, and H. Krcmar, “Emerging Business Models in Education Provisioning: A Case Study on Providing Learning Support as Education-as-a-Service,” *Int. J. Eng. Ped.*, vol. 7, no. 3, p. 92, 2017, <https://doi.org/10.3991/ijep.v7i3.7337>.

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