

## DIGITALIZATION IN EDUCATION: A LITERATURE REVIEW

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### Abstrak

Business today cannot be separated from issues that relate to sustainable development. For example, business is often accused Technology has altered the way people are conducting their business by utilizing information systems (IS). The velocity of development of IS has been perceived as a knout in conducting business in many sectors such as educational institutions, profit, and non-profit companies, government, and other areas. However, the development of IS has encouraged people to catch up with the pace of technology by digitalizing their work to take advantage of and compete with people in the world. Moreover, information system skills have become essential for recruiters, as companies use technology for their activities. Therefore, education's role becomes very vital to create a better education system to produce well-equipped people for companies. This paper presents such a review for highlighting the progress and aims to help improve the awareness on the best experiences of creating an active teaching and learning method by integrating the information technology knowledge. It is intended to provide a clear idea for those wishing to generate a road map for digitizing the most technology used in education. Note that, this literature review provides a concrete explanation about curriculum, eLearning, artificial intelligence (AI), and gamification which are implemented and used in education, and categorizes the discussion based on the methodology of literature, Technology Used, and Year. This literature review will provide information on research from 2009 to 2019 that has been conducted regarding digitalization in education and review gaps in the literature for future research.

Keywords: Digitalization, Education, eLearning, Artificial Intelligence, Gamification, Curriculum

## 1. INTRODUCTION

Technology has become a need for everyone in the world. It is part of a human's daily life that nowadays can overcome every human's problem. The primary goal of education sectors is to produce professional experts for every field that can give benefit to industries, government, and other areas. It could be said that education is the root of a solution for everyone who needs experts for doing professional works. However, the problem in school, nowadays, most students do not have enough practical knowledge to fulfill the companies' needs. It is because many educators could not seize the technology connectivity in the teaching and learning process, and they also do not have the information technology competency when using it (Chigona, 2018). So, this fact has forced the universities to develop their current curricula or create a new teaching method that gives the students

strong fundamental knowledge, which as the way people communicate in the business realm in the 21st century, has been shifted from traditional literacy to digital literacy.

Ramesh et al. (2015) cite that eleven universities have redesigned the IS curriculum between 1997-2005; however, many issues are appearing that forced universities to upgrade there is curriculum regularly to fulfill the companies' desired information system (IS) workers' skill. Nevertheless, Nomass (2013) in Chigona (2018) states that in the digital age, the integration of the Information Communication Technologies (ICT) in the classroom has been admitted as "the most exciting innovations in educational institutions."

The purpose of most of the studies that have been reviewed is to create an active teaching and learning method to prepare students to be able to join the 21st-century world of work by integrating the information technology knowledge in each course curriculum as part of the students learning and lives (Chigona, 2018). This literature review will discuss the research of digitalization in education. The studies are conducted between 2009 and 2019 with a focus on the utilization of information systems in education, the urgency of information system skill as a worker in the business, the technology tools that the universities used in the classroom such as eLearning, artificial intelligence, and gamification method.

By knowing the high needs of improving the teaching and learning process by utilizing technology, this paper presents such a review for highlighting the progress and aims to help improve the awareness on the best experiences of creating an active teaching and learning method by integrating the information technology knowledge. It is intended to provide a clear idea for those wishing to generate a road map for digitizing the most technology used in education. Note that, this literature review provides a concrete explanation about curriculum, eLearning, artificial intelligence (AI), and gamification which are implemented and used in education, and categorizes the discussion based on the methodology of literature, Technology Used, and Year. This literature review will provide information on research from 2009 to 2019 that has been conducted regarding digitalization in education and review gaps in the literature for future research.

Talking about current related studies in Indonesian education cases, there have been several studies committed related to digital education. Efendi (2018) examines the use of digital animation as a learning method for students to learn actively in the digital-based learning revolution. This is taken as one of the learning method options for the full day school system (8-9 hours), which is a new revolution in the development of student learning in schools.

In the following year, Afif (2019) examines the dynamics of teaching and learning in the Digital Age. He found that learning in the digital era had different characteristics from one in the previous period. The generation in this era consists of those with digital native characteristics. Emalia and Farida (2019), in the same year, conducted research on the form of innovation carried out in the world of education by utilizing technology, especially in the era of the industrial revolution 4.0. The results of this study indicate that the forms of innovation that have been carried out in education in Indonesia have been started with many pilot projects for development schools, the 1975 curriculum, the Pamong project, SMP Terbuka (off school), Universitas Terbuka (off campus), reform of the educational education system, the 1984 curriculum, the 1994 curriculum, the KBK curriculum, the curriculum. KTSP, curriculum 2013. In the era of the industrial revolution 4.0, educational innovation carried out was the formation of digital learning as it is currently known as the Online Learning System.

## 2. METHODS

The literature review in this paper focuses on articles or journals under the digitalization method or approach in education which is conducted by using a systematic literature review methodology. The primary sources of articles and literature were obtained from the Association for Information Systems' (AIS) Electronic Library website. This thematic literature review investigates how education utilizes technology in the teaching and learning process to give great IS experience for students. Therefore, the finding literature process is using keywords "digitalization and curriculum and education," "digitalization and eLearning and education," "Artificial intelligence and education," and "gamification and education" and by filtering the search for the period January 2009 to December 2019.

The articles that were found were not merely from information system journals in the informatics field but also in different areas such as the journal of social and behavioral sciences, the journal of the Virginia Community Colleges, and the journal of information systems education. Using these keywords, nineteenth (19) articles are used for the review in this paper. Then, these articles are divided into four (4) themes, namely, the changes of curriculum, eLearning, artificial intelligence (AI), and gamification in education, to narrow the topic and find the gaps among these themes. Besides the theme, this article will categorize the discussion based on the methodology of literature, Technology Used, and Year.

## 3. RESULTS AND DISCUSSION

### Theme

As explained earlier, this literature review consists of four critical themes that are relevant to be used to find the gaps of digitalization in education among articles. The process of getting these themes is by analysing and synthesizing nineteen articles. These themes are explained below.

#### *the changes in curriculum*

The curriculum is chosen as the first theme as it is discussed frequently compared to other themes in digitalization in education. The specific topics that were discussed are concerned with integration course design, redesign of the IS core class, information system curriculum, digital fluency, and information system field. These research topics are related to the development of the curriculum and bring changes to an applicable information system curriculum. For example, Albrecht et al. (2019), Austin et al. (2009), Jacobs (2016), Ramesh et al. (2015), Santos et al. (2014), and Chigona, 2018 studied how to integrate the IS core course model to build students' understanding about collaborative projects which is starting from the introductory course through the capstone experience by using practical, such as concentration on business and management issues in the companies, and integrated with across other cases in the class and changing the traditional approaches in the curriculum.

Moreover, an educator is also to be forced to have digital fluency as needed to create an effective IS curriculum (Chigona, 2018). Articles in this theme review and discuss the importance of the Information System curriculum in the education field to support the students, lecturers, and companies' desires in the future and to balance the speed of technological development in the market. It is believed that the continuity of this theme relevant research studies about how the better IS curriculum should be made and implemented to students can make the application of information system or technology in education better in the future and produce well-

equipped workers for industries. The change was also done to the education system in Indonesia. However, it did not sharply change. This can be seen from the change step in the curriculum of this country as mentioned in Emalia and Farida (2019).

### ***e-learning***

Articles found in these themes focused on online group work, flexibility and lifelong learning, blended interactive eLearning. E-Learning is a learning process that is using electronic technology to provide the learning material outside a traditional classroom (Khusanov & Sulaymonov, 2018). Studies have proven that eLearning can increase the learning outcome, quality of education, and support students who “want relevant, mobile, self-paced, and personalized content in their learning process”, it is also much cheaper, faster, and better than traditional learning (Wan et al., 2011, Khusanov and Sulaymonov, 2018, and Mwakisole, 2019). Moreover, Wan et al. (2011) study result shows that students who engage with eLearning have a higher GPA performance in their learning outcome. As an essential part of digitalization in educational institutions theme, eLearning has been discussed in a small number of studies. It could be seen when the searching process on the articles with the usage or development of eLearning in education is too difficult to be found in some databases of articles.

### ***artificial intelligence***

Artificial intelligence is becoming a very critical issue in technology. Many technology experts are researching to dig deep into the benefit of artificial intelligence usage in business, education, government, and other fields. The emergence of Artificial intelligence has been altering the capabilities of IS, such as the way IS works and is used and possible task exchange between humans and IS. AI will change the way people do their job, life, and study. Artificial intelligence is created to help humans in making effective, consistent, and efficient decision by creating machines that associate with human thinking and activities (Dellermann, Ebel, Sollner, & Leimeister, 2019).

Issues are abundant according to the emergence of artificial intelligence in the technology realm, such as workforce transition to a machine in which 5.6 workers' workload in the US is replaced with one new robot (Ma & Siau, 2018). My review revealed a few numbers of articles on this theme due to researchers mostly concerned about the development of business artificial intelligence, and it is rarely in educational institutions. Still and all, some exciting topics had been covered under this theme, such as hybrid intelligence, machine intelligence, automation, such as how education can help and contribute to AI development through the teaching and learning process.

Ma and Siau (2018) state that the artificial intelligence existence will impact curricula, enrollment, and teaching and learning process in higher education in many ways. It means that the transformation of education system is highly needed to pursue the fast development of AI technology and educational institution has to think about how to help students to compete in the AI era by providing them an up-to-date curriculum as AI continues to grow in the future (Ma & Siau, 2018, Rat et al., 2018, Barrett, et al., 2019, and Dellermann et al., 2019). I strongly encourage researchers or educators to conduct more research about the usage of artificial intelligence and dig more in-depth into how to seize artificial intelligence in the classroom through the changing curriculum, regulation in the institution, or the used tools and applications.

### ***gamification***

Gamification is chosen as one of the themes in this literature review. Many researchers have covered and implemented it by educators in their teaching and learning process in the classroom. It is common to be used in

an educational institution as a motivation tactic for students in the class by utilizing a game element for lessons and assignments (Urh et al., 2015). The specific topics that were discussed are concerned with game mechanics or dynamics, greater engagement of students as a critical component in the model of eLearning. Some studies have proven that implementation of gamification in education field can be very useful either online or face to face in the classroom, which has a positive impact on students' performance such as higher satisfaction, very motivated, enriching the student experience, and greater engagement in the class (Urh et al., 2015, Faghihi et al., 2014, Kenny et al., 2017).

In a nutshell, the research about gamification in the education field is still needed in the future as the study about this theme is still low. It believes that future research may magnify the benefit of gamification in education, which is providing more research about the differences in the gamification method in education in developed and developing countries. It is essential due to the differences in resources in each country, the changing of students' behavior after using the gamification method in their learning process. Efendi (2018) finds that gamification choice (digital animation) is one of the good alternatives as a learning method for active students in Indonesia's nowadays education setting.

### **Methodology of Literature**

In the analysis process of the literature review, the articles are grouped based on the research method that is used for conducting the research. These nine (9) primary methods are found among nineteen (19) articles reviewed. The list of research methodologies can be found in the below table (Table 2).

According to figure 1, the most used methodology of literature among nineteen (19) articles is the conceptual method with five articles. It makes sense because the topic of digitalization in education is a few types of research. In this method, papers are discussing and reviewing theory without collecting data. So, an explanation of the theory of the usage of IS in education is still needed. The following methodology standard to be used is survey, experimental, and design approach.

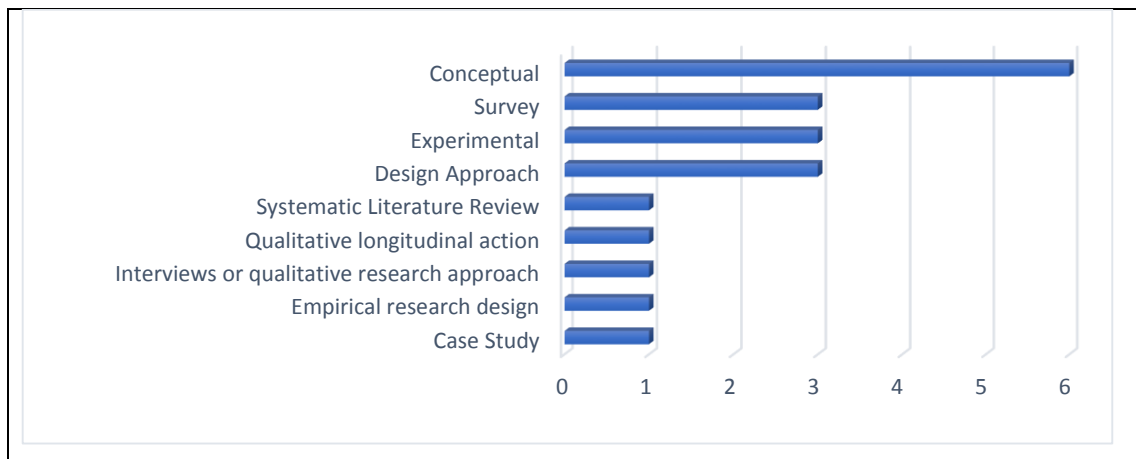
The survey method is used in this topic, which is three articles, to acknowledge the response of students when they have to face the advanced technology in their learning process, whether their satisfaction and motivation to study is greater or not. In these three articles, the survey results show that students are satisfied and motivated in their learning process.

The experimental method is needed to be conducted as there are just a few IS that can be used in each university. The studies show that each university has its unique characteristics; thus, it needs specific IS to be implemented for its students and faculties. The design approach has three articles as well in this literature review. In this method, papers are designing an IS course for certain subjects, which I think this method can have a positive impact on other universities that need an example to make an IS course for their students. Furthermore, systematic literature review, qualitative longitudinal action, Interview, experimental research design, and case study are only one article found for each method. The lack of these methods found is not surprising as digitalization in education is still growing; the number of studies and users to be interviewed will increase by the time too.

**Table 1. The Used Methodology of Literature**

Methodology	Author	Description
Interviews or qualitative research approach	Chigona, 2018	Hosting one on one discussions to gather data such as focus group discussions and in-depth interviews with the educators.
Survey	Albrecht et al., 2019	Giving some questions about the students' feeling toward the core IS courses.
	Wan et al., 2011	Giving some questions to measure the students' perceptions and evaluation of self-efficacy in an eLearning system.
	Kenny, Lyons, & Lynn, 2017	Students are surveyed after creating their own gamified experiences in the classroom.
Design Approach	Austin et al., 2009	Designing of an IS Management Course.
	Khusanov and Sulaymonov, 2018	Developing the web application of electronic learning for the university and college students.
	Rad et al., 2018	Presenting an open and interactive cloud-based learning platform for AI Thinking.
Experimental	Jacobs, 2016	Experimenting syllabus for Introduction to Art History.
	Mwakisole, 2019	Comparing the appropriate e-Learning system.
	Faghihi et al., 2014	Testing 30 students with a quiz for mathematical abilities pre- and post-tutoring sessions.
Case Study	Ramesh et al., 2015	Designing a unique and innovative integrated core curriculum for MSIS program which is similar to the curriculum used in MBA programs
Conceptual	Urh et al., 2015	Describing the model for introduction of gamification into e-learning in higher education.
	Rat et al., 2018	Describing AI thinking for cloud education platform with personalized learning.
	Dellermann, Ebel, Sollner, & Leimeister, 2019	Describing the concept of hybrid intelligence.

Methodology	Author	Description
	Barrett et al., 2019	Describing artificial intelligence to enhance educational opportunities.
	Santos et al., 2014	Describing “concept of digital innovation for a variety of teaching styles and topical emphases for the IS core class.”
Qualitative longitudinal action	Ma & Siau, 2018	Describing how artificial intelligence impact on higher education by focusing on solving an immediate problem and providing a reflective of the problem solving.
Systematic Literature Review	Antonaci, Klemke, & Specht, 2019	Review the effect of gamification in online learning environments.
Empirical research design	Jhon et al., 2017	Providing explanation about the theoretical foundation for the lean gamification approach in education.



**Figure 1. The Number of Used Methodologies**

## Technology Used

In this literature review, the technology used in the reviewed articles is also chosen as an essential category since digitalization is related to information systems and technology. Hence, this study looks to identify how education seizes information systems in the teaching and learning process. The data of software is categorized based on the themes, namely, curriculum, eLearning, artificial intelligence, and gamification. The top finding of software usage is in the artificial intelligence theme with six reviewed articles such as CT Scan for helping doctors to make the decision, virtual AI teaching assistant for answering students' questions, intelligent tutoring systems for giving online tutoring, smart education, ACE, and cloud-eLab. Artificial intelligence software has been seen as a useful technology to help people to do their activities, such as helping teachers to make an interactive material for their course and make the students get involved much higher.

E-Learning is the second top finding of software adoption in education with four information systems used among articles reviewed such as Macromedia for multimedia classes, Cloud architecture for eLearning storage infrastructure, learning management system (LMS) for management, administration, and learning process in the class, and Learning Database Management for database competency. Universities, nowadays, are mostly utilizing eLearning to make the teaching and learning process more comfortable and give the students more excellent opportunities to access the class material from the outside classroom. The studies result that eLearning can increase the students' performance by acquiring a higher GPA. Moreover, Neatline is found as one of the technologies used in the development of curriculum for art history classrooms by using digital visualization methods. This application allows students to get a real picture of knowledge and more experience by creating a beautiful and sophisticated image in their learning activities. However, a high need for more studies on technology in the development of the curriculum has been higher than before to produce well-skilled, and well-equipped IS students as IS workers in the companies. The final technology to be used is in the gamification theme, which is "MathDungeon." This application has helped teachers to provide an interactive lesson for students by creating upper-level mathematical concepts games and had enriched students' experience and had a positive impact on students' behaviour.

**Table 2. The Used Technology in Education**

<b>Theme</b>	<b>Technology Types</b>	<b>Description</b>
Curriculum	Neatline (Visualization digital method)	"A geotemporal exhibit-builder that allows you to create beautiful, complex maps, image annotations, and narrative sequences...and to connect your maps and narratives with timelines that are more-than-usually sensitive to ambiguity and nuance," (Jacobs, 2016)
e-Learning	Macromedia as part of adobe system	Application to produce movies, create small games (Ashok, 2014)
	Cloud architecture compared to Moodle benchmark tool and Apache Jmeter	Cloud-based infrastructure (Mwakisole, 2019)
	Learning management system (LMS)	"A software application or Web-based technology used to plan, implement, and assess a specific learning process" (Khusanov and Sulaymonov, 2018)  For management and administration of courses activities such as providing schedule, tracking of the progress of courses, providing newsgroups as well as acting as a repository for uploading and downloading of learning materials (Wan et al., 2011)



Theme	Technology Types	Description
	Learning Database Management (LDBM)	“A 24/7 online eLearning tool developed in addressing the growing need for database competency in graduates across a range of disciplines at the University of Queensland” (Wan et al., 2011)
Artificial Intelligence	CT Scan	This can help physicians to determine the type of patient’s disease by giving a prediction disease. Hence, the doctor has to be able to leverage the predictive power of AI and combine it with the doctor’s knowledge and feeling to make an appropriate decision (Dellermann, Ebel, Sollner, & Leimeister, 2019).
	Virtual AI Teaching Assistant	It can answer questions without human’s help (Ma & Siau, 2018)
	Intelligent tutoring systems	It provides private tutoring in real-time by using cognitive science and AI technologies (Ma & Siau, 2018)
	Smart Education	It can make education system easier to be implemented (Ma & Siau, 2018)
	ACE	It is provided to respond users’ requests or questions (Barrett et al., 2019)
	Cloud-eLab	“It provides a secure quantitative analysis cloud-driven AI-thinking platform for online hands-on education and research solution exchange among educational communities” Rad et al., 2018)
Gamification	MathDungeon	“Gamifying upper-level mathematical concepts” (Faghihi et al., 2014)

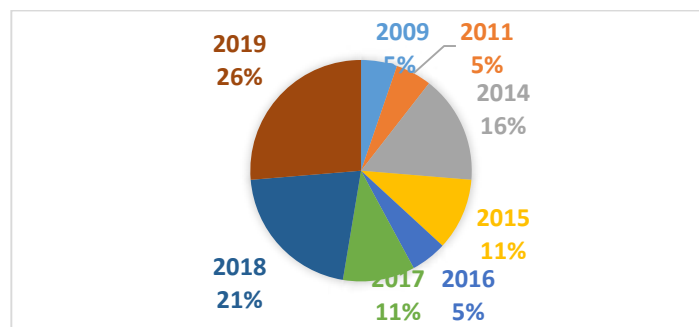
## Researched Year

Digitalization in education topics has been researched many times when the researchers have been realized by the needs of technology in humans’ daily life. Based on Austin et al.’ s (2009) finding that high demand for IS workers has been uttered by industries in which this situation has encouraged and forced education sectors to change their curriculum to fit with the need of the companies and could increase the enrolments of universities. Year data information in this review is discussed to show how important the digitalization application is in education in the research field. Table 3 shows the year range of research data used in this review.

**Table 3. The Year Range of Research**

Year	Authors
2009	Austin et al.
2011	Wan et al.
2014	Ashok, Santos et al., Faghihi et al.
2015	Ramesh et al., Urh et al.
2016	Jacobs
2017	Jhon et al., Kenny et al.
2018	Chigona, Khusanov and Sulaymonov, Rad et al., Ma & Siau
2019	Albrecht et al., Mwakisole, Dellermann et al., Barrett et al., Antonaci et al.

As the diagram picture in figure 2 shows, the majority of research on digitalization in education topic is in 2019 with 26% and follows in 2018. It can be seen from 2009 to 2017, the research in this field is still low and drastically increase in the following current year, which is 2018 and 2019. It can be concluded that the information system in the education field has been attracting many researchers to dig in-depth into the benefits of technology for the teaching and learning process in educational institutions.



**Figure 2. The Percentage of Articles Year**

### Research Gaps

Most of the research from 2009 until 2019 results that technology can create a better education for students in the future and help companies to have well-skilled IS workers for their business. It means that most of the universities have implemented an information system in their teaching and learning process. However, these results do not mean that all IS curriculum that has been created will have the same impact on the student skills and knowledge and succeed to be implemented. As different universities, states, countries, student backgrounds, or even teacher knowledge of techniques and methods for the development of information systems can have different results, either success or not the universities in seizing the technology advantage.

Furthermore, the resources can be other gaps for these studies, such as the availability of internet, devices, and other infrastructures that can help the teaching and learning process to succeed. Therefore, the need for more future research about information systems or technologies can improve the educational institution to prepare students with better IS skills and to compete with people in the world in different countries or even by distinguishing between developed and developing countries.

#### 4. CONCLUSION

The emerging technology has created many different ways of thinking about humans in the world. It also affects the way people behave and interact with each other. Many fields have exchanged their way of conducting activities. For instance, many companies develop their system to give higher satisfaction to their customers; governments change their approach in serving the community by creating a new information system with high technology attributes. This literature review has shown an abundance of research has been conducted from 2009 to 2019 about digitalization in education by using many kinds of research methodologies and technologies. It also shows that the intensity of research increases every year, which implies many researchers and educators want to use digital in every educational activity to make students engage easily in the class. However, gaps are found in this analysis, which is the need for further research on the effect of limitations and different resources in different countries and universities.

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