Sustaining Enhancement Of Learning Outcomes Across Digital Platforms During The COVID-19 Pandemic: A Systematic Review

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Abstract

The spread of COVID-19 has led to the closure of all educational institutions and a complete shift to distance learning using digital platforms, which succeeded in playing a major role in sustaining enhancement of educational goals during the crisis. Several studies have directed attention towards examining the factors that enhance the sustainability of digital platforms in enhancing learning outcomes during the pandemic, whether through technological or educational design elements or through the integrative design of all platform tools and educational strategies. Accordingly, the current study was proposed with the aim of identifying the role of digital platforms in improving learning outcomes during the pandemic, and thus the sustainability of learning, through a systematic review of several qualitative and quantitative studies conducted on digital platforms during the crisis. The systematic review was based on twenty three studies, which divide as seventeen studies devoted to studying the efficiency of technological and educational design elements, and six studies for dealing with the efficiency of the integrated design of digital platforms in enhancing learning outcomes. The results have demonstrated the role of some digital platforms such as Moodle, Google classroom, Microsoft Teams, Edx, Canavas, Teachsus, and CCtalk in achieving sustainable learning during the pandemic. However, the most important learning outcomes that were enhanced are knowledge, satisfaction, interaction, participation, and higher-order thinking skills, and performance skills, motivation, in addition to attitudes, perceptions, communication skills, and self-efficacy. The technological design elements that were based on gamification variables, flipped classes and mini video also were shown to have a role in enhancing the learning outcomes. The educational elements that were based on problem-based learning, cooperative learning activities, discovery learning, integrating synchronous and asynchronous learning, and formative assessment were shown to have a significant role in enhancing learning outcomes.

Keywords: digital platforms, learning outcomes, learning sustainability, COVID-19 pandemic

1. Introduction

Since March 2020, the gradual shift towards distance learning and the use of digital platforms has begun in various educational institutions in most countries of the world due to the Covid-19 pandemic. Teachers and learners have found themselves forced to adopt digital platforms in the teaching and learning process due to the COVID-19 pandemic [1-3] . However, the current time has become the most appropriate time to think about re-designing the educational system, which calls for choosing best practices based on technology and pushing the learner to be an active part in the educational process [4-6]. The prevailing belief was that no educational intervention could replace traditional education, but after the Covid-19 pandemic, the situation has changed and there has been an educational shift from traditional education to e-learning and from traditional classrooms to virtual classrooms so that the sustainability of the educational process can be maintained [7]. Despite the sudden transition to providing education via digital platforms in educational institutions, it is clear cross-platform education will prevail and become

one of the future strategic options even after the end of the Covid-19 pandemic, as digital platforms will become a symbol of sustainable education [8]. Among the most popular educational digital platforms that can be relied upon in the educational process are Blackboard, Canvas, Moodle and Edmodo [9]. This is in addition social media platforms that have become the most important systems in supporting sustainable learning [10]. It is therefore important to research the developmental context in which digital platforms can serve as an environment for sustainable learning [11]. Educational digital platforms are characterized by it ability to develop independence, which can improve the critical thinking of learners and thus improve the quality of the educational process [12]. It also provides solutions for delivering knowledge and information, facilitating the learning process, and increasing performance by developing the appropriate knowledge flow [13]. The use of digital platforms has greatly expanded the types of educational activities and helped in the development of teaching forms and methods. Additionally, the features of adaptive learning in some educational platforms such as (iSpring) contribute to improving the performance of learners by encouraging and motivating them to learn better and faster [14]. The results have shown that learners' motivation has increased by 25% when using a set of gamification elements such as leaderboard, badges, points and instant feedback, which can serve as a recipe for interactive learning and thus improve learning outcomes [15]. In general, the use of digital platforms during the outbreak of the COVID-19 pandemic has been recommended for their ability to provide good solutions in teaching during the lockdown period [16]. Despite the many advantages of digital platforms and their ability to attract millions of learners during the Covid-19 pandemic, many of these platforms lack incentives among learners. This means that there is a need to pay attention to some variables that are concerned with enhancing learners' motivation and encouraging their enthusiasm, such as gamification [17]. It can be said that despite the effectiveness of digital platforms as an integrated system in improving learning outcomes, some design variables can play a qualitative and pivotal role in enhancing these outcomes [18, 19]. These design variables always need more scientific studies to show how they could more profoundly

affect the learning outcomes [20, 21]. In fact, the widespread use and dependence of digital platforms as a basic educational environment requires studying and researching its variables [22]. Within the framework of the design elements that are covered extensively in educational platforms during the Covid-19 pandemic, the variables related to gamification are among the most important variables, especially the elements of gamification such as points, badges, levels, and leaderboards [23]. Additionally, the design elements associated with the use of digital platforms as flipped classroom systems are important variables as directed by previous studies in the context of the COVID-19 pandemic [24]. There are also educational design variables that are used as independent variables in the design of educational platforms, such as problem-based learning variables and cooperative learning variables on which digital platforms can be restructured [25, 26]. Moreover, there have been multiple studies concerned with digital platforms and learning management systems as integrated models in enhancing learning outcomes. Accordingly, the current study comes as an attempt to bridge the research gap associated with reaching a deeper understanding regarding the impact of digital platforms on learning outcomes in the context of the COVID-19 pandemic, whether through the integrated impact of the platform or through the influence of specific design elements included in the platform, such as gamification and the use of platforms as classroom systems, flipped or through pedagogical design elements. Learning via digital platforms in the context of the Covid-19 pandemic represents a new phenomenon because it requires new practices and qualitative procedures that did not exist before. Students' and teachers' dealing with technological elements also took another direction [8, 27]. This calls for thinking and analysis to explore opportunities for sustainable learning via digital platforms by enhancing learning outcomes via digital platforms during the pandemic, which the research team is trying to explore through the systematic review of the current study. This comes in line with what has been referred to that the Covid-19 pandemic changed operating conditions in general, and created a different work environment, and therefore the nature of digital platforms before the pandemic is different from its nature

during the pandemic, which means the need to research the role of platforms in enhancing learning outcomes within this new context [28-29]. Thus, the current study aims to conduct a systematic review of some studies that have been implemented in the context of the COVID-19 pandemic to determine how digital platforms and their design elements affect learning outcomes during the pandemic and thus the sustainability of the learning process. The current research will attempt to answer the following questions:

(RQ1) What methodologies and evaluation tools were used?

(RQ2) What are the areas of content and context used within the platforms?

(RQ3) What digital platforms have been used to enhance learning outcomes?

(RQ4) What learning outcomes have been enhanced through digital platforms?

(RQ5) What are the technological design elements that enhanced the learning outcomes within the digital platforms?

(RQ6) What are the educational design elements that enhanced the learning outcomes within the digital platforms?

(RQ7) How did the design of educational digital platforms holistically affect the enhancement of learning outcomes?

2. Literature Review

2.1 Digital platforms as sustainable learning environments

Digital platforms are called by several names, the most important of which are learning management systems, content management systems, distributed learning systems, and course management systems [30, 31]. Digital platforms are defined as educational networks that represent a means of teaching and learning for both teachers and learners and provide an interactive environment and a set of technologies that support the learning process efficiently without restrictions of time and place [32]. It consists of a set of tools that support learning events and activities such as the discussion page, individual and group conversations, file sharing, assignments, as well as the ability to conduct exams and assessments for the course [33]. It enables learners to manage their own educational activities and content [34]. Digital platforms have evolved from being programs used to share lectures between teachers and learners so that they can only read [35, 36] to being a dynamic learning environment that supports modern learning strategies such as collaborative learning and flexible learning [37]. Additionally, there are the reports they provide about each learner, which helps teachers to take appropriate methods to support and motivate learners [38, 39]. Digital platforms have also developed in line with the development in the social web where platforms can be customized according to the needs of learners, share resources through interaction between learners and teachers and each other, and provide resources synchronously or asynchronously [40]. All of these developments in digital platforms have helped develop their ability to become a fertile environment to support sustainable learning, and in particular their ability to enhance learning outcomes through educational strategies based on collaborative learning and social learning [41, 42]. Digital platforms are based on three main characteristics: firstly, they are a digital environment that includes interactive interfaces for teachers and learners; secondly, they provide content and assessments digitally, and thirdly, they include special tools for managing classroom activity [43]. For digital platforms to be powerful, they must be able to: use self-service and self-directed services, compile and quickly deliver educational content, be measurable, personalize content, and enable content reuse [43, 44]. In this context, it can be said that digital platforms and current learning management systems are effective in organizing and enabling e-learning [45]. Digital platforms have many advantages, including acquiring knowledge at a time that suits the learner and the ability to watch the lecture more than once in addition to the possibility of using different types of educational materials and multimedia and dividing the content into parts [46]. Platforms help increase learning effectiveness and personalize learning for learners with different educational needs and preferences, and they are characterized by providing a variety of learning tools that help increase the effectiveness of courses [47, 48]. They also help faculties and teachers in using different types of calendar tools [49]. In addition, digital platforms enhance the processes of interaction and learning with peers [50].

2.2 Design elements for digital platforms

Jaber and his research team [51] referred that the COVID-19 pandemic as a new context for education calls for research into variables that can be focused on as a new format for the learning process. Bacher and his team [52] explained that digital platforms during the COVID-19 pandemic are the main mediator for managing teaching and learning processes, and with the different types of these platforms and tools, it is important to research the variables of their design and impact on learning outcomes. Rahiem [53, 54] also believes that researching the most important elements and factors that maintain students' motivation and ensure their continued enthusiasm in the learning process through digital platforms during the COVID-19 pandemic is an important matter. It is difficult to enumerate the design variables of digital platforms, but during the COVID-19 pandemic, many studies have been directed towards redesigning digital platforms to be more motivating for learners [55]. This has led to an interest in gamification variables as design elements for digital platforms [56, 57]. Gamification-based platforms are among the most important digital content platforms that can be relied upon to support teaching and learning during the pandemic. This is because they contain some incentives such as points, badges, leaderboards, and progress bars that can be used in non-play-based educational situations in order to motivate and excite the student towards implementing Learning tasks [58-59]. Some studies have also been directed towards the use of digital platforms as systems for flipped classrooms during the COVID-19 pandemic; therefore, these platforms have been restructured to accommodate flipped learning. In this context, the Moodle platform has been re-engineered as a flipped classroom system during the COVID-19 pandemic [60]. As for the study of [61], it developed the Tencent Class platform in developing a flipped learning system during the COVID-19 pandemic. The Canvas platform and Zoom were developed in a research experiment at Rice University in Texas to implement online flipped classes during the COVID-19 pandemic [62]. The idea of using digital platforms as systems for flipped learning was reinforced by the availability of multiple tools that support flipped learning across digital platforms, such as video presentation systems and tools for implementing educational activities [63-66]. In a related context, the success of the learning process via digital platforms during COVID-19 should focus on basic pedagogical elements: learner-centered design, social learning, cooperation between learners, as well as good planning for the learning process [67]. Teachers have a large and vital role in encouraging learners to use digital platforms by urging them to participate in discussion forums, share educational content across the platform, and take exams [68, 69]. Additionally, digital platforms during the COVID-19 pandemic must enhance learners' self-organized learning skills so that they can continue to rely on digital platforms as an educational environment, especially that a large part of learners' satisfaction with learning through digital platforms is related to the ability of these platforms to support self-organized learning [70]. The quality of e-learning and teachers' self-efficacy are among the critical factors that make learners ready to continue their educational practices via digital platforms [71]. Moreover, the learner's experience through the digital platform must be continuously improved through the presence of tools that continuously stimulate the motivation of learners, and the provision of various support services to learners in a timely manner as to maintain a positive learning behavior [72].

2.3 The context of using digital platforms during the COVID-19 pandemic

The COVID-19 pandemic has posed a major challenge for teachers who have had to rely on many digital platforms as one of the main tools for the sustainability of the educational process [73]. The COVID-19 pandemic has raised the importance of digital platforms to a new level [74], as well as the opportunity for technology companies to develop new digital platforms with quality specifications and make them available to educational institutions [75]. The COVID-19 pandemic has changed the entire educational context, with all teaching and learning processes being implemented via digital platforms, with a new structure of intensive use, and the disappearance of face-to-face learning, with a state of total closure of educational institutions [76]. Accordingly, digital platforms in the context of the Covid-19 pandemic represent a new phenomenon because they require new practices and qualitative procedures that did not exist in the

past. Students' and teachers' dealing with the technological elements associated with digital platforms has taken another direction, which requires thinking and analysis to research opportunities and constraints resulting from digital learning during a pandemic [8]. Additionally, the Covid-19 pandemic has changed the operating conditions in general and created a different climate for the work of digital platforms; therefore, the nature of digital platforms before the pandemic is different from its nature during the pandemic, which means that it is necessary to research the uses of technology within this new context [28, 29]. Among the challenges associated with the use of digital platforms during the Covid-19 pandemic is that the rapid rush to use digital platforms during the Covid-19 pandemic without appropriate educational planning may lead to users relying on these platforms as mere temporary solutions without adherence to sound pedagogical principles of teaching and learning processes [77]. The rapid transition of digital platforms has also raised concerns about privacy, surveillance, and impact on learner lives[78]. Therefore, educational institutions must set appropriate criteria to choose the best platforms that correspond to their educational and pedagogical needs, in order to mitigate the potential negative effects [79]. There is no doubt that choosing the most appropriate digital platforms during the COVID-19 pandemic depends on multiple criteria, including the infrastructure of the digital platform, ease of use, and test management system [80]. The quality of the platform design and the digital content offered through it, as well as the variety of assessment tools can help improve learner satisfaction across these platforms [28, 70]. Learners on digital platforms during the COVID-19 pandemic need more digital motivation tools to overcome the anxiety and stress caused by the pandemic [81]. Although some has set specific criteria for selecting digital platforms during the pandemic, such as their ability to create tests and enable discussions, others ignore some more important criteria such as digital motivation mechanisms for students during learning [80]. Accordingly, it is of great importance to consider the quality of platforms that can be relied upon to improve teaching and learning processes, which is what the current research is trying to do through a systematic review of studies that focused on digital platforms in the context of the Covid-19

pandemic so as to extract the most important factors affecting digital platforms and their ability to enhance learning outcomes.

3. Theoretical Framework

The use of digital platforms in the educational process depends on many theories; among these is the constructivist theory whose principles support the use of digital platforms in the educational process and allow building knowledge through the learner's personal experiences, expertise, and his/her interpretations of the outside world [82, 83]. Digital platforms provide active, collaborative, self-directed and fair participation among learners and build knowledge by sharing multiple viewpoints, which support the application of constructivist theory principles across digital platforms [84]. There is also a relation between digital platforms and the social constructivist theory, which believes that learning occurs through the participation and social interaction of the learner with his peers and the teacher. Learning is a social by-product of conversation and negotiation among learners who acquire knowledge through participation in related social activities [85-87]. Digital platforms provide some tools that facilitate the process of social interaction, such as forums that allow learners to discuss, interact, and share resources [88]. Vygotsky [89] believes that learners learn best when they receive enough appropriate support from their peers and teachers. Thus, the role of digital platforms is to provide educational materials and real situations that help cooperation among learners and provide assertive processes from teachers [90]. Digital platforms are also related to the communicative theory which believes that the Internet, digital technologies, and networks have created learning environments and learning opportunities. These technologies include digital learning platforms that enable learners to share information with their peers [91]. It is a proposed theory of learning in the digital age, which believes that learning is a procedure and continuous updating of communication with others and with sources of knowledge and linking people from different geographical locations [92, 93]. The networks through which learners communicate can be small or large, and successful networks that support knowledge development are diverse, independent, connected, and open [94]. This is also supported by digital

platforms that have been able to build effective communication relationships among learners, regardless of their geographical locations.

4. Methodology

4.1 Approach
A single research study may not be enough to determine the factors affecting the efficiency of digital platforms in enhancing learning outcomes during the Covid-19 pandemic; of course, it will be limited by many factors related to the learning context during the pandemic. However, the research team has a tendency for using systematic review of several studies that have been implemented on digital platforms and their impact on learning outcomes in the context of the COVID-19 pandemic. In this way the knowledge gained from several research studies can be aggregated to better understand the phenomenon of digital platforms in the context of the COVID-19 pandemic. To provide a concrete and comprehensive understanding of the impact of digital platforms during the COVID-19 pandemic, we conducted a systematic literature review (SLR) using specific systematic approaches to identify, select, and aggregate all research material directly relevant to the research questions. The

process and methodology used to conduct a systematic review in this study is the PRISMA model (Preferred Report Elements for Systematic Reviews and Descriptive Analyzes) [95]. The process followed is manifested in the following steps [96]:
- Precise identification of research questions.
- Navigating databases.
- Determining inclusion and exclusion criteria.
- Data analysis and extraction.
- Summary and interpretation of results.
- Writing a review report.

4.2 Database search methodology
Studies were investigated using the Web of Science, Scopus, and Springer databases as one of the most rapid research publications on the educational context of learning via digital platforms during the COVID-19 pandemic. The selected databases are also distinguished by the quality of its published research. Through the previous databases, investigation was carried out according to the previously mentioned search questions, as the previous questions were converted into search terms, and the basic research terms were identified as shown in Table 1.

Table1. Terms that was used in the research across databases

Core Concepts	Synonyms
Learning Platform	Educational platforms, Digital educational platforms, Digital platforms
Learning Management System	LMS, SCORM
Learning Environment	Virtual Learning Environment, Interactive learning environments
Distance Learning	Online education, remote learning, online distance learning
Learning Outcomes	learning opportunities
Covide-19	Corona Virus, COVIDE pandemic

The terms shown in Table (1) were investigated using the coordinators (and) and (or), in order to reach the relevant research studies.

4.3 Inclusion/Exclusion Criteria
Research papers and conference papers describing the impact of digital platforms and their design elements on educational outcomes during the COVID-19 pandemic were included. To find relevant studies, the following inclusion criteria were followed:

- The study should be published in 2020-2021 and related to the context of the COVID-19 pandemic.
- The study experience was applied in the higher education stage.
- Availability of information in the study about the used digital platforms.
- Availability of information in the study on learning outcomes.
- Availability of information related to the efficiency of the platforms and their design elements.

▪   The study should be quantitative, qualitative, or mixed.

▪   As for the exclusion criteria, they were defined as follows:

▪   Not to use English in Writing.

▪   The study is published as an abstract only.

▪   The study addresses digital platforms in a context different from that of COVID-19.

4.4 Review Process

The initial results of the research in the included databases revealed a total of (6339) articles, and after reviewing the titles and checking for duplicates, a total of (6036) articles were excluded. The remaining articles were confirmed and reviewed, and they were (303). Other articles which were not related to the Covid-19 pandemic such as learning analytics, technology acceptance, etc. were all excluded, the number of excluded articles was (271). The remaining (32) articles were carefully reviewed as they relate to the study questions, included standards, procedures and methods used, and (9) articles that did not have clear methods and procedures were then excluded. The 23 articles were definitively included in the systematic review. Figure 1 shows the PRISMA process followed by the research team.
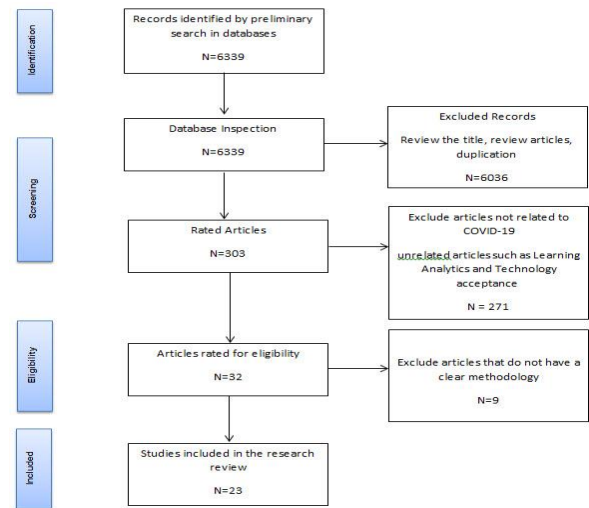

Figure 1. PRISMA review process.

4.5 Data Extraction and Analysis

The (23) articles, as shown in Table 2, were further analyzed to provide the results of data related to the research questions by the researchers who conducted a comprehensive review and analysis of the attitudes of studies, methodologies and platforms used in addition to the design elements of the platforms, whether they were technological or educational elements and the educational outcomes that were improved.

Table2. Articles included in the research review

No	Author	Source	Area of Content	Country / University	Educational Context
1	[97]	Web of Science	Computer Engineering	University of Salamanca in Spain	Comparison of traditional and cross-platform education using Blackboard and Google Meet
2	[98]	Web of Science Scopus+	Medicine	Shandong First University in China	Comparison of traditional and cross-platform education using Xuexi Tong and Tencent Live Conference
3	[99]	Scopus	Medical Care	Indonesia Universities	Cross-platform learning assessment using Zoom and YouTube Live
4	[100]	Web of Science + Scopus	Radiology	Qassim University in Saudi Arabia	The effectiveness of teaching using platforms compared to traditional teaching, the Blackboard platform was used
5	[101]	Scopus	English Language	Saudi Arabia Universities	Benefits of using Blackboard in teaching English
6	[102]	Scopus	Educational Management	University of Negeri Malang in Indonesia	Improving learning outcomes using digital platforms through SIPEJAR and Google Meet

No	Author	Source	Area of Content	Country / University	Educational Context
7	[23]	Web of Science + Scopus	Computer Science	Universities of Jawa in Indonesia	Evaluating the effectiveness of learning across digital platforms with the use of the design element (gamification) with the Google Classroom platform
8	[103]	Web of Science Scopus+	Environmental Sciences	Top universities in Romania	Appropriateness of applying the principles of gamification via Moodle and TeachSuS IT&C platform in improving the quality of education
9	[104]	Scopus	Engineering	A university in India	Gamification learning effectiveness using Microsoft Teams combined with Kahoot
10	[105]	Web of Science + Scopus	Computer Science	University of Technology in Malaysia	Students' attitudes in using the design element (gamification) in the learning process. Blackboard platform has been used
11	[60]	Scopus	Math	University of Muhammadiyah Surbaya In Indonesia	Improving learning outcomes with Flipped Classrooms via Moodle
12	[61]	Web of Science Scopus+	Medicine	University of Nanchang In China	Flipped Classroom Model Using Tencent Class Platform and Leveraging MOOC to improve education
13	[62]	Web of Science Scopus+	Scientific disciplines Physiology	Rice University of Texas	Relying on Flipped Classroom via Canvas and Zoom to improve learning outcomes
14	[106]	Web of Science + Scopus	medical education	Germany	Evaluation of the Flipped Classroom Model Using Zoom in Education
15	[24]	Web of Science + Scopus	Education	University of Zaragoza in Spain	Self-efficacy check after using Flipped Classroom across digital platforms
16	[107]	Web of Science + Scopus	Engineering	Chengdu University in China	Check the effectiveness of different teaching methods and flipped classroom online
17	[25]	Springer	Computer Science	Quebec Artificial Intelligence Institute in Canada	Comparison of learning outcomes from two platforms using the pedagogical design component, active and problem-based learning
18	[108]	Web of Science Scopus+	Fist Aid	A university in Turkey	The use of the educational design element based on solving problems through digital platforms and its impact on learning outcomes, and I used the Zoom platform
19	[26]	Web of Science Scopus+	Chemical Engineering	Francisco de Vitoria University in Spain	Using the pedagogical design element based on collaborative learning across Blackboard and Moodle platforms and its impact on student performance

No	Author	Source	Area of Content	Country / University	Educational Context
20	[109]	Scopus	educational programming	University of Ioannina in Greece	Using the educational design element based on student-centered learning and discovery learning across MS-Teams and Moodle platforms and its impact on learning outcomes
21	[110]	Web of Science + Scopus	emergency nursing	Huazhong University in China	Analysis of the application of the common mode of micro video via MOOC and its impact on learning outcomes
22	[111]	Scopus	Education	IAIN Bukittinggi University in Indonesia	Recognizing the effectiveness of cross-platform learning by integrating two learning methods via Zoom and YouTube and its impact on learning outcomes
23	[112]	Web of Science + Scopus	English Language	Southern Medical University in China	Examining learning outcomes across iCourse and CCtalk using formative assessment as an educational design element

5. Results

The most important keywords in the included articles were extracted to look at the main topics that were discussed and analyzed. The most important keywords were "improving learning outcomes", "teaching using digital platforms" and "design elements of digital platforms." These initial findings indicated that the main objective behind digital platforms is to improve learning outcomes during the COVID-19 pandemic and maintain them without negative impact.

5.1 Methodology and Assessment Tools

This section evaluates the methodological approaches used in the 23 articles included in the research review and the assessment tools used to collect data as shown in Table (3). Regarding methodology, we found that most of the studies used the quantitative approach (22), and one article used a mixed approach. Most of the included studies fol-

lowed a quantitative approach to measure the effectiveness of digital platforms and their design elements in improving or maintaining learning outcomes without negative impact during the COVID-19 pandemic. Figure 2 shows the methodologies that were used in the analyzed studies.
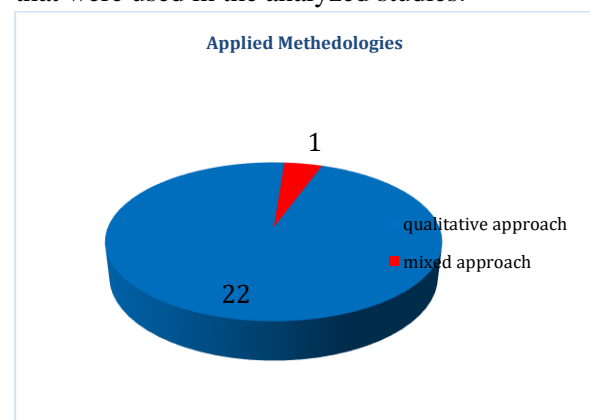

Figure 2. Comparison of methodologies used in the included studies

Table 3. Methodology and tool for all studies' data

No	Author	Methodology	Data Collection Tool
1	[97]	Quatitative	Test + Questionnaire
2	[98]	Quatitative	Test + Questionnaire
3	[99]	Quatitative	Test + Questionnaire
4	[100]	Quatitative	Test + Questionnaire
5	[101]	Mixed	Questionnaire + Interview
6	[102]	Quatitative	Questionnaire
7	[23]	Quatitative	Questionnaire

8	[103]	Quatitative	Questionnaire
9	[104]	Quatitative	Questionnaire
10	[105]	Quatitative	Questionnaire
11	[60]	Quatitative	Questionnaire
12	[61]	Quatitative	Test
13	[62]	Quatitative	Test
14	[106]	Quatitative	Questionnaire
15	[24]	Quatitative	Questionnaire
16	[107]	Quatitative	Questionnaire
17	[25]	Quatitative	Test + Questionnaire
18	[108]	Quatitative	Test
19	[26]	Quatitative	Test + Questionnaire
20	[109]	Quatitative	Questionnaire
21	[110]	Quatitative	Test + Questionnaire
22	[111]	Quatitative	Test + Questionnaire
23	[112]	Quatitative	Questionnaire + learning records

Regarding assessment tools, the data collected revealed many similarities about the procedures followed. It has been shown that the tests and questionnaires were the tools and data sources used in the studies that followed the quantitative approach, while the only study that followed the mixed approach included the two tools of questionnaires and interviews. The most used data collection tools in the included studies were questionnaires (18), followed by tests (12), interview (1), and records (1). Figure (3) shows the comparison between the evaluations tools used in the research.
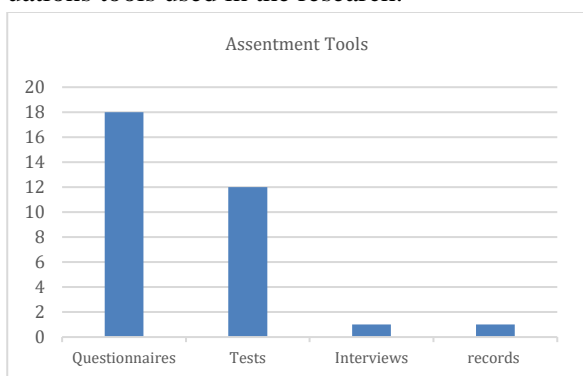

Figure.3. The frequency of data collection techniques in all studies.

5.2 Countries, content area and educational context

According to the collected data, as shown in Table (2), all studies included students from higher education. The studies included a variety of developed and developing countries. China ranked first equally with Indonesia with 5 studies for each, and

this may be because the Covid-19 pandemic began to appear in East Asian countries, particularly the Chinese city of Wuhan [113]. Three studies came from Spain, two studies from Saudi Arabia, and one study each from the USA, Germany, Canada, Greece, Romania, Turkey, Malaysia, and India. Figure 4 shows the countries to which the studies included in this review belong.
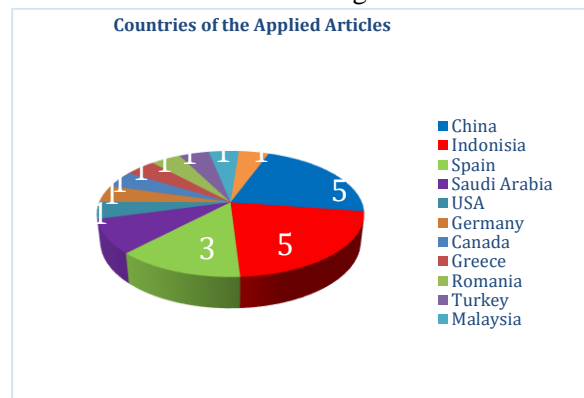

Figure.4. Countries to which the reviewed studies belong

The data show that (7) studies were related to medical education, (5) studies to computer science, (3) studies to engineering, (3) studies in scientific majors such as mathematics and physiology, and (3) studies for education. To studies were associated with teaching English as shown in Table (2). Figure (5) shows the comparison between the disciplines associated with the included studies.
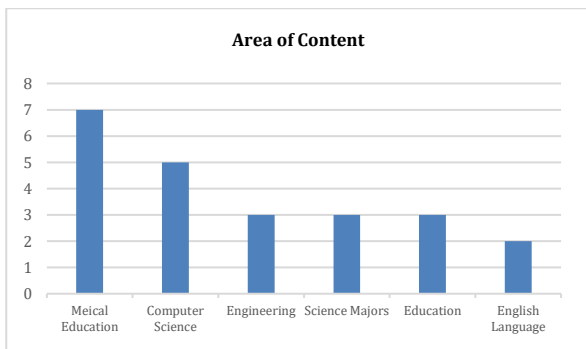
Figure.5. Content areas in the reviewed studies

The primary objective of these studies was to improve or maintain learning outcomes during the COVID-19 pandemic in various fields. Educational institutions in various countries of the world have used various digital platforms to continue the learning process [114]. This has increased the importance of studies related to learning via digital platforms during the pandemic. From this point of view, the researchers realized the importance of this stage, as they made more research efforts and verified the effectiveness of digital platforms, either through the integrative design of the platform or through its technological design elements such as gamification and flipped classrooms or various educational design elements such as active and co-operative learning and discovery learning and their impact on improving Learning outcomes in this global pandemic.

5.3 Used Educational Digital Platforms

The data collected from the studies included in this review have shown that universities have used many digital educational platforms to continue the learning process. In this review, we have noted that the Blackboard platform is one of the most widely used digital platforms, as it has been completely relied upon to provide the educational process due to its multiple characteristics and advantages that provide distinctive educational content for learners [115]. The Zoom platform is also one of the most widely used digital platforms, whether relying on it as a primary digital platform or as a supportive digital platform for implementing synchronous meetings. The systematic review has also shown the use of a variety of other digital platforms such as(Moodle, Google classroom, Microsoft Teams, Edx, Canavas, Teachsus and CCtalk in addition to the Chinese platform Tencent. Figure (6) shows the percentages of digital platforms used in the reviewed studies
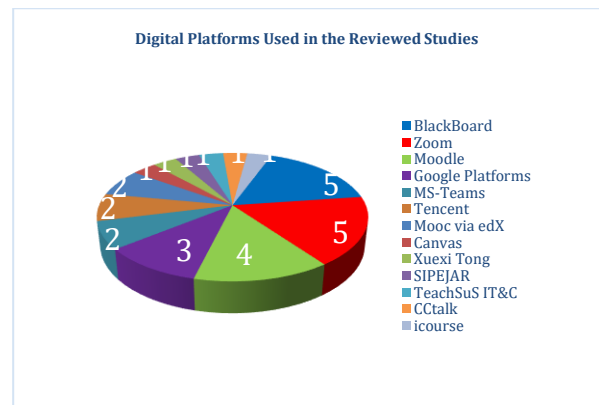

Figure .6. Digital Platforms Used in the Reviewed Studies

5.4. Learning Outcomes that are enhanced through Digital Platforms

The data have showed that educational digital platforms have enhanced many learning outcomes during the COVID-19 pandemic. Among the most important outcomes of these outputs are the following: First is knowledge. It is considered one of the most learning outcomes that have been enhanced. In addition, there are issues such as satisfaction, enhanced interaction and participation in addition to higher-order thinking skills, performance skills and motivation in addition to trends, perceptions, communication skills and self-efficacy. Figure 7 illustrates the learning outcomes that have been enhanced via digital platforms during the COVID-19 pandemic in the studies included in this review.
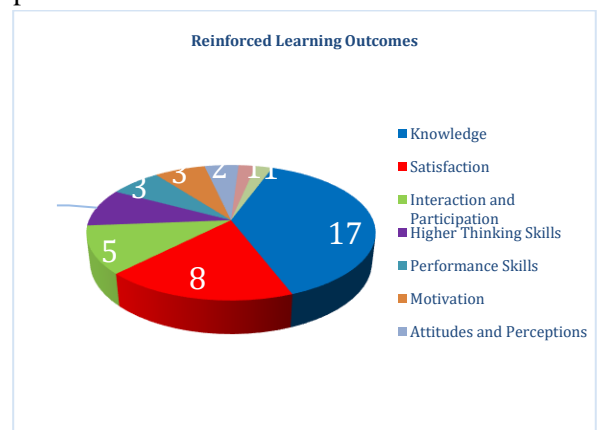

Figure.7. Learning Outcomes Reinforced in Embedded Studies

5.5 Technological Design Elements for Digital Platforms

The data have shown that researchers have used several technological design elements for digital platforms with the aim of using the best practices to improve and enhance learning outcomes during

the COVID-19 pandemic, as shown in Table (4). These technological design elements have consisted of three elements: flipped classroom, gamification, and micro video. The number of studies included in this aspect have been 11 studies, where 6 studies have used platforms as systems for flipped classrooms during the pandemic, while (4) studies have dealt with re-designing digital platforms according to the gamification variable, and one study has dealt with the design of mini-video within digital platforms, as shown in the figure 6.
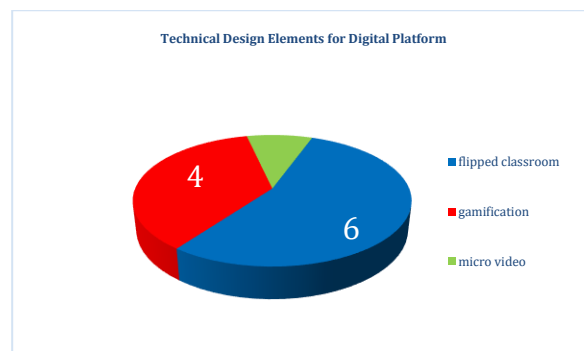

Figure 8. The comparison among the technological design elements of digital platforms

Table 4. Technological design elements of digital platforms in embedded studies

No	Author	Technological variable	Most Prominent Results
1	[60]	Flipped classroom	Flipped Classroom platforms contribute in increasing learning motivation and improve academic achievement
2	[61]	Flipped classroom	Flipped Classroom platforms have improved teaching quality and academic achievement
3	[62]	Flipped classroom	Flipped Classroom platforms have contributed in improving academic achievement
4	[106]	Flipped classroom	Flipped Classroom platforms have helped to continue teaching and led to good assessment results for courses
5	[24]	Flipped classroom	Designing active learning environments based on Flipped Classroom platforms that enhance students' sense of self-efficacy
6	[107]	Flipped classroom	Flipped Classroom platforms have improved student learning
7	[23]	Gamification	The gamification model has helped increasing students' motivation
8	[103]	Gamification	Cross-platform learning is suitable for improving the quality of teaching and gamification-based learning that helps to enhance student participation
9	[104]	Gamification	Gamification as an educational tool that helps improving students' performance, understanding and enhancing their level of confidence
10	[105]	Gamification	Student satisfaction is ranged from neutral to positive towards cross-platform learning and the use of gamification as one of the preferred ways for students to enhance their participation in cross-platform learning
11	[110]	Micro video	The effect of the common style of the mini video via Mooc is the same as that of the traditional methods but the satisfaction has been higher.

5.6 Educational Design Elements for Digital Platforms

The data collected from the studies have included in this review have shown that researchers have used several pedagogical design elements of digital platforms to use best practices to improve and enhance learning outcomes during the COVID-19 pandemic, as shown in Table 5. These educational design elements consist of five elements: problem-based learning, cooperative learning activities, discovery learning, integrating synchronous and asynchronous learning, and formative assessment. The number of studies included in this aspect is 6 studies, where two studies have used problem-based learning and one study for each of the cooperative learning activities, discovery learning, the combination of synchronous and asynchronous learning, and formative assessment, as shown in Figure 9.

Educational Design Elements for Digital Platforms

- Problem- based learning
- Collaborative Learning activities
- Discovery Learning
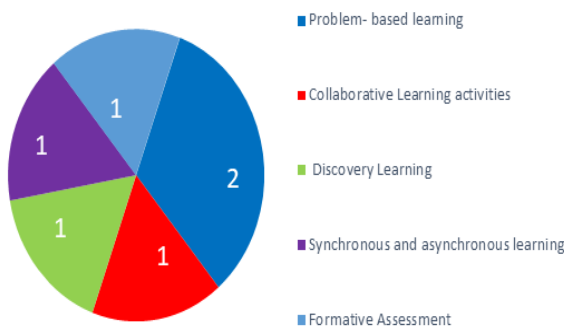- Synchronous and asynchronous learning
- Formative Assessment

Table 5. Educational design elements of digital platforms in embedded studies

No	Author	Educational Variable	Most Prominent Results
1	[25]	Problem-based learning	Problem-based learning across platforms improves metacognition
2	[108]	Problem-based learning	Problem-based learning across the platform increases student achievement, problem-solving skills and interaction
3	[26]	Collaborative learning activities	The design element based on cooperative learning activities positively affects student performance and enhances higher-order competencies and learning outcomes. Students reports a positive perception of the learning experience
4	[109]	Student-centered learning and discovery learning	The course design that focuses on student-centered learning and discovery learning leads to a satisfactory assessment of the variables (student satisfaction, social presence, and learning outcomes)
5	[111]	Integration of synchronous and asynchronous learning	Integration of synchronous and asynchronous learning is effective in enhancing communication skills, interaction and student achievement
6	[112]	Formative Assessment	The use of formative assessment has a positive impact on student learning and enhances learning outcomes. Students' perceptions are positive

5.7 Results of the impact of the platform as an integrated system

We have included 6 studies that have examined the absolute effectiveness of digital platforms as an integrated entity regardless of the presence of specific design elements whose impact on learning outcomes during the COVID-19 pandemic is being tested. The following table 6 shows the included studies, the platform used, and the most prominent results.

Table 6. Studies on the impact of educational digital platforms in a holistic manner

No	Author	Platform	Most Prominent Results
1	[97]	Blackboard + Google Meet	An overall increase in students' scores at all assessment items as well as student satisfaction with the way the course is taught

2	[98]	Tencent + Xuexi Tong	High achievement scores as well as high satisfaction score
3	[99]	Zoom	Achievement scores are high and overall satisfaction is positive
4	[100]	Blackboard	Gaining knowledge, interacting and enjoying learning
5	[101]	Blackboard	Attitudes are positive towards using the platform for learning as well as the platform's ability to provide an interactive environment and improve learning outcomes
6	[102]	Google Meet + SIPEJAR	Motivating Students

6. Discussion

In the era of the COVID-19 pandemic, educational institutions have closed their doors. Thus, education has shifted from the traditional face-to-face method to a fully distance learning environment. Universities have been quick to provide education to their students through their official digital platforms to ensure the sustainability of the learning process. Faculty members must do more to ensure the quality of the educational courses they provide to their students. Students also must put in more effort in order to acquire knowledge. All the studies described here have aimed at maintaining the sustainability of the educational process by enhancing teaching and improving various learning outcomes using digital platforms and various design elements in the era of the COVID-19 pandemic. The results of the review have shown a significant impact of the design elements of digital platforms on improving learning outcomes during the COVID-19 pandemic. It is noted that the use of design elements for digital platforms has a clear impact on improving learning outcomes in most cases if these elements are well designed. It has been noted that studies are interested in using technological design elements such as gamification because of their impact on increasing students' motivation and thus improving their participation and educational outcomes. Where [103] indicates in this context that gamification-based learning and the use of various digital stimuli elements such as points, badges, leaderboards, and progress bars are one of the most agreed upon methods to improve different learning outcomes and enhance student participation in the learning process. The result of this study confirms the findings of the study [81], which has aimed to identify the needs of university students in learning via digital platforms. The results have manifested students' desire for more environments that support

happiness, self-monitoring, and competitiveness through motivational elements such as leaderboards, rewards, and badges. It can help in making the learning environment as fun and engaging. It encourages them to put in more effort to learn. The employment of stimuli in digital platforms is supported by the theory of self-determination, which indicates that students' movements to carry out tasks are motivated by a set of internal motives that lead to the practice of behaviors which in turn makes the student feel pleasure and satisfaction. The theory confirms that students, by their innate nature, need support and feedback from the social environment. The motivators provided at the end of the assignment serve as feedback and support for the student[21]. In addition to the theory of social comparisons, which indicates that the best situation to learn about our abilities is to compare them with others? According to that theory, individuals who have a desire for continuous improvement judge themselves by comparing their abilities with others who have better performance, which is called upward comparison. It gives students the incentive for continuous improvement to achieve the highest levels [116]. This is in line with studies that have indicated that learning environments based on game elements enhance motivation and happiness within the learning environment, which enhances the ability of these environments to be a source of sustainable learning [117]. In addition, several studies have tended to employ the flipped classroom technology as a design change for digital platforms. Such results have indicated that the use of flipped classrooms across digital platforms improves learning outcomes and increases students' motivation to learn. It is due to the fact that it has made the learning environment more flexible and allowed more students to learn. Discussions between students and their teachers have supported critical thinking processes and facilitated active

learning processes and students' self-efficacy. This result is consistent with the principles of the constructivist theory. The constructivist approach depends on learners constructing their learning by building their new knowledge on the basis of their previous knowledge, through their personal experiences and the sharing of multiple points of view. It also gives learners the freedom to build their own concepts, either individually or through interaction and cooperation with others and the sharing of multiple viewpoints [82-84, 118-120]. A study conducted by Huber et al. [106] has reported that the use of flipped classrooms across digital platforms leads to at least good assessment results that will be similar to those implemented in traditional face-to-face classrooms. The study [106] has combined the use of the flipped classroom model and digital stimuli for learning via digital platforms during the Covid-19 pandemic, and its results showed the effectiveness of digital platforms as a supportive environment for sustainable learning. Also, the micro video has been used across platforms and compared with the traditional method of teaching. The results have shown that there are no differences in grades, but it has a positive impact on students' satisfaction with the learning method. Within the framework of studies that have focused on the elements of educational design, some studies have compared between education through traditionally digital platforms and education via digital platforms using some design elements, including problem-based learning and active learning, for example. The results have shown the superiority of digital platforms because they provided a range of well-designed items that stimulate metacognition, raise academic achievement scores, and support a higher level of problem-solving skills. The design elements based on cooperative learning activities have a positive impact on students' level and participation, enhancing higher-order thinking skills, and creating a positive perception towards the learning experience. Moreover, discovery-based and student-centered learning are among from the design elements that have a positive impact on learning outcomes and students' social presence in the virtual classroom. One study has used an important design element, which is the combination of two learning styles, synchronous and asynchronous. It is noted that this design element is effective

in enhancing students' communication and interaction skills, as well as achievement. Also, it has used the design element based on formative assessment and has a positive impact on improving students' active participation, facilitating their learning and improving its quality through digital platforms. Thus, pedagogical design elements have improved learning outcomes in most cases and supported the sustainability of learning during the pandemic, because these elements rely heavily on student-centered design based on active learning for students. This is confirmed by a study [121], which confirms that active learning practices via digital platforms and online learning enhance communication and cooperation among learners and have a significant impact on course design across digital platforms. This study supports the principles of social constructivist theory, which asserts that learning occurs through participation and social interaction of the learner with peers and teachers. Therefore, digital platforms provide tools that facilitate the process of social interaction such as discussion forums that allow students to interact and share files and resources [85-88, 122, 123]. A number of researchers confirm that the social constructivist theory is being applied more in e-learning processes and via digital platforms in particular [124, 125]. In addition to the communicative theory that asserts that learning is a continuous process and updating of communication with others and with sources of knowledge. It also connects people from different geographical locations and confirms that digital platforms have created learning environments and learning opportunities that enable students to share information with others [91-93]. Thus, digital platforms in general have helped improving learning outcomes during the COVID-19 pandemic. It can be stated that these platforms have maintained the sustainability of the learning process without a negative impact, according to the studies that have been included. Changing the method of learning from the traditional face-to-face form to learning via digital platforms environments for various courses have not reduces students' satisfaction. These studies have proven that education through digital platforms in university education is possible and acceptable. It maintains the continuity of providing knowledge to students without interruption. This matter has coincided with studies that

have indicated the ability of digital platforms to enhance the continuity and sustainability of the learning process, especially in the case that there are high rates of satisfaction among learners with these platforms [126], as well as in the case that these platforms promote engagement in learning [127]. It is noted, according to the included studies, that the transition to education via digital platforms is well perceived by students. This is reflected positively in their simultaneous presence across the platforms. Also, the transition to education via digital platforms has helped to motivate the students and make them have a very good ability for self-learning. It has helped the students to expand their research and improve their knowledge in a very good way. Digital platforms have also been able to provide a flexible and interactive environment that enhances interaction between faculty members and students in one hand and among students with each other. Thus, digital platforms are an example of harnessing the capabilities of modern technology in the learning process in addition to the development of different teaching methods. In addition, it enables students to manage their learning more flexibly, synchronously, and asynchronously, by attending live lectures, taking tests, participating in discussion forums, and accessing course-specific learning resources.

7. Limitations

The focus of this study is to examine the impact of digital platforms and their design elements on improving learning outcomes related to the context of COVID-19 only during the years 2020-2021 and published in English. Also, studies that are applied in higher education have been selected only without viewing general education studies. Thus, the results of this study cannot be compared with age groups in general education. It is recommended to conduct a similar study to examine the impact of digital platforms and their design elements on improving learning outcomes in public education. In addition, there has been a focus on studies in Education & Educational Research. Thus, it is recommended to conduct similar studies focusing on other areas.

8. Conclusion

The current study has explored the role of digital platforms and their design elements in sustaining the learning process during the COVID-19 pandemic by enhancing students' learning outcomes. The systematic review is used by including 23 studies, including 6 studies that have dealt with digital platforms in general and 17 studies that have dealt with the design elements of digital platforms and their impact on improving learning outcomes during the COVID-19 pandemic. A positive impact of digital platforms in figured out in most cases on various learning outcomes, such as cognitive abilities, higher-order thinking skills, performance skills, communication and interaction skills, and others. The design elements of the digital platforms have varied among technological elements represented in gamification, flipped classrooms, mini-videos, pedagogical elements based on problem-based learning, cooperative learning activities, discovery learning, merging synchronous and asynchronous learning, and formative evaluation. In future studies, a systematic review is recommended in addition to further expansion of the technological components during the COVID-19 pandemic and their impact on learning outcomes, as well as examining the impact of the design elements of digital platforms on the learning of people with special needs during the pandemic.

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