

Systematic Review

The Significance of Digital Learning for Sustainable Development in the Post-COVID19 World in Saudi Arabia's Higher Education Institutions

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Abstract: Saudi Arabia, like other countries, has established several strategies and initiatives to support the 17 Sustainable Development Goals (SDGs). Saudi Arabia's 2030 Vision recognizes the technological dimension of the SDGs. Furthermore, higher education institutes are an essential component of Saudi Arabia's sustainable development goals, and the government is eager to adopt sustainability measures in universities in this regard. Saudi universities have implemented significant e-learning and digital transformation projects aimed at long-term development. During the COVID-19 pandemic, Saudi universities discontinued traditional face-to-face classes in favor of online learning. The rate of use of online education has been extraordinary and overwhelming. Given this background, this paper aims to study the impact of digital learning on sustainable development in the higher education institutions of Saudi Arabia post COVID-19 by highlighting the educational processes followed during the pandemic. In addition, we analyze the obstacles and values of digital learning in Saudi higher education institutes. We used the PRISMA statement 2020 for the inclusion and exclusion of the records and the VOS viewer software for the classification of literature. The results identified the three primary data streams, higher education, e-learning and digital transformation after the co-occurrences of critical terms and content analysis. Findings indicate the significant changes brought by the recent pandemic outbreak for the higher education institutes in Saudi Arabia. Results suggest that E-learning programmes have gained recognition as effective learning aids for higher education since conventional education (face-to-face) was abruptly forced to relocate online owing to the COVID-19 pandemic. Furthermore, findings demonstrate a substantial and positive relationship between digital transformation performance and Saudi Arabia's higher education institutions, as well as their potential for e-learning toward sustainable development, their capacity for improvisation, and their organizational readiness.



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Keywords: higher education institutes; digital learning; sustainable development; digital transformation; e-learning; blended learning

1. Introduction

For higher education to be in line with global sustainability goals, a shift in policy, curriculum, and practice is necessary worldwide in higher education for sustainable development [1]. Institutions of higher learning are essential to the pursuit of a sustainable future. The integration of sustainable development into higher education has increased in the past decade [2,3], and the influence of sustainable development education (SDE) research has increased significantly. Studies have investigated how universities and colleges in various countries address the issue of sustainability and maybe alter their curricula across multiple disciplines. There must be tremendous effort from both educators and students in this regard [4]. Teachers must be technically proficient in inter- and trans-disciplinarity. On the other hand, students must become aware of their role and responsibility toward society [3,5]. Due to fast development, higher education has a difficult time keeping up with the social context of modern society. Educational institutions perpetuate unsustainable learning

and practices [4]. That emphasizes how important academics are to making sustainable decision-making. It is highly recommended for higher education institutions to embrace sustainable practices to prioritize research and development to ensure sustainability and social welfare [6].

Saudi Arabia, like other countries, has established many strategies and initiatives to support 17 sustainable development goals. Saudi Arabia's 2030 vision acknowledges the technological dimension of the Sustainable Development Goals (SDGs) and the role of technology in accomplishing the SDGs [7]. In addition, Saudi Vision 2030 is an ambitious development plan focusing on labor-market skills, higher education promotion, and curriculum development [8]. Furthermore, Saudi Vision 2030 is to improve educational measures on a global scale and to encourage people to define their work. 'University rankings should include the top two hundred universities worldwide' [3]. The higher education institutes are a vital part of the sustainable development goals of Saudi Arabia, and the government is keen to adapt the sustainability measures in universities in this regard [9]. Higher education institutes in Saudi Arabia have simultaneously adopted considerable e-learning and digital transformation projects geared toward sustainable development.

However, with the continued educational process during the COVID-19 pandemic, Saudi Arabia universities have suspended traditional face-to-face classes and shifted to online learning. The rate at which the transition to online learning has occurred has been unprecedented and overwhelming [10]. According to Alammery et al., [10], the lack of preparedness among institutes, teachers, and students for online learning has resulted in significant challenges during COVID-19. Given that many teachers at all levels of education are technologically illiterate, the sudden shift to e-learning has made it more difficult for teachers and students to adjust to the new mode. In addition, the COVID-19 pandemic has tested professors and students in terms of their readiness to embrace and implement digital technologies in their online learning activities [11]. Consequently, educational institutions and students throughout the COVID-19 period were forced to deal with advanced online information and communication technology to follow up on their tasks and carry out daily learning activities, while maintaining social distancing protocols [12]. However, after the advent of COVID-19, academic institutions were more open to digital learning. Digital learning has increased in popularity, and hybrid learning practices were adopted in Saudi Arabia during COVID-19. Such developments have transformed the opportunities for learning both for students and teachers [13].

Given this background, this paper aims to study the impact of digital learning on sustainable development in the higher education institutions of Saudi Arabia post COVID-19 by highlighting the educational processes followed during the pandemic. Additionally, we analyze the obstacles and prospers of digital learning in Saudi higher education institutes. On the other hand, this study helps us to understand the current state of knowledge and education in universities. Furthermore, understanding how to enhance the examined state based on the recommendations presented in this study is critical.

2. Research Methodology

This research has used the PRISMA Statement 2020 to include and exclude articles from the current investigation. The PRISMA Statement includes reporting criteria for the literature search component and is the most often utilized set of reporting recommendations for systematic reviews. At the end of July 2022, a thorough online search was conducted on Scopus and Web of Science. These databases have been chosen because of the many updated articles, book chapters, and review papers. The period under consideration was from 2011 to 2021, considering the most recent reports with studies on digital learning [14]. The databases thoroughly analyzed the records to select suitable relevant for the study. The search was made using several queries containing the terms "digital learning", "higher education institutions", "sustainable development", and "Saudi Arabia". The criteria for this study's selection were the following: (a) studies about digital learning in higher education; (b) there were also restrictions on language (only English).

Moreover, the papers need: (c) to have to full-text available, and (d) to be published after 2011. More specifically, the new research and trends in higher education selection were based on the first criteria of keywords: “digital learning” and “higher education institution”, resulting in 555 articles. The second criterion discipline resulted in 322 articles published as criteria 201. The fourth stage in PRISMA statement criteria is regarding the type of publication, and all were excluded besides the review articles (6), book chapters (5), and the research articles (93), resulting in a total of 104 pieces (Figure 1). Finally, the fifth criterion was based on scientific papers resulting only from Saudi Arabia in 42 articles to be analyzed. Figure 1 illustrates the PRISMA statement 2020 selection and rejection criteria.

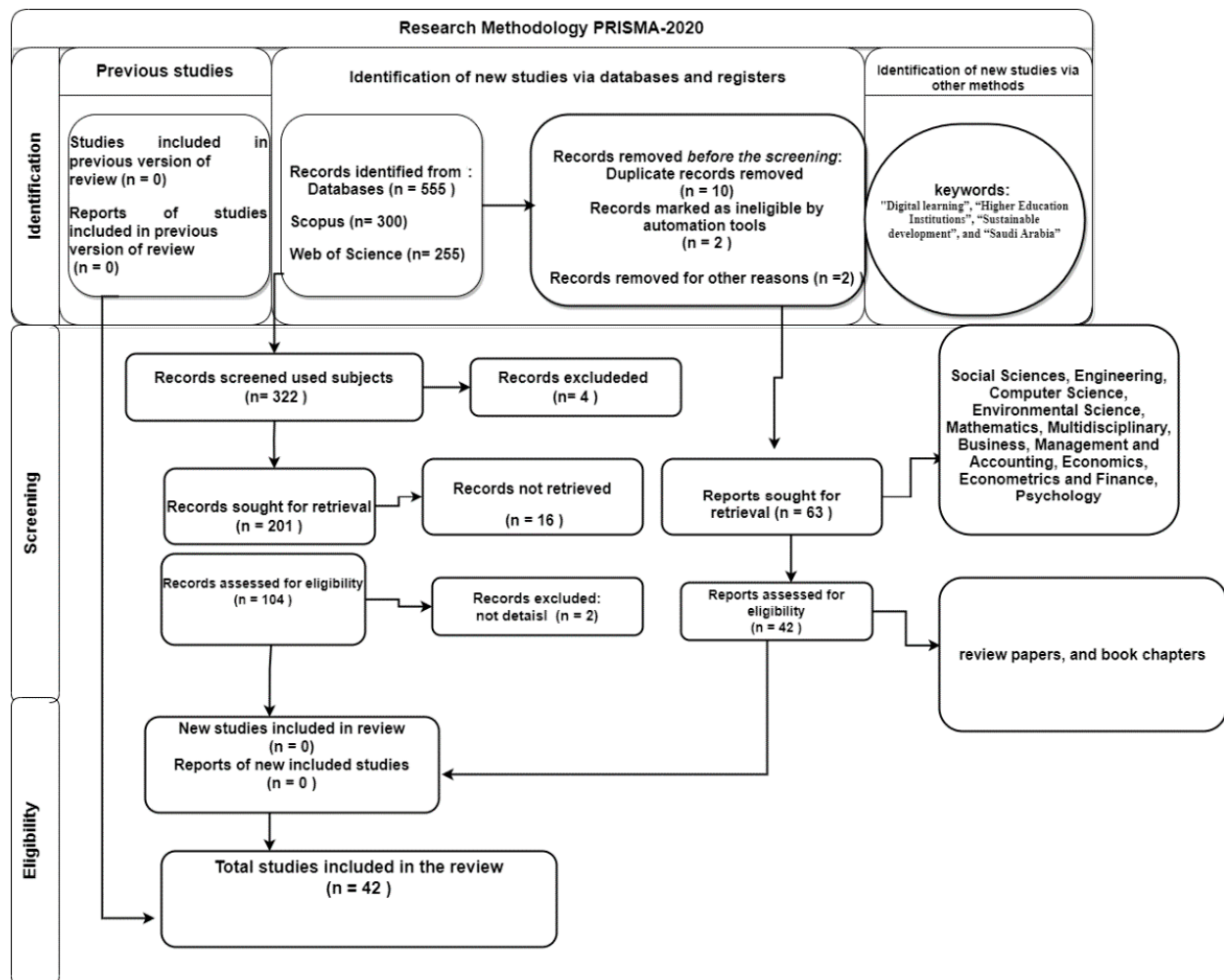


Figure 1. Research methodology using the PRISMA 2020.

Most of the selected digital learning and sustainable development documents in Saudi higher education institutes followed the robust selection criteria for the current study. Figure 2 highlights the perspective of analysis based on document type contributions. The significant contribution of the article (79%), review articles (12%), and book chapters (9%), are presented in Figure 2.

In addition, the subject criteria used for the extraction of records for the data analysis part, social sciences, engineering, and computer sciences, are significant areas that contributed to the current study. On the other hand, Figure 3 illustrates the number of low articles selected from mathematics, multidisciplinary, business, management, accounting, economics, and psychology.

The selected articles published between 2011 and 2021 are shown in Figure 4. Most papers were published between 2020 and 2021, and few reports were published from 2011

to 2021. This shows that each year number of publications is increasing, indicating the growing interest of higher education institutes in digital learning in Saudi Arabia. The COVID-19 pandemic is a triggering factor for digital learning. Figure 4 illustrates the number of articles selected each year.

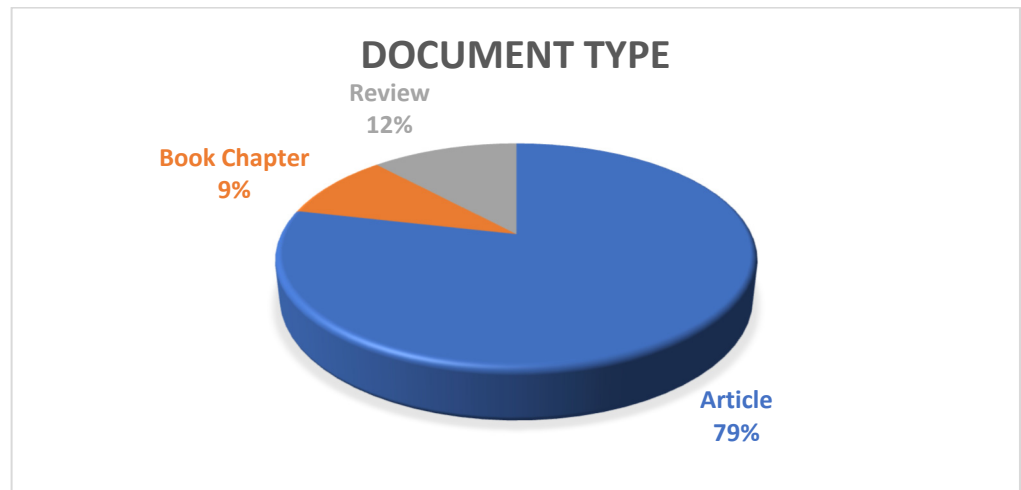


Figure 2. Distribution of documents (articles, reviews and book chapters).

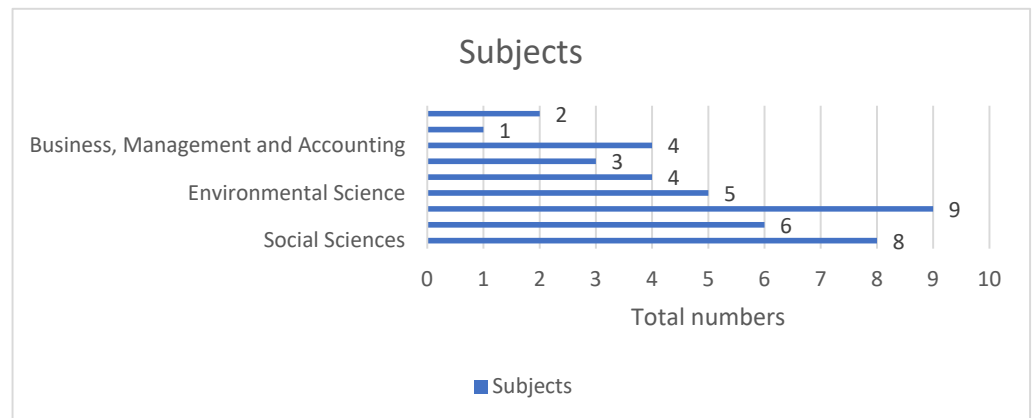


Figure 3. Distribution of documents from each subject.

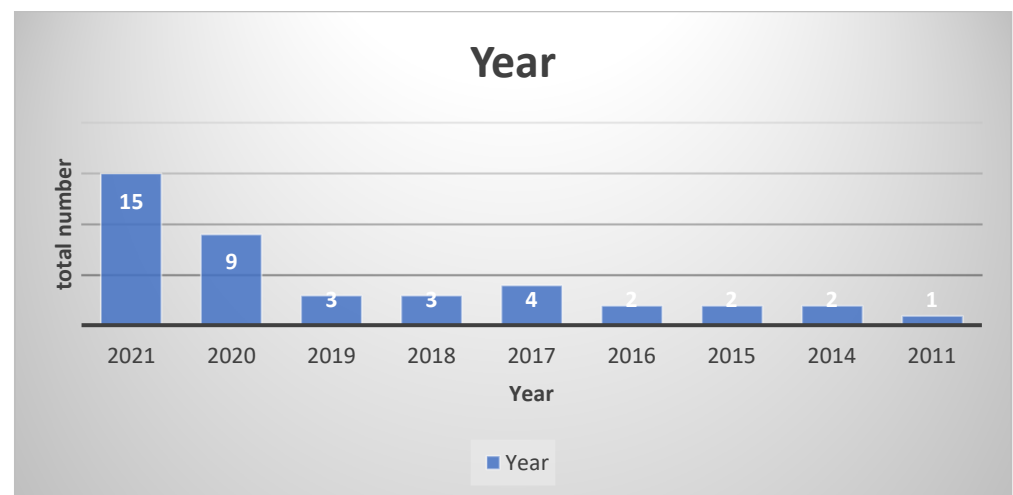


Figure 4. Distribution of documents from each year.

Additionally, the source-based publication analysis for the current study reveals that Sustainability (Switzerland) contributed the most publications, seven, with an average of 23% citations. Second, with four publications and 21% of all sources, IEEE Access, is where most articles are chosen. The names of the previous studies are gradually being removed from the current study, and additional critical contributions are highlighted in Table 1 with the title of the source, the number of publications chosen, the number of times cited, and the average number of citations each time.

Table 1. Source titles, number of articles cited, and average citations.

Source Title	Number of Articles	Cited by	Average Citations
Sustainability (Switzerland)	7	105	23%
IEEE Access	4	96	21%
Virtual Reality	2	65	15%
TechTrends	2	58	13%
Educational Technology Research and Development	3	30	7%
Higher Education Research and Development	3	30	7%
European Journal of Innovation Management	2	15	3%
E-Learning and Digital Media	1	11	2%
Computers in Human Behavior	2	10	2%
Frontiers in Psychology	2	9	2%
Education and Information Technologies	2	7	2%
International Journal of Emerging Technologies in Learning	2	7	2%
Expert Systems with Applications	2	5	1%

In parallel, we assessed how Saudi Arabia's higher education institutions contributed to digital learning for sustainable development. The institutional contribution to the adaption of digital learning tools depends on this process. King Faisal University and King Abdulaziz University are at the top of the list of significant assistance. Figure 5 highlights the contributions made by Saudi Arabian institutions to sustainable development and digital learning after 2011. In addition, Prince Sultan University, King Saud University, and Al Qassim University, also contributed excellent articles. However, there is still a dearth of top-notch research conducted by Saudi Arabia's leading institutes.

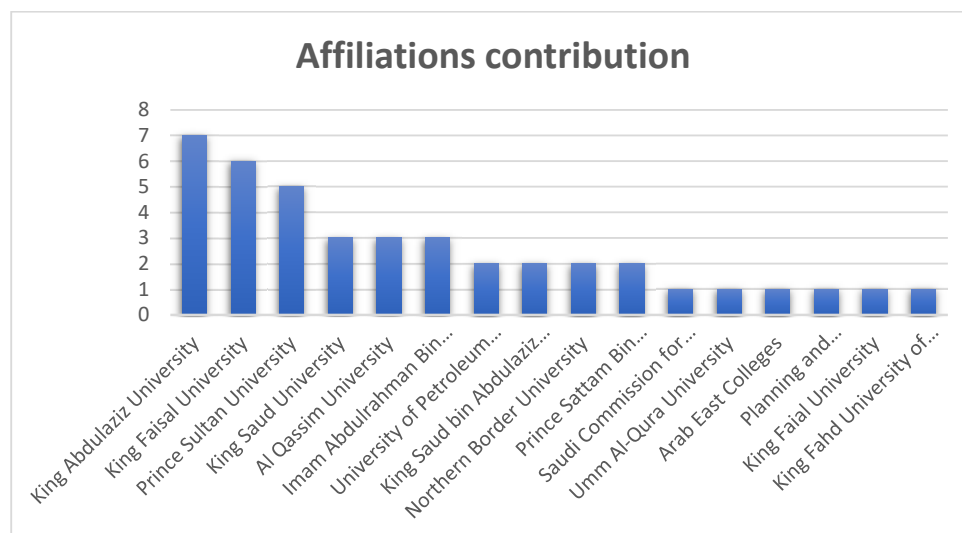


Figure 5. Distribution of documents from each institution in Saudi Arabia.

3. Review of Literature

E-learning is expanding continuously in higher education institutes, and researchers are looking deep into these digital transformation changes step by step. The current study evaluating e-learning efficiency for the higher education sector in Saudi Arabia uses different digital technologies in the educational development era. A further classification of literature drives the published literature and researcher perspective toward e-learning adaptation in Saudi Arabia universities. We identified the occurrences of e-learning, digital transformation, and higher education sustainability to identify the most frequent keywords used in the studies. As mentioned above, there were 42 studies included in the keywords at literature review stage 1; further, these studies were used to identify the literature classifications from these keywords. Table 2 depicts the keywords occurrences, occurrences, and total link strength.

Table 2. Keyword occurrences and total link strength.

Keyword	Classification	Occurrences	Total Link Strength
digital transformation	digital transformation	6	27
artificial intelligence		4	29
machine learning		4	21
digital learning		4	18
augmented reality		3	12
big data		3	12
digital literacy		2	13
technology integration		2	10
digital technology		2	9
big data analytics		2	8
sustainability		2	8
e-learning		e-learning	12
distance learning	4		22
learning analytics	4		18
online learning	3		17
learning management system	3		13
Gamification	3		11
Internet	2		14
Programming	2		12
engineering education	2		11
online education	2		11
eLearning	2		9
technological pedagogical content knowledge	2		9
blended learning	2		7
Entrepreneurship	1		11
Innovation	1		11

Table 2. Cont.

Keyword	Classification	Occurrences	Total Link Strength
higher education	higher education	23	98
COVID-19		12	63
education		6	33
COVID-19 pandemic		4	21
instructional design		3	12
classification		2	10
m-learning		2	10
Saudi Arabia		2	8
special needs		2	8
student engagement		2	8
systematic review		2	7
lifelong learning		2	6
teaching/learning strategies		2	6
pyramid (bop), people		1	11
e-services		1	11

A more in-depth investigation of the records using content analysis was performed to establish and validate the research’s categories. The published literature is examined using the VOS Viewer software, which groups the text’s data into clusters based on related themes. According to a recent study, keywords used by researchers and those added later in the databases’ indexation of journals are both relevant for bibliometric analyses to identify the structures of an investigation’s field. We used both keywords for the co-occurrence analysis within the research domain related to e-learning. The study included 42 documents, and the data contained 53 keywords. We carefully considered and selected only the 42 keywords that appeared at least 10 times. The results of the content analysis are displayed in Figure 6. The group said four significant clusters in Figure 6 in different colors. Research related to higher education, m-learning, and big data is shown in the yellow cluster. In addition, the blue color indicates digital transformation, blended learning, and online education. Finally, the green collection represents COVID-19, machine learning, and e-learning. The detailed key-term occurrences and classification tailored for the current investigation are shown in Figure 6. The supplementary files of the articles are uploaded in the publication website.

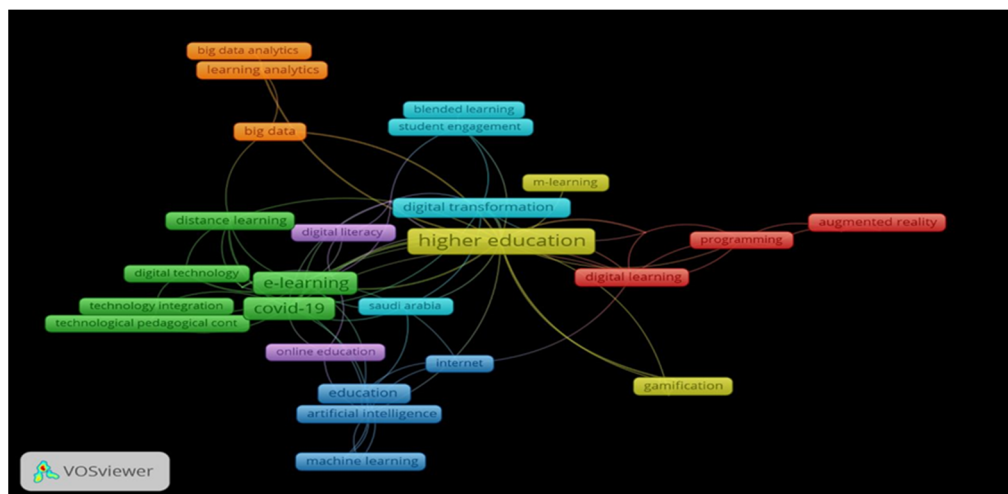


Figure 6. Distribution of data streams.

4. Classification

4.1. Higher Education

Saudi Arabian society is undergoing fast educational growth impacting all facets of daily life. Technology is being pushed as a significant enabler and driver of future Saudi change by Saudi Vision 2030 [15]. According to Hishan et al., 2021 [16], as a result, higher education competencies are given much attention, and instructors in Saudi Arabia are being asked more and more to incorporate information and communication technology (ICT) into their lessons. In this light, technology in the classroom has become an essential component of the Saudi Arabian educational system. In addition, the recent fast advancements in digital technologies have produced a variety of new opportunities and problems in delivering the learning experience. A digitally aware generation's need for an interactive experience that has a much more significant impact than traditional textbook learning is forcing the higher education system to adapt to a new role [17]. According to the findings of Park, 2020 [18], higher education is undergoing a wide range of digital transformation initiatives, from digitizing academic records to adopting digital tools like LMSs (Learning Management Systems), interactive whiteboards, and other e-learning application tools in university courses. However, it goes beyond merely making use of cutting-edge equipment. More significant and in-depth changes and rising demand may include several facets of learning. Despite the initial resistance to new technology brought on by constant change, we are compelled to maintain and adopt this most recent trend [19]. Additionally, recognizing the most recent challenges or trends in research on teaching and learning in higher education has a specific significance since it allows researchers to reflect on current and past studies and seek out acceptable routes for the future of education (Fayoumi et al., 2020) [20]. Table 3 is illustrating the details of authors, citations, settings, and segments extracted from the literature.

Table 3. Details of authors, citations, settings, and segments.

Authors	Cited by	Settings	Segments
Bensaid & Brahim, 2021 [21].	32	Industry 4.0	sustainable development
Syed et al., 2021 [17]	58	Online learning	Educational imperialism
A. M. Al-Abdullatif, 2019 [15]	30	Flipped classroom	Video/digital materials
Mehta R et al., 2018 [22]	16	Learning analytics	Student attrition
Al-Abdullatif A.M 2020 [23]	11	Big data	Teaching and learning
Almohammadi K et al., 2020 [24]	10	Data mining and decision-making	Artificial intelligence (AI) techniques
Alzaidiyen N.J et al., 2021 [25]	7	COVID-19	Education business
Al-Abdullatif, 2020 [26]	7	Information and Communication Technologies (ICT)	Learning Management System (LMS)
Badwelan, 2019 [27]	5	Pre-service teacher	Technological knowledge
Kumar et al., 2011 [12]	5	Personal Digital Assistant	University students' attitudes

However, without paying specific attention to the social settings and ideological commitments that support and shape how these technologies are embraced and used in higher education, the growth of learning technology will not continue to influence personalization [28]. These techniques constantly improve institutions' and teachers' abilities to track students' academic development. Therefore, improving "data-driven techniques" is crucial for personalizing higher education [29]. Since learning analytics and personalized learning are still growing and gaining acceptance throughout higher education, the attitude of the students and teachers toward utilizing technology for educational purposes determines how well it will be adapted [25]. According to Alblawi and Alhamed, 2018 [30], attitude is crucial in technological integration. The significance of perspectives on technical acceptability is well documented in a large body of literature.

Additionally, with the acceptance of technology, users' adoption of a wide range of technical improvements has been recognized as strongly predicted by users' attitudes about innovations [21]. However, [31] suggest that when adopting individualized learning, students' preparedness for higher education might be a barrier in and of itself. To successfully exploit such a learning environment, they must receive proper training. Technology-related competencies, communication skills, and abilities for self-education and self-mentoring must all be included in the preparation process. In addition, to successfully adopt personalized learning, its supporting technological models, and other technologies such as Web 4.0, teachers must also be prepared and undergo training [32]. This is a problem for many colleges since it calls for a unique mix of technological abilities and competencies, educational strategies and modes, and other related skills, such as networking, communication, and virtual teaching and mentoring. Universities must build a technical infrastructure to support cutting-edge teaching methods [33].

4.2. E-Learning

E-learning programmes have gained international recognition as effective learning aids for higher education. Since conventional education (face-to-face) was abruptly forced to relocate online owing to the COVID-19 pandemic, there has been minimal growth in the number of e-learning systems providing various types of services, demonstrating the relevance of e-learning in higher education. As a result, the evaluation of e-learning systems is essential for their successful usage and deployment [34]. In addition, e-learning systems in education provide several benefits, including instant access to course materials and information, communication, collaboration, and various learning methods based on student needs. Further research is made possible by using new technological advancements in higher education (Hanif et al., 2018) [35]. Additionally, the accelerated development of e-learning in Saudi Arabia is due to several factors. One of them is a massive gap between the demand and supply for education, which forces many educational institutions to deal with overcrowding and inadequate facilities to deliver the conventional teaching style. E-learning is suitable for solving these difficulties (Education and 2020) [36].

E-learning and distance education have extended access to higher education during the past 10 years. Nearly all higher education institutions now incorporate e-learning modules within their regular curricula. As an alternative, higher education institutions have expanded their campuses, labs, and educational facilities to support online and distance study [37]. At the same time, with the findings of Yamani, 2021 [22], the Saudi government has offered Internet services to allow users to access ICT services in 19,351 remote locations, including rural areas, increasing the number of Internet users in Saudi Arabia. Saudi Arabia is also one of the top nations for information and communication technology development, coming in at number 48 internationally. According to Saudi Arabia's Vision 2030, all these technological advancements in information and communication technology services have made the country one of the most digitally connected nations in the world (Mehta et al., 2021) [38]. However, digital, and lifelong learners, are rapidly putting pressure on educational institutions to adopt new teaching and learning paradigms, even as the economic viability of higher education institutions (HEIs) is threatened by the ongoing global economic downturn (Mehmood et al., 2017) [23]. In this historically innovative and competitive period, the future of higher education and education, in general, is uncertain. To spur global economic growth, there is a clear and pressing need to alter the teaching and learning environment (A. Al-Abdullatif et al., 2020) [26]. Table 4 illustrates the details of authors, citations, settings, and segments extracted from the literature.

Table 4. Details of authors, citations, settings, and segments.

Authors	Cited by	Settings	Segments
Yamani H.A. 2017 [22]	96	Higher education institutions	eTeaching
Alamri H.A et al., 2021 [28]	47	Medical education	Learning Management Systems (LMS)
Alblawi A.S & Alhamed A.A. 2021 [30]	28	Higher education	COVID-19 outbreak
Jun, W et al., 2015 [39]	19	Game-based learning	Higher education institutions
Abirami et al., 2021 [40]	15	COVID-19	Teaching and learning
Alenezi A.M. 2020 [36]	12	Students' emotional intelligence	Online education
Park Y.-E. 2014 [18]	11	E-content	Higher education
Mystakidis S et al., 2021 [41]	9	COVID-19	Online teaching competencies
Fayoumi A.G & Hajjar A.F. 2021 [20]	6	Computer-Supported Collaborative Learning	Students learning styles
Al-Otaibi H.M et al., 2021 [24]	5	Online education	Research
Akram H et al., 2017 [42]	5	Linguistic uncertainties	Adaptive learning environment
Alenezi A. 2020 [36]	5	Undergraduate students' knowledge	Digital literacy
Omar A& Almaghthawi A. 2014 [43]	5	COVID-19	Blended learning
Alrashidi M et al., 2019 [24]	55	Teaching and learning	Mobile learning

Although there is growing evidence that online education is just as effective as traditional on-campus instruction, there is little data on what works in the context of Saudi Arabia [44]. In the recent pandemic, every government had to keep using distance learning because of COVID-19's long-lasting effects. As a result, universities started using online courses in 2020, either fully or partially (blended) [45]. Through online learning, students can pick up knowledge and information whenever it suits them. Although there is evidence that students feel less engaged in remote learning, which involves more work from their teachers, it does help students feel less reluctant and bashful to ask questions (Shorfuz-zaman et al., 2019) [46]. In addition, the competencies and skills were initially complex for teachers and students. According to the findings of [42], teaching is characterized by selecting various techniques for a specific topic, which may involve lesson planning or instructional and learning materials. Without the necessary competencies, teachers find it challenging to execute and arrange online instructional programmes efficiently; in addition, operating specific technologies requires technological knowledge, which is essential for incorporating technology into the teaching and learning process. Teachers that effectively integrate technology into their pedagogical approaches will produce excellent online learning [47].

4.3. Digital Transformation

The acceleration of higher education's digital transformation must consider the effects of COVID-19. According to [43], there has been a digital transformation in most innovation and change processes utilised by institutions and organizations because of its benefits boosting workflow effectiveness and minimizing mistakes, improving performance, productivity, and quality consumer contentment. Additionally, education and research are impacted by several characteristics of the higher education environment. These include: the rise in global university rankings; nationwide declarations that their universities are of the highest caliber; the creation of regional control and reform structures; the emergence of international standards for quality assurance; and the internationalization of higher education institutions [41]. Although successfully deploying digital transformation data

governance policies, processes and procedures must be created and implemented. Despite the gravity of the topic, little data analysis has been conducted within higher education institutes in Saudi Arabia and universities, as well as educational institutes [40]. In the context of Saudi Arabia's higher education institutes, the digital transformation capacity, improvisational capability, and organisational readiness have a significant and favourable association with improving higher education performance [39].

Furthermore, learning due to digital platforms and devices has rapidly grown in Saudi higher educational institutes in recent years. As a result, several of the nation's governmental and educational institutions are investing in mobile learning, in line with the Kingdom 2030 Vision of developing a knowledge-based economy that looks beyond oil [48]. According to [27], mobile technology has benefited global learning. Therefore, it is not unexpected that higher education institutions worldwide are spending money on developing and enhancing online tools for intensive learning to advance and preserve the necessary student knowledge and abilities. According to Iqbal and Bhatti, 2016 [49], higher education is ideal for incorporating student-centered mobile learning due to the quick uptake of mobile technology in university environments, including portable devices and wireless networks. In addition, the stakeholders' perspectives, and involvement, including students, teachers, university management, and support staff, are crucial to the success of m-learning in the educational context [24]. In addition, the findings of Al-Otaibi et al. (2016) indicate that the relatively inexpensive cost of these devices is one of numerous, it is claimed, that is responsible for the popularity of mobile phones. That suggests that to incorporate mobile-assisted language learning (MALL) into their teaching environment, teachers or institutions are not needed to give students sophisticated, expensive equipment or installations. Table 5 illustrates the details of authors, citations, settings, and segments, extracted from the literature.

Table 5. Details of authors, citations, settings, and segments.

Authors	Year	Cited by	Settings	Segments
Mehmood R et al., 2019 [23]	2019	65	VR/AR technologies	Human–computer interaction
Macleod H et al., 2021 [31]	2021	21	Information and communications technology	Sustainability at Saudi universities
Shorfuzzaman M et al., 2022 [46]	2022	16	Industry 4.0	Artificial intelligence
Ibrahim N.K et al., 2020 [44]		15	Digital platforms capability	Organizational readiness
Hanif A et al., 2021 [35]	2021	12	Handwriting recognition	Artificial neural network (ANN)
Iqbal S & Bhatti Z.A. 2018 [49]	2018	9	Education intelligence	Universities and governments
Al-Adwan et al., 2020 [34]	2020	8	COVID-19	Higher Education system
Zawacki-Richter O et al., 2017 [37]	2017	8	Behaviors and actions	Pedagogical virtual machine
Nanehkaran et al., 2014 [50]	2014	11	From the Ancient to the Modern Tablets	3D immersive eLearning
Bamiah M.A et al., 2021 [51]	2021	5	M-learning	Privacy and gender segregation in education

In addition to its two traditional responsibilities of research and teaching, higher education has a responsibility and a crucial role to play in redefining education for sustainability. On the other side, access to resources has become much simpler thanks to technology for people worldwide, and in the country. Technology-assisted education has been proliferating [52]. Nowadays, it is widely understood that higher education and sustainability are two intertwined concepts [50]. According to [53], sustainability and higher education are now understood to be closely related ideas. Higher education has a responsibility and an essential role in redesigning education for sustainability in today's

culture, in addition to its two conventional duties of research and teaching. Contrarily, technology has greatly facilitated access to resources for people throughout the nation and the globe [50]. A new pedagogy that needed to incorporate digital platforms in the teaching process for better comprehension resulted from adopting and using educational technology in nations' educational systems in the COVID-19 era [51].

5. Discussion and Conclusions

This research operated a systematic review of the extant literature intending to understand digital learning's effect on the sustainable development of the higher education institutes in Saudi Arabia. The current study also assesses the current pandemic situation, which nearly altered the entire educational paradigm in both developed and developing nations. For the data extraction, we used two well-known databases, Scopus and Web of Science. Finding the appropriate records for the current study was the goal. Additionally, we used the PRISMA Statement 2020 to determine which documents to include and exclude because social science researchers frequently employed this approach [54]. The top 42 articles from a respected journal were chosen for the piece. In the following stage, three main themes were selected from the literature and classified using the VOS viewer key terms occurrences and content analysis.

Furthermore, the classification of literature is divided into three major data streams higher education, e-learning and digital transformation. The results of the data evaluation state that Saudi Vision 2030 is an ambitious development plan focusing on labor-market skills, higher education promotion, and curriculum development. Saudi Arabia is strongly committed to achieving the 2030 Sustainable Development Agenda through innovative approaches to bring the 2030 agenda closer to Saudi Vision 2030. As a result, higher education competencies are given much attention, and Saudi Arabian instructors are being asked more and more to incorporate information and communication technology (ICT) into their lessons [16]. The higher education sector is undertaking a broad spectrum of digital transformation projects, from digitizing academic records to implementing digital tools such as LMSs (Learning Management Systems), interactive whiteboards, and other e-learning application tools, in university courses. However, employees' resistance to the e-learning transformation in higher education institutions was caused by a lack of ability and skills to manage the change [55]. Despite the initial resistance to new technology brought on by constant change, we are compelled to maintain and adopt this most recent trend [19].

The recent pandemic outbreak for higher education institutes in Saudi Arabia brought significant changes. Results indicate that E-learning programmes have gained recognition as effective learning aids for higher education. Since conventional education (face-to-face) was abruptly forced to relocate online owing to the COVID-19 pandemic, there has been minimal growth in the number of e-learning systems providing various types of services, demonstrating the relevance of e-learning in higher education [53]. However, the findings of Shorfuzzaman et al., (2019) [46], show that remote learning requires more effort from the student's teachers and results in lower student engagement; it does make students feel less reluctant and shy to ask questions. On the other hand, research demonstrates that teachers find it challenging to plan and carry out online instructional programmes effectively without the required competencies. In addition, using specific technologies requires technological knowledge, which is crucial for integrating technology into teaching and learning [27,43]. Figure 7 below is depicts the outcomes from the literature.

Furthermore, findings demonstrate a substantial and positive relationship between higher education performance and Saudi Arabia's higher education institutions, as well as their potential for digital transformation, their capacity for improvisation, and their organizational readiness [24]. In addition, higher education has a commitment and an essential role in reframing education for sustainability in addition to its two conventional duties of research and teaching. On the other hand, technology has made it much easier for people domestically and outside to access resources. Technology-assisted learning

has become increasingly common in Saudi Arabia for sustainable development. Finally, the findings indicate that the adoption and use of educational technology in countries' educational systems during the COVID-19 era led to the development of a new pedagogy that required the integration of digital platforms in the teaching process for improved comprehension.

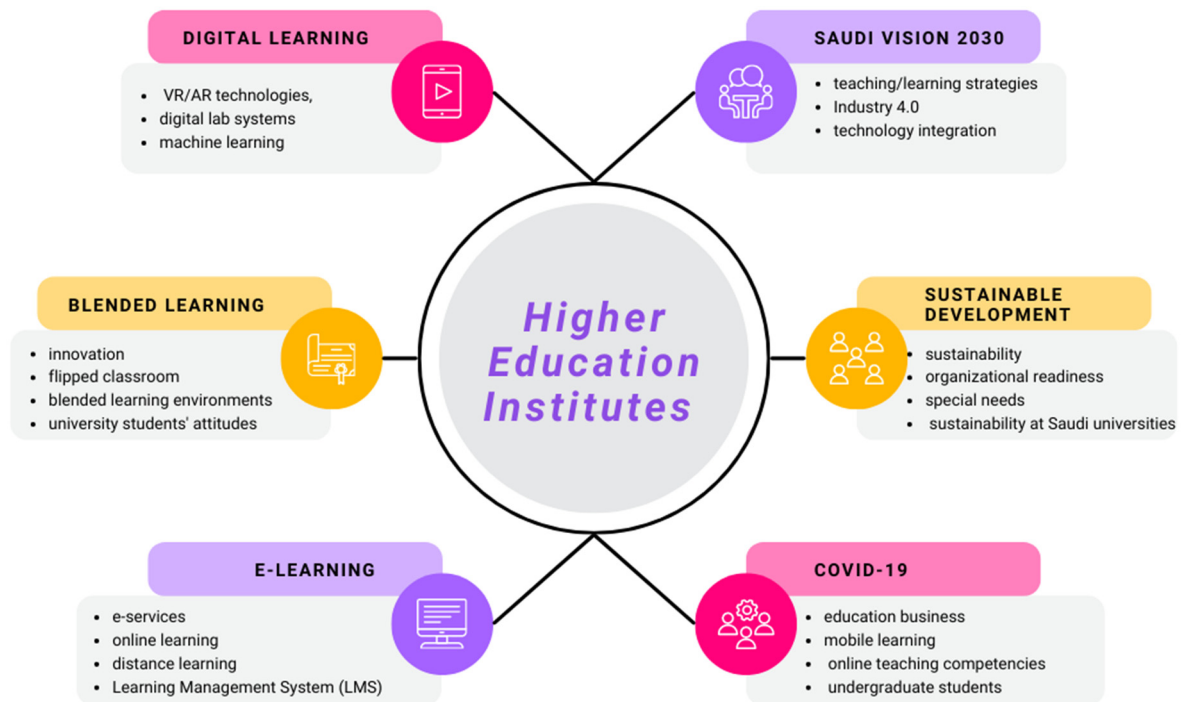


Figure 7. Study outcomes based on findings.

6. Practical Implications and Future Agenda

This study validated digital learning in Saudi higher educational institutes for sustainable development and presented data on using digital knowledge for academic growth. The study acknowledges the significance of digital transformation in the acceptance and efficient use of e-learning resources, which will enhance the long-term development of Saudi Arabian universities. Furthermore, there is a skills and capability gap between current technologies and future talents that must be bridged in Saudi universities for blended learning mitigation. Another contribution of the present study examines the impact of the COVID-19 pandemic on Saudi Arabia's higher education institutions; in recent years, very few scholars have read this important topic. One of the critical areas of the Saudi 2030 Vision is the sustainable growth of higher education institutions. The current study shows the capabilities and requirements for digital transformation for the sustainability goals of higher education institutions.

Additionally, the size and sample size employed in research is typically one of its difficulties. The researchers in this paper acknowledged the study's low sample number and size. Due to the limitations, this work's findings must be produced with caution. We challenge upcoming researchers to confirm the study using more extensive records to help generalize the results.

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