BALTIC JOURNAL OF LAW & POLITICS
A Journal of Vytautas Magnus University
VOLUME 15, NUMBER 7 (2022)
ISSN 2029-0454

Cite: *Baltic Journal of Law & Politics* 15:7 (2022): 1237-1250
DOI: 10.2478/bjlp-2022-007091

Independence in E-Learning, Education Management, and Industry 4.0 During COVID 19

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Received: October 16, 2022; reviews: 2; accepted: December 23, 2022

Abstract

In the last few decades, different technological advancements have also influenced the education sector, effectively promoting the implementation of e-learning strategies. During Covid-19, promoting these strategies has proven to be efficient in improving the communication gap between teachers and students, leading to a productive learning environment. However, in the past few years, more focus has been given to the significant impact of Industry 4.0 technologies in this regard. These technologies are vital in creating an innovative and autonomous learning environment for students. Therefore, almost no past study focused on the impact of Industry 4.0 facilities on e-learning. Thus, the main aim of this quantitative study was to determine the impact of education management and Industry 4.0 facilities on e-learning in the education sector in Indonesia during covid-19. For this purpose, a questionnaire-based survey method was used, data was collected from 213 respondents from different universities in Indonesia, and statistical analysis was conducted. The results obtained from this study showed that education management and Industry 4.0 facilities significantly impact e-learning.

Keywords

E-learning; Industry 4.0 Facilities; Education Management; Covid-19; Indonesia

1. Introduction

A major viral pandemic outbreak, a natural disaster, COVID-19, occurred, disturbing the health industry and education. For instance, SARS wreaked havoc on several countries worldwide in 2002. Traditional face-to-face teaching was

outlawed in some parts of China to combat the virus (Nhongo & Siziba, 2022). According to UNESCO, as of March 25, 2020, schools worldwide closed for the COVID-19 period were getting ready to prevent 1,524,648,768 children from engaging in regular academic activities. Substitute strategies, such as e-learning at home, were used to maintain uninterrupted instruction. Learners must be prepared to excel in 21st-century abilities to solve problems enthusiastically to thrive in the uncertain and challenging world. E-Learning is an excellent opportunity to support students' active learning at home during the period of disruption to the learning process (Huang et al., 2020).

Regarding psychological prowess and sentiments for other people and human nature, the success of education depends on the learning process. Hence quality service management is necessary for a successful learning process (Sagala, 2013). The Indonesian government has traditionally given the education industry more attention. This is demonstrated by the fact that the government has mandated several policies in the area of education, including the allocation of 20percentage points of Indonesia's State Revenue and Expenditure Budget (APBN) for the field, scholarships for those from disadvantaged backgrounds, and initiatives aimed at raising educational standards.

With prudence, internet education can be used in developing nations (Basilaia & Kvavadze, 2020). There are still a lot of places in Indonesia where the internet is not accessible. Only some people have the resources necessary for online learning. The cycle of internet adoption is hampered by the need for more access to quick, dependable, and moderately priced web associations, especially for people living in rural areas and other provinces remote from developed capital cities (Wains & Mahmood, 2008). Personal web access knowledge is noteworthy because, as we all know, COVID-19 arguably arrived without enough time for us to prepare and fast adjust. In this epidemic, people who ordinarily receive instruction before beginning something must begin something while also learning how to comprehend without such training. According to Agustina and Cheng (2020), an exploratory study looks at how Indonesian junior high school students see taking classes while dealing with the Coronavirus (COVID-19). We surveyed secondary students to learn what they thought of Indonesian online education. The study's findings showed that digital learning could not produce desired results in developing countries like Indonesia, where most students cannot use the internet due to technical and financial concerns. Understudies in advanced education also had concerns with reaction time, lack of eye contact with the teacher, and participation in traditional homeroom socialization.

An educational ecosystem that supports the development and growth of reasoning, character, inventiveness, freedom, relaxation and student competence is created during the learning process. In the Industrial 4.0 era, the freedom to learn creates superior or quality resources to fulfill educational possibilities to develop the country and the State (Yamin & Syahrir, 2020). The education sector is the backbone of every country's development process and helps form a

foundation for it. The actual outcome of education is the development of human personality and intellectual level. In the present study, researchers focus on the evolution of E-learning during the covid-19 time and how this development affected educational management and industry 4.0 facilities. The government's strategy in responding to the industrial revolution 4.0 is quite clear if all Indonesian people support it. The generation with higher and updated knowledge of I.T. can help the development of a country in the present era of information technology. A plan termed "Making Indonesia 4.0" can be developed to bring about more effective transformation due to these opportunities and difficulties, which can also lead to additional employment and new technology-based investments.

2. Review of Literature

This section of the paper focuses on the independence of E-learning, the education system, and Industry 4.0 during Covid-19. The researchers analyze the impact of e-learning on educational and industrial development.

2.1. E-learning development during Covid-19

Web-based learning and training provided by electronic, internet-based resources like computers, mobile phones, or laptops are called e-learning (Gautam, 2020). This digital transformation has been vital in managing education systems and industries during Covid-19. Students and employees of any department can utilize their spare time at work while at home. This has become possible due to e-learning. It is the most diverse and formal form of teaching. When Covid-19 appeared, all gatherings and meetings were restricted to avoid spreading the virus. These days, e-learning ensured a lower risk of epidemic spread (Agustina & Cheng, 2020; Huang et al., 2020; Javaid et al., 2020). When e-learning replaced traditional teaching methods, potentially rich data was collected from students of different universities to understand their research better using various web means (Basilaia & Kvavadze, 2020; Hardiyanty et al., 2021). During Covid-19, most students were willing to study at different colleges and universities and needed some structure to their educational curriculum. The shift of educational institutes towards a web-based model allowed students to avail themselves (Eruchalu et al., 2021).

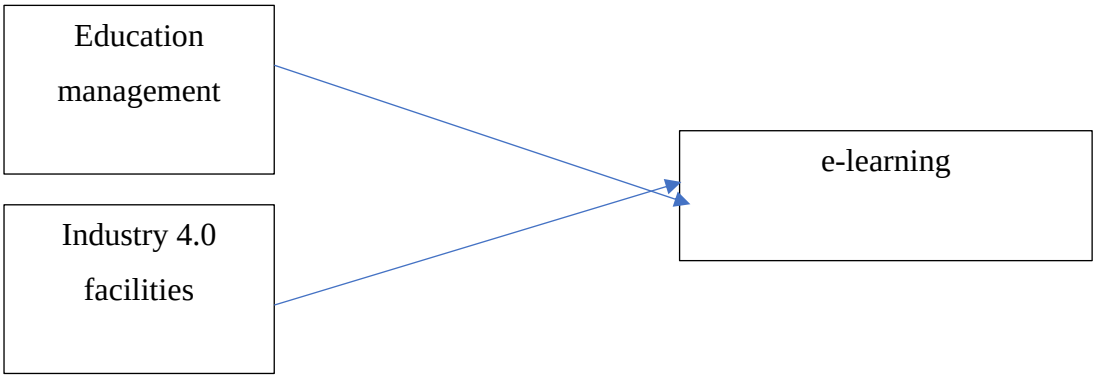

Figure 1: Theoretical Framework

2.2. Effects of E-learning on Education Management

In Indonesia, the government pays much attention to the education sector. Education is an unending way of building fundamental abilities and capabilities regarding the intellectual and emotional power of the human psyche toward others. If we say learning is the key to success, then we must consider the quality of education management for quality learning (Sagala, 2013).

Research conducted on Covid-19 and e-learning showed that the education department was severely affected during the epidemic. Colleges and universities were forced to close all their activities like conferences, ceremonies, graduation, workshops, etc. University administration was supported to work in lockdown and observe the Covid-19 protocols. Most institutions were introduced to digital education to continue the teaching and learning process. An online class-based teaching method was introduced on mobiles and laptops through either zoom call or Google meet (Hardiyanty et al., 2021). It was easy for the administration to carry forward a new schedule for classes, class leave, exam carrying system, and recording lectures for students' convenience. According to a recent study by Gautam (2020), many enjoyers of e-learning confirmed that the advanced teaching methods are much more interesting, time-saving, and easily manageable for tutors and learners. It also helped reduce a student's expenses and efforts while traveling or in regular learning. The digital transformation has remarkably provided convenience to teachers and students in administrative efforts, preparation, attendance, and recording lectures. It helps pursue the students' taking classes in difficult circumstances when they are not able to attend college and students become complacent learners (Chukwuemeka et al., 2021). However, there are some drawbacks to digital learning. The most important of these are students' reliability on only the theoretical part, while practical work needs to be included (da Motta Reis et al., 2020). There may be a misuse of technology while online examination plans or assessments (Gautam, 2020)

However, in implementing E-learning in the education system, teachers and administrators experienced many challenges, for example, a lack of resources, network connectivity issues, and less face-to-face interaction with students. Students could not go through practical or clinical work (Eruchalu et al., 2021). Teachers could only assess the student's knowledge-based capability. There needed to be more immediate responses from learners than the traditional method. Reports said some students misbehaved with the teachers, showed less attention, and misused online resources during assessment tests (Chukwuemeka et al., 2021).

Last but not least, E-learning while Covid-19 was flexible and effortless. Most faculty members assured me that e-learning had evolved the education system. E-learning must be looked for to achieve progress. However, it was never denied that e-learning has helped administration and managers to manage distance learning appropriately in less time (Martin, 2019). First, it was observed that e-learning has significant effects on education management. In alignment with the

outcome of (Haghshenas, 2019), the findings illustrated that e-learning helps in improving the communication skills of teachers and learners. It provides a productive environment for potential students. In this way, education management is essential as it influences e-learning programs.

Thus, based on these associations, it is proposed that education management impacts e-learning.

H1: There is a positive and direct impact of education management on e-learning.

2.3. Development in Industry 4.0 and e-learning

Revolution in the manufacturing, packing, and distribution of products is essential while talking about E-learning. During Covid-19, It was challenging to maintain social distance among workers and continue routine work. The technology industry found a route to keep people safe and healthy during a pandemic. They helped industries conduct video calls and conferences using telecommunication resources. They also helped citizens with the correct information and awareness of SOPs to combat the virus (Czifra & Molnár, 2020).

An educational ecosystem facilitates the growth and development of innovation and student expertise. So, we can say that the freedom of learning remarkably affects the industrial era 4.0. The ultimate aim is the development of the state and country (Yamin & Syahrir, 2020). The education system is the only source of better civilization in a country. The education department is associated with the revolution in industries. We know that economic change in any country also causes a change in the education system (Fairholm, 2013). Internet is widely used in every aspect, especially after Covid-19. It helps identify objects using virtual images. A complete interaction between e-learning and Industry 4.0 can be seen in Indonesia. For this purpose, the internet plays an important role in learning and concept building for theoretical and practical learning (Prihatmoko, 2016).

According to Perkins Coie's survey, 49% of business institutes tried to use V.R. to create a realistic image. Hence, education is the backbone of industries, which depends on one's behavior toward one's responsibilities regarding e-learning. The governmental strategies in the case of industrial revolution 4.0 are creating more opportunities for an innovative generation. There must be proof in all aspects (Martin, 2019).

They postulated that e-learning success was based on the development of industry 4.0. and findings by Eruchalu et al. (2021) provide evidence of the significance of the association. The industry has dramatically revolutionized e-learning. According to da Motta Reis et al. (2020), virtual concepts and physical learning systems have greatly affected students innovatively. Technological development benefits students' learning outcomes and increases self-determination as an efficient result for their professional aspects. Therefore, it is proposed that developments within industry 4.0 and the application of industry 4.0 technologies within educational institutes would increase the e-learning success.

H2: There is a positive and direct impact of industry 4.0 development on e-learning.

3. Methodology

Research methodology involves essential steps for gathering data and analyzing it adequately. It must align with the formulated objectives for the research study (Snyder, 2019). Therefore, the objectives of the present study focus on the deductive approach moving from general to specific reasoning as the present study focus on the impact of education management and industry 4.0 facilities on e-learning, so the research philosophy integrated into the present study was positivist. The study's explanatory nature and quantitative approach explain the cause-and-effect relationship between e-learning, education management, and industry 4.0 facilities.

3.1. Population and Sampling

The target audience is the population of a research study selected based on the developed research objectives (Gupta & Gupta, 2022). Therefore, the present study focused on the impact of education management and industry 4.0 facilities in education sectors in Indonesia, so the population of the present study was students from different universities in Indonesia. There are more than 3000 universities in Indonesia (Fernando et al., 2019), so it was quite hectic for the researcher to gather data from such a larger population, so random sampling was done, and a potential sample of 315 respondents was selected.

3.2. Data Collection Route

The data was collected via a survey method for the present quantitative study. For this purpose, a questionnaire was developed, including the demographics of respondents and important questions regarding the variables under study. Before distributing the questionnaires, the selected respondents were guided regarding the purpose of the study, and their written consent was taken. Later, 315 questionnaires were distributed online, 275 were received, which were later analyzed properly, and a final sample of 213 was selected for further analysis. However, the present study was cross-sectional due to limited time and resources.

3.3. Measures

The constructs of the present study were measured by using a "5-point Likert scale" ranging from "1 (strongly disagree) to 5 (strongly agree)." The following instruments were used for the variables under focus:

Table 1. Measures

Variables	**No. of items**	**Developed by/ adapted by**
Education management	6 items	(Ghilay, 2019)
e-learning	5 items	(Stefanovic et al., 2011)
Industry 4.0 facilities	6 items	(Motyl et al., 2017)

3.4. Data Analysis

Quantitative analysis was conducted for the present research study. For this purpose, different statistical techniques and tools were selected. Initially, inferential and descriptive statistics were determined using SPSS and AMOS software. The suitability of selected data was also determined utilizing the CFA, and finally, the structural equation modeling (SEM) technique was used to test the present study's developed hypotheses. This was an effective mechanism for determining the impacts of education management and industry 4.0 facilities on e-learning in the educational sector in Indonesia.

4. Results

4.1. Demographics of Respondents

The respondents' demographics for the present study are observed in table 2. It has been observed that the total number of respondents was 213. 53.1% of these respondents were male, while 46.9% were female. About 56.8% of these respondents were older than 35 years, whereas 24.4% were aged between 31 and 35 years and 16.4% were aged between 25 and 30 years, and only 2.3% of respondents were less than 25 years old. 29.1% of respondents had completed their intermediates, 39.4% completed their Bachelor's and 27.2% completed their Master, and almost 4.2% were enrolled in other courses.

Table 2. Demographics of Respondents

		Frequency	**Percent**
Gender	Male	113	53.1
	Female	100	46.9
	Total	213	100.0
Age	Less than 25 years	5	2.3
	25-30 years	35	16.4
	31-35 years	52	24.4
	More than 35 years	121	56.8
	Total	213	100.0
Education			
	Intermediate	62	29.1
	Bachelors	84	39.4
	Masters	58	27.2
	Other	9	4.2
	Total	213	100.0

4.2. Descriptive Statistics

The descriptive statistics for the present study include mean, minimum, and maximum values, standard deviation, and skewness, as presented in table 3. The mean value must be 3 or equal to 3 for significant outcomes. The total number of observations was 213, and the mean values for all variables were more than 3 showing significant outcomes. In skewness, the cut-off value must lie between -1 and +1, as observed in table 3.

Table 3. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
EM	213	1.00	5.00	3.7864	.81224	-.791	.167
EL	213	1.00	5.00	3.7709	.79604	-.781	.167
IND	213	1.50	5.00	3.6495	.65254	-1.002	.167
Valid N (listwise)	213						

4.3. KMO and Bartlett's Test

The value of KMO and Bartlett's test was found to be .814, which shows the accuracy of the sample size.

Table 4. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.814**
Bartlett's Test of Sphericity	Approx. Chi-Square	3799.705
	df	136
	Sig.	.000

4.4. Rotated Component Matrix (RCM)

Table 5 shows RCM for the present study. The minimum value must be 0.4, and the maximum value must be 0.8. Table 5 shows that the values of all variables were between 0.4 and 0.8, showing zero cross-loadings in the context of RCM.

Table 5. RCM

	Component		
	1	2	3
EM1	.736		
EM2	.599		
EM3	.884		
EM4	.570		
EM5	.818		
EM6	.839		
EL1		.768	
EL2		.901	
EL3		.551	
EL4		.819	
EL5		.841	
IND1			.760
IND2			.681
IND3			.727
IND4			.602
IND5			.500
IND6			.781
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			

4.5. Discriminant and Convergent Validity

Table 6 shows the discriminant and convergent validity analysis. The threshold value of C.R. and AVE include 0.7 and 0.5. From table 6, it is observed that C.R. values for all variables were greater than 0.7. In contrast, the AVE values for all variables were greater than 0.5 ensuring the suitability of data for further analysis.

Table 6: Discriminant and Convergent Validity

	CR	**AVE**	**MSV**	**EM**	**IND**	**EL**
EM	0.831	0.892	0.313	0.801		
IND	0.929	0.823	0.392	0.823	0.757	
EL	0.919	0.806	0.327	0.607	0.597	0.602

4.6. Confirmatory Factor Analysis (CFA)

Table 7 shows that the value of RMSEA is 0.075, which is ≤ 0.08, showing accuracy in the results of the present study. The pictorial representation of CFA is presented in figure 2.

Table 7: CFA

CFA Indicators	**CMIN/DF**	**GFI**	**IFI**	**CFI**	**RMSEA**
Threshold Value	≤ 3	≥ 0.80	≥ 0.90	≥ 0.90	≤ 0.08
Observed Value	1.590	0.834	0.951	0.810	0.075

4.7. SEM Results

The SEM results are presented in table 8. For this purpose, the value of p must be ≤ 0.05 for positive outcomes. Thus, it has been observed that for H1, the value of p was 0.00, whereas, for H2, the value of p was 0.03. This shows the acceptance of both developed hypotheses. The pictorial representation of SEM results is presented in figure 3.

Table 8: SEM Results

Effects	**Hypothesized Path**	**B**	**S.E**	**P value**	**Conclusion**
Direct Effects					
Hypothesis 1	EM-→ EL	.145	.052	0.00	Accepted
Hypothesis 2	IND→ EL	.134	.040	0.03	Accepted

EM= education management; EL= e-learning; IND= Industry 4.0 facilities

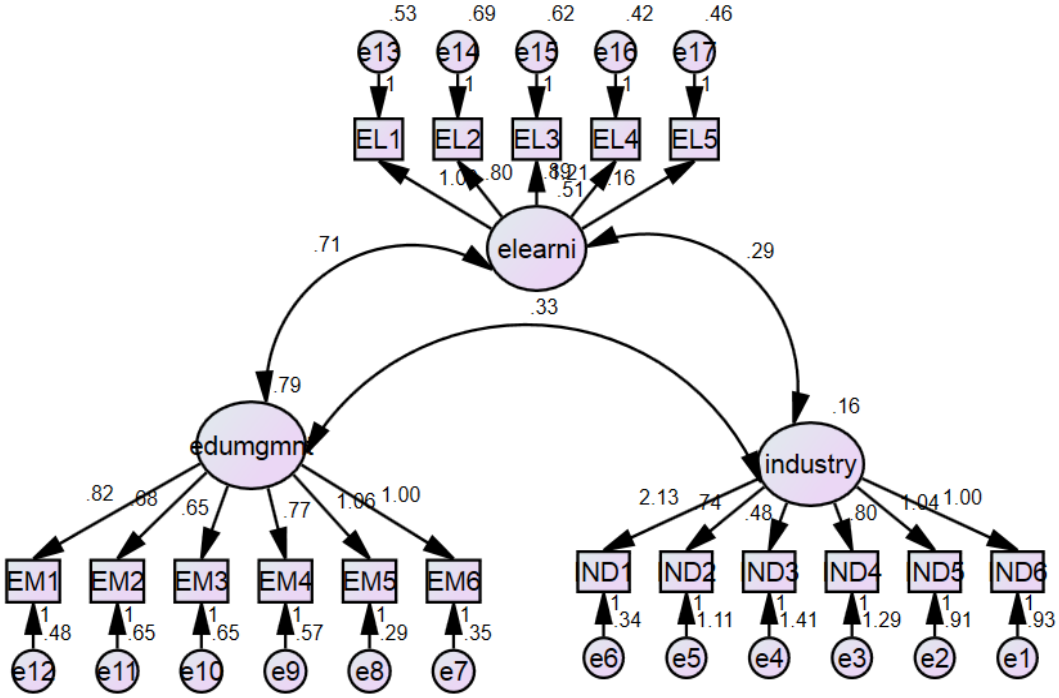

Figure 2. CFA

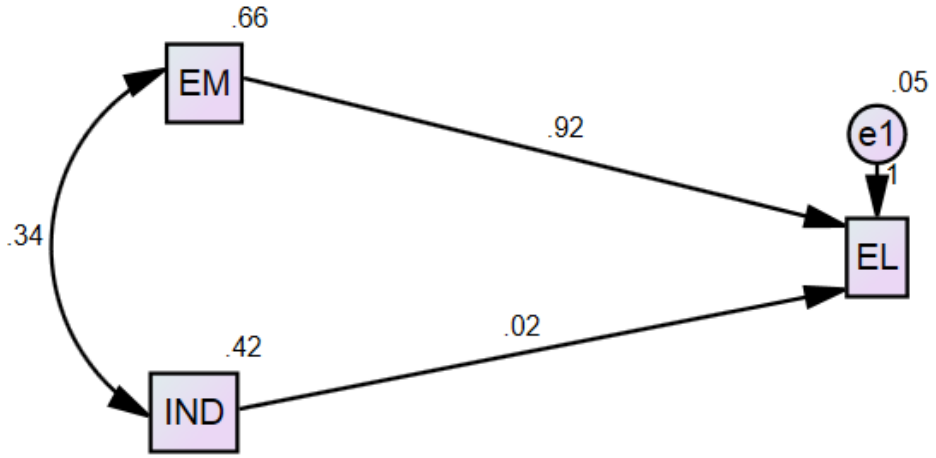

Figure 3. SEM

5. Discussion

The outbreak of covid-19 in 2020 impacted not only social and professional lives but also impacted academic life. As a result, e-learning has become crucial in different educational institutes worldwide, especially in higher educational settings. According to Vershitskaya et al. (2020), Industry 4.0 has revolutionized the educational sector, effectively impacting its overall performance. In this regard,

education management is also considered to play a crucial role. Thus, for the present quantitative study, the data was collected from 213 respondents from different universities in Indonesia to determine the impacts of education management and industry 4.0 facilities on e-learning. For this purpose, two hypotheses were formulated and analyzed using the SEM technique. Two important findings were obtained from this study which are discussed as follows:

First, it was observed that education management significantly impacts e-learning. This result was in alignment with the findings of Rabiman et al. (2020) and Alqahtani and Rajkhan (2020). According to Haghshenas (2019), e-learning improves communication between teachers and students. This has been effective in encouraging a productive learning environment for the students. However, in this regard, the education institutions' education management plays a significant role as they influence the budget and e-learning programs (Al-Jedaiah, 2020).

Second, it was observed that Industry 4.0 facilities significantly impact e-learning. This outcome was aligned with the findings of Hendradi et al. (2019) and Bhardwaj et al. (2021). Industry 4.0 has greatly revolutionized the learning environment. According to Halili (2019), integrating virtual and physical environments via Industry 4.0 technologies has provided students with an innovative and effective learning environment. These technologies have proven to be efficient in improving the students' learning outcomes (da Motta Reis et al., 2020); they are also effective in improving the students' autonomy resulting in their increased self-determination, which is beneficial for their future professional and academic lives.

6. Research Implications

The present study has effectively improved the knowledge regarding the relationship between education management, Industry 4.0 facilities, and e-learning in the context of the education sector in Indonesia. Almost no past study has focused on the impact of Industry 4.0 facilities on e-learning, so the present study has added novelty in this context. The conceptual framework provided by the present study could also be effective in encouraging education management in higher education institutions to take important measures for implementing Industry 4.0 technologies such as Big Data, Artificial Intelligence, and others to improve the e-learning performance of the students for better outcomes. This could also help encourage different educational policies to promote the implication of Industry 4.0 and e-learning technologies in the education sector for an effective and digital future.

7. Limitations and Future Research

In the present research study, different limitations are also observed, which can be overcome in future studies. The present study was limited to a small sample size due to limited time and resources. Therefore, future studies can focus on a larger sample size. Another shortcoming of the present study was its quantitative

nature due to researcher bias, and no focus was given to the concepts and experiences of respondents. However, future studies can conduct interview-based qualitative studies to understand the associated concepts in detail. Moreover, the availability of limited resources also encouraged the current study's cross-sectional approach, which can be overcome in future research by conducting more longitudinal studies.

8. Conclusion

Over the years, the education sector has transformed digitally, promoting more e-learning techniques. These techniques have proven beneficial during covid-19 as they helped improve communication between the students and the teachers. In this regard, education management also plays an important role as they update the education system according to modern trends. However, the application of Industry 4.0 facilities in the education sector has proven to be efficient in improving students' analytical and cognitive learning, encouraging them to take important measures to improve their educational performance. Almost no past study focused on the impacts of education management and industry 4.0 facilities on e-learning in Indonesian universities, so the present study is effective. For this purpose, the statistical data was collected from 213 respondents from different universities in Indonesia, and statistical analysis was conducted to determine the formulated hypotheses. The results obtained from this study showed that education management and Industry 4.0 facilities significantly impact e-learning in the education sector in Indonesia.

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