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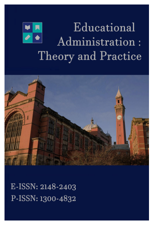

Sound E-Learning of STEM in Malaysian Higher Education Institutions

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Abstract

The economy has globally impacted livelihood and organizations because of the COVID-19 pandemic. It has also impacted the 4th Industrial Revolution Digitalization in education, carrying out many programs with STEM-based courses that entail hands-on methods to online manner. This study was carried out to ensure that STEM education at Malaysian higher education institutions was well-integrated through e-learning (HEIs). Data were collected via questionnaires and semi-structured interviews with a mixed-methods research design. Respondents were STEM educators in HEIs within the Klang Valley. Educators between the ages of 30-35 are found to be more adept at using various software suites, browsing websites, and handling multimedia tools for e-learning. 83 percent of the sample stated that their institution has no STEM e-learning procedure, contributing to extra challenges in STEM education. A sound e-learning integration of STEM requires educators with specialization in the courses being taught, able to process knowledge of digital applications, cultivate skills and values to problem resolve, and integrate collaboration in the technological curriculum. HEIs must involve stakeholders to develop resistance plan modification and to portion the integration of e-learning in segments pertaining to course learning outcomes for achieving strategic objectives in STEM education.

Keywords: E-Learning; STEM Education; Higher Education

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Introduction

STEM is an educational strategy that integrates information from four fields at the same time, namely Science, Technology, Engineering, and Mathematics (Fazurawati, 2018). In the Malaysian context, STEM refers to education that improves competitiveness and skilled manpower in the area of science and technology to meet the challenges as stated in the Malaysian Education Development Plan, PPPM 2013-2025 (Ministry Malaysian Education, 2017). This fact is also supported by Halizan Mohamood, 2019 that it can be addressed by providing a generation of manpower with the knowledge and skills in line to cope revolutionary wave (Halizan, M, 2019). According to the National Council for Scientific Research and Development, Malaysia needs skilled workers an average of 493 830 people in the field of Industry 4.0 by 2020 to help the government during the initiative in the New Economic Model.

This corresponds to a 31 percent annual growth rate in STEM fields (Ministry of Education Malaysia, 2017). However, based on the present rate and development, the Ministry of Science, Technology, and Innovation (MOSTI) predict that there is a workforce deficit of 236000 individuals (Nur Azlina, 2018). This fact is also supported by the study article by Nur Farhana et al. (2017), in which researchers state the importance of generating skilled workers in the future in this field of High Technology. Therefore educators should be inculcated this STEM-related knowledge to help increase more resources to the country in the field of the global economy to face challenges in the country's move to the edge of the business revolution (IR 4.0) (Pierson et al., 2000). This is also held by an article reviewed by Sze-Yeng and Hussain (2010) which states that the role of teachers in promoting STEM education in Malaysia is indeed undeniable.

STEM emphasizes the concept based on components of 4C such as communication, creativity, critical thinking, and collaboration as contained in 21st-century learning (Fazurawati, 2018). In short, STEM education referred to planning which focuses on two or more integrated learning areas involving instructors and students through the process of teaching, project-based learning, and reasoning as well as learning collaborative to encourage students to think outside the box and in the field of technology (Handayani et al., 2021). The Malaysia Education Development Plan 2013-2025 provided 11 necessary strategies for operational adjustments performed to accomplish the desired goal, as well as eight branches that must be strictly adhered to by Siti Afiqah (2017).

The primary goal is to improve the quality of STEM to overhaul the existing national education system (Ministry of Education Malaysia, 2018). Implementation of STEM curriculum framed in three phases. First Wave, 2013-2015, to improve the quality of STEM education through curriculum reinforcement, instructor training, and the use of multimode learning models. Second Wave, 2016-2020, to implement campaigns and collaborations with relevant agencies to foster community interest and awareness of STEM. Third Wave, 2021-2025 to have STEM shifts to excellent levels through improved operational flexibility (Source: Ministry of Education Malaysia, 2013, Wave of Malaysia Education Development Plan, 2013-2025). It is clear that less than a year from now, the role of every individual, especially educators and students, is necessary to meet the demands of this wave by fostering awareness of STEM pedagogy through the campaign and collaborative cooperation with STEM in the industry (Nur Amelia, 2019).

Former Minister of Education Malaysia, YB Dr. Maszlee Malik, has also expressed support for this initiative. In 2019, STEM4ALL will launch a campaign at the Bett Asia Leadership Summit and Expo (Ministry of Education, 2017). The main purpose of the campaign launched was to build a culture of inclusion among Malaysians in STEM education. Following, YB Dr. Maszlee Malik says that government will also enhance STEM learning access to marginalized rural societies, low-income families, and students with exceptional needs and work together to give full support to higher education institutions to organize STEM activities. In addition, STEM-related institutions such as The Malaysia STEM Exploration Center, Center of Engineering Education (CEE) Malaysia Global Science and University Technology Malaysia and Innovation Advisory Council (GSIAC) are working with associated agencies in the formulation of STEM education that is more standard as well as can cultivate interest and awareness of society towards STEM (Malaysian Education Development Plan, 2013-2025, Ministry of Education Malaysia, 2013). Ultimately, the education system is more concerned with building the consolidation of STEM to improve Science and Technology performance with international standards (Malaysia Education Development Plan

2013-2025, Ministry of Education Malaysia, 2013).

Problem statement

Since STEM was introduced, the Ministry and Board of higher education have examined the major changes that would ensue to educate an enormous number of students with lowered costs. A transition from mere knowledge accumulation to the learning of a variety of cognitive and non-cognitive abilities was also contemplated. However, motivation, curriculum, time limits, a lack of training, poor facilities, student involvement, school community response, and academicians were found lacking in creativity and innovation via incorporating e-learning in STEM subjects. Besides, exercising a student-centered teaching style is also still insufficient for hands-on experiments and exercises in e-learning.

Based on the global education ranking in 2017, our education system has not executed well to groom students using STEM modules towards critical thinking, technology literacy, and problem-solving, thus making Malaysia ranked 52nd out of 72 countries. Numerous studies say the answer is clearly yes. These teaching approaches involve basing the didactic e-learning methodology on education research and facts rather than tradition, and anecdotes, and applying new technological tools to promote student learning. Using new technological tools effectively should improve student learning, allow instructors to personalize lectures to individual students, and even be suitable for working with huge groups of students. In a survey done by Khazanah Research Institute in 2018, only 32 percent of all tertiary students enrolled in STEM-related courses.

Questionnaire of Self-administered adapted from Siebel 4.0-2 Survey Questionnaires (SSQ) and interviews used as data collection instruments for data triangulation. The sample consisted of educators from private and public higher educational institutions in Kuala Lumpur and Selangor with university grades associated with the STEM model at the tertiary level. Flipped classrooms, virtual reality systems, cloud computing, massive open online courses MOOCs, and other forms of e-learning are used in this study. As to support the nation and achieve global economic, The Malaysian government, through The New Economic Model, plans to create 1.3 million STEM employments in diverse industries by 2020, enabling infrastructure and supporting the growth of industrial clusters. According to The National Council for Scientific Research and Development, Malaysia needs a workforce of 493,830 people in STEM-related industries to support government initiatives. The rate of increase in STEM is estimated to be 31% per year. Currently, only 11 universities out of 41 universities in Kuala Lumpur and Selangor are in STEM education. MOSTI estimates a shortage of 236,000 professionals in STEM-related areas. Given these skills gaps, the nation's economic future is dependent on the prospective implementation of STEM and the preparation of more students to enter these sectors. Thus, factors for sound associate e-learning in STEM implementation in higher education institutions in Malaysian crucially need to be recognized and evaluate STEM modules that can be appropriately implemented among students in the higher education institution.

The purpose of this research is to identify factors for sound associated with the use of e-learning in STEM in higher education institutions in Malaysia. It is important to implement proper STEM modules to improve student engagement in learning science to develop their enthusiasm and appreciation for STEM subjects.

Research question

What are the factors for sound integration between e-learning and STEM in higher education institutions?

Research objective

To explore the factors for integration between e-learning and STEM in higher education institutions.

Literature Review

The use of e-learning in higher education institutions has become a popular research topic in recent years (Halizan Mohamood, 2019). Earlier research has indicated that e-learning can offer numerous advantages, such as improved student engagement, cost savings, and the ability to accommodate a variety of learning styles. Early research on using e-learning in higher education institutions has suggested that students tend to be more engaged when they use technology in their coursework. By providing students with various learning tools and activities, instructors can keep them engaged and interested in the presented materials. Furthermore, e-learning is more cost-effective than traditional classroom instruction because it does not require physical classrooms or additional staff. Recent research has demonstrated that e-learning can be used to accommodate various learning styles and preferences (Checa, 2020). By providing students with a range of multimedia materials, such as video, audio, and interactive activities, instructors can ensure the material is accessible to all learners. This can be especially helpful for students struggling to understand the written materials.

In recent years, higher education institutions have increasingly turned to e-learning (Alhabshi, 2011). This is due to the rising costs associated with traditional on-campus education and the need for more flexible and accessible educational options for students with varying needs. Many institutions hesitated to adopt the technology in the early days of e-learning. This was due to the cost of setting up the infrastructure required for successful e-learning and the perceived quality of the educational experience. However, as technology has advanced and the cost of e-learning has increased, many higher education institutions have begun to embrace it. Many higher education institutions have fully integrated e-learning into their curricula (Checa, 2020). This has allowed them to provide students with more flexible and affordable educational options and a more engaging learning experience.

The sound e-learning of STEM (Science, Technology, Engineering, and Mathematics) in Malaysian higher education institutions is essential in ensuring that students can access quality education in these fields (Nadelson, 2017). Through sound e-learning, students can develop their understanding of the core concepts and principles of STEM and gain the skills and knowledge necessary for further study and employment in these industries. Sound e-learning in STEM can be implemented in various ways, such as through online platforms, seminars, tutorials, and simulations. It is essential for providing students with a comprehensive understanding of the concepts and principles of STEM, and they need to be able to access these resources promptly. Allowing students to access material from various sources, from both physical and virtual locations, will help ensure that they can access the best quality information and guidance for their studies (Handayani, 2021). In addition, it is crucial for Sound e-learning in STEM to be integrated with other educational programs, such as work experience and internships (Hyatt, 2013).

Several reports demonstrated that higher education institutions must consider Sound e-learning in STEM (Nadelson, 2017). With the rise of technology, access to information has become easier than ever, and allowing students to learn more about STEM topics online has become increasingly important. By providing sound e-learning for STEM topics, higher education institutions can ensure that students receive the best possible education and build a strong foundation of knowledge that will serve them throughout their lives (Hyatt, 2013). Sound e-learning in STEM courses has several advantages (Fazurawati, 2018). It allows students to work independently and review materials more efficiently. It also allows for greater peer collaboration, as students can communicate more quickly online (Nur Amelia, 2019).

Additionally, sound e-learning provides a more engaging learning experience, as students can interact with multimedia content, such as visuals and audio, to better understand the material (Ravet, 2017). Finally, sound e-learning of STEM subjects allows students to better understand the material than in traditional classroom learning (Zamri, 2017). By providing students with the opportunity to learn in an immersive environment, they can gain a better understanding of the subject matter and develop better problem-solving skills (Kristanto, 2017). This will prepare them for the real world, in which problem-solving skills are essential for success.

Methodology

This study occupied a wide area of evaluating quantitative data analyzed by SPSS and qualitative data by using NVIVO. To investigate the interrelationships between major relationships of determinants for sound on incorporating e-learning in STEM education at higher education institutions, a concurrent triangulation mixed method technique was used. The quantitative section of the study uses an equal probability of selection design with one-step cluster sampling. The interview sample size was determined by purposive sampling with educators in university-status higher education institutions in Kuala Lumpur and Selangor. With a face validity of 0.867 and a reliability of 0.78, the SSQ instrument was determined to be valid and reliable. The quantitative survey has four parts, consisting of demographic data, impact on educators and institutions, and factors for sound e-learning integration for educators and institutions. Using Krejcie and Morgan's (1970) model with a 95% confidence level, a total of 131 educators were required for this study. For the qualitative study, one participant from the Ministry of Education (MOE) and one participant from the Malaysia Association of Private Higher Education (MAPCU) were recruited. The interviews were conducted based on a purposive sampling method with semi-structured interview methods. Because of their popularity in the literature for NVIVO investigation, e-learning, and STEM were included as a priori themes in this study. The direct analysis of both data sets, as well as the triangulation of data sources, was used. The participants and interview duration are shown in Table 1.

Table 1. Participants and Interview Duration

Position as Stakeholder	**Institution**	**Number of Interviews**	**Duration of Interview**	**Coding Theme**
Deputy Vice-Chancellor	A	1	1.5	PM-1-1-535-454
Senior lecturer	B	1	1.5	DM-1-1-453-646
Committee Member	MOE	1	1.5	DM-1-1-554-232
Committee Member	MAPCU	1	1.5	PG-1-1-467-435
Lecturer	C & D	2	1.5	DW-1-1-945-565
Total		6	7.5	

Statistical analysis

The obtained data were analyzed by using IBM SPSS Statistics version 24.0 (USA, Armonk, IBM Corp., NY), with p values less than 0.05 considered statistically significant. The Kolmogorov-Smirnov test was used to determine the normality of the data. Skewness and Kurtosis values were also detected. Based on the normality result, the Kruskal-Wallis test was performed to determine the disparities in the measurement of concerns that occur for sound e-learning variables among educators' categories. A Spearman correlation was performed based on the normality result to determine the association between issues that occur for sound and educator categories e-learning incorporation was addressed with factors such as service and satisfaction (SS), ownership control (OC), and academic transform (AT) most effects the STEM education factors as investors' system view (SV), involvement (SI), understanding transition (UT), system evaluation (SE), system design (SD), and evolving mindset (EM). Stepwise multiple regressions were also applied in this case. The variables were regressed against STEM education to determine which variables related to factors for e-learning integration.

Results

Number of questionnaires distributed, returned, and usable

Out of 41 institutions of higher education with university status, 35 private universities and 6 public universities were identified for this research. A total of 36.6 % of higher education institutions participated with 14 private universities and 3 public universities. Besides this, 170 survey questionnaires were sent to achieve the required sample size of 131 responses. A total of 140 responses were received, indicating an 82.4 percent response rate. Out of the 140 questionnaires received, 131 were approved (93.6%) and nine were refused to owe to incomplete responses (6.43%).

Socio-demographic background of the study population

A total of 131 educators, consisting of 24 males (18.3%) and 107 females (81.7%) responded to this study. The average age of the study subjects was 22.02 ± 1.51 years. The subjects' minimum age was 30-35 years old, with 79 subjects and their maximum age was 50-55 years old, with 5 subjects. The distribution of race among the subjects showed the majority was Malay with 115 (87.8%) subjects followed by 11 (8.3%) Indian, 5 (3.8%) Chinese, and 1 (0.7%) other. Descriptive statistics of the issues that occur to achieve sound ways were assessed, and analyzed with maximum, minimum standard deviation, and mean value found shown in (Table 2).

Table 2. Descriptive statistics of the issues to achieve sound ways of e-learning integration

Factors	**Mean ± SD**	**Minimum**	**Maximum**
SI	10.64 ± 2.11	5.00	17.04
SV	10.37 ± 2.81	7.00	18.81
EM	11.47 ± 2.54	4.75	18.57
UT	9.49 ± 4.18	0.00	22.12
SD	10.90 ± 4.06	3.00	21.11
SE	10.38 ± 3.39	2.00	19.04

Test of normality

The normality of the requirements for efficient e-learning integration was determined using the Kolmogorov-Smirnov test. With p-values less than 0.05, the test results were statistically significant. including the skewness and kurtosis values. The distribution was classified as skewed because the skewness and kurtosis values were both high. As a result, the findings indicated that normal distribution was unlikely to produce system evaluation. The results of the Kolmogorov-Smirnov test were shown in Table 3, and a p-value of less than 0.05 was judged significant.

Table 3. Result of the Normality Test

Factors	**Kolmogorov-Smirnov**		**Skewness**	**Kurtosis**
	Statistic	**Sig. (p)**		
SI	.114	.011	1.103	1.473
SV	.096	.074	.481	.778
EM	.102	.402	.664	.681
UT	.101	.210	.703	.284
SD	.049	.509	.105	.579
SE	.103	.108	.141	.408

Correlation between issues to achieve factors for sound e-learning integration and STEM education

According to the summary of Stepwise Multiple Regression analysis, For STEM education, there are e-learning integration factors. With all of the factors considered, the adjusted R2 for OC is.047. (F (1, 486) = 35.14, p.005) for stakeholder involvement. An adjusted R2 of AT yielded .069 (F (2, 217) = 14.87, p0.005). There were no other variables in play. In terms of stakeholder involvement, OC was the primary predictor, accounting for 7.4% of the variance. Other factors were insignificant. In the system view, OC produces an adjusted R2 of.085 (F (1, 486) = 14.42, p.005) when all factors are included in the equation. AT yielded an adjusted R2 of.036 (F (2, 486) = 9.48, p0.005).). There were no other factors in the equation. OC was the most important predictor in the system view, accounting for 5.8 percent of the variance. Other variables were insignificant.

For a developing approach, with all factors taken into account. An adjusted R2 of AT yield is .172 (F (1, 486) = 12.53, p<.005). An adjusted R2 of SS formed .184 (F (2, 486) = 12.53, p<0.005). There were no other factors in the equation. For evolving approach, AT was found to be the most important predictor, accounting for 2.17% of the variation. Other variables were not significant. For an understanding change, with all factors taken into account, an adjusted R2 of AT yields .013 (F (1, 486) = 10.24, p.005). An adjusted R2 of SS produced .146 (F (2, 486) = 9.12, p<0.005). There were no other factors in the equation. AT was the key analyst for the system view, accounting for 1.3% of the variance. Other factors were not significant.

When all factors are included in the equation, an adjusted R2 of SS yields .321 (F (1, 486) = 7.47, p.005) for system design. An adjusted R2 of AT formed .231 (F (2, 486) = 15.54, p<0.005). There were no other variables in the equation. SS was the most important predictor in terms of system design, accounting for 32.1% of the variance. Other factors were not significant. When all factors are considered in the equation for system estimation, An adjusted R2 of SS yield is .176 (F (1, 486) = 15.63, p<.005). AT formed an adjusted R2 of .224 (F (2, 486) = 15.63, p<0.005). There were no other factors in the equation. For system estimation, SS was the most important analyst accounting for 18.2% of the variation. Other variables were not significant. As a result, the importance of STEM education elements reduces among SS and OC, from 9.23 percent to 31.54 percent.

Discussion

The factors for sound e-learning may vary across the organization, limiting the scope to departmental or group levels. The triangulation of data based on interviews and questionnaires revealed that the most major obstacle that instructors faced was transitioning. Successful changes must include top supervisors, and nominate a champion who primarily establishes by being visionary, unswerving, and convincing. Simultaneously, respondents agreed that strategic planning should not neglect persons who have conscientious objections or divergent opinions of the fundamental role of higher education. This form of input should be closely monitored, evaluated, and decoded to attain e-learning integration in STEM education. The Majority of defendants also strongly agreed that e-learning implementation for STEM learning champions was not used successfully due to various reasons involving the top management to the students such as policy, method of implementation, user-friendly e-learning platform, staff training inadequacy, lower satisfaction among students, lack of broadband speed both educator and students, awareness level towards IR4.0 at global scale (Hyatt et al., 2017). Respondents claimed that they do not have enough information to anticipate new changes due to e-learning integration. Inadequately construe acting in the new working environment of STEM education creates a viewpoint that needs to be recognized and shared impact in teaching and learning style. Wide changes include restructuring operations, modifying the institutional mission, integrating classrooms with e-learning facilities, and introducing new technologies, as well as integrating and collaborating with other e-learning practicing universities, which are all viewed as institutional transformations.

Respondents also agreed that institutional operations, such as significant cuts or infusions of funds, technology advancements, competitor actions, and the necessity for a drastic expansion in services, were all important factors in overcoming the deficiency of technical skills. The services of educators must be broadened to assist e-learning. Because e-learning is heavily reliant on technology, organizing drills and assistance for instructors was critical (Zamri, Jamalul Lail, & Ibrahim, 2017). For those educators, obtaining such university support and training is a big concern. According to the literature by Meerah et al. (2011), the difficulties of updating rules and processes necessitate proper management. Respondents also agreed that e-learning integration should include specialized dynamic material that is led and supported by tools for tracking progress toward learning objectives. Respondents suggested fostering internal and external collaboration and cooperation among different faculties, to achieve superior results as part of the e-learning integration with STEM education. The need to accelerate knowledge acquisition of e-learning mechanisms, as a result of which the content will be simplified. easy presentations, and ease of creation. In e-learning knowledge acquisition, Technology is the vehicle for speeding up performance. According to Alhabshi, Ismail, and Bacha (2011), the ultimate success in establishing a greatly successful workforce stems from matching strategic goals with people, processes, and technology.

To maintain the integration, research, and development were required, which may result in changes to the university's strategic procedures, policies, and processes. In addition to e-learning ambitious, continuous transitions in educational content encourage and improvise the e-learning integration with STEM. An almost equal percentage of respondents responded that email, LMS platform, and electronic chat was the most commonly utilized tool in e-learning, while many global institutes have already implemented and administrating successfully the application of different technologies (i.e. simulation, augmented, virtual reality, online interactive learning, and digital gaming) (Checa & Bustillo, 2020; Nadelson et al., 2017). Respondents claimed that educators need to self-perception in change with their normal interactions in operating and choosing a more appropriate action e-learning mode. The institutionalization of knowledge starts with providing proper tools for educators to gather, store, analyze, organize, and made accessible. According to Shahir et al. (2018), each tool in e-learning integration with STEM represents technology that assists diverse portions of gathering information and storing it as knowledge, which is consistent with current literature. These portal practical tools would help educators to turn knowledge into action and application. Educators play a vital role in the future workforce and they could share best ideas, practices, and views for innovation via email and Internet chat. According to Ravet and Layte (2017), this is a crucial module for guaranteeing quality in STEM development as well as increased instructor knowledge and awareness.

The majority of respondents claimed that strategies utilized at institutions during the integration of e-learning with STEM have affected system adaption to produce a shared purpose. e-learning knowledge gathered and shared during the drilling process opens up new information sources and opportunities for innovation, while also encouraging knowledge sharing and cooperation. The ad hoc need for extra understanding of the learning themes is supported by information retrieval. Respondents also mentioned that the integration of e-learning for STEM must be realistic so that it is achievable. Some activities must be delegated to educators to accelerate a sustainable strategy for success. According to Ibrahim (2016), files, documents, and internet information sources or intranet are viewed as critical knowledge that must be preserved as internal and external information to assist educators in completing activities and projects at any time and location.

The participants in this study strongly disagree that concerns connected to e-learning integration at the institutional level should be resolved quickly. Educational leaders must be well-prepared for changes in e-learning integration and be able to respond rapidly. Before beginning to address concerns, university officials must ensure the administration and communication systems are efficient and reliable. This study is consistent with Pierson et al. (2000) findings, which revealed that communication can help to prevent other organizational issues from inhibiting academics from embracing change.

The majority of defendants also strongly disagree that it is critical to assess the complexity and variety of the many institutions and colleges when selecting the type of reform to be implemented. Every college and university has its own business, technological contexts, and human resource. A considerable number of respondents expressed moderate viewpoints on the subject of dealing with criteria for sound e-learning individually. Transparent and consistent communications from the bottom-up, top-down, peer-to-peer, and side-to-side are crucial to the achievement of organizations undergoing a major transformation. According to Nanda and Sørensen (2010), organizations must confirm that consultants are highly expert institution-wide, obtain as much response as possible from educators, and include their views on the problem's implementation, technical glitches, and their ideas for solutions, all while focusing on satisfying the demands of educators and staff in dealing with e-learning integration in STEM education.

The majority of respondents disagree with the method of addressing resistance through greater and sustained education and communication, with a focus on teachers who felt their professionalism was being questioned or challenged. The majority of defendants also strongly disagree with constantly enduring variations in a strictly bottom-up method since it slows the implementation procedure, resulting in a high level of reluctance to contact faculty members to discuss difficulties and gain a sense of ownership for the solutions.

According to the survey, a modest percentage of respondents thought that barriers and inadequacies in technology implementation had an impact on their work function at the institution. Some institutions guarantee that their operations are very dependable, and they are proponents of innovations, especially technological advances, due to the nature of their business in the education industry. According to the study of Kristanto (2017), the transition is a key component in determining an organization's vision, purpose, strategies, policies, and procedures. Educators oppose e-learning integration for reasons ranging from disagreement to the reality of e-learning deployment itself. Some of the reasons that must be addressed are change initiatives that represent a temporary belief that team members are capable, a loss of authority or control, a loss of job security, a lack of faith in their ability to learn new skills, and a sense that the organization is not rewarding for the extra effort. Adding to the difficulties, there are times when the stated purpose conceals the true, more strongly personal motive. To break down resistance, educators must first identify hidden causes.

According to Noraini and Nor (2015), a complete understanding of the strategic components of e-learning integration is essential for STEM progress. The majority of respondents mostly cited inadequate planning and a lack of foresight on the part of institutional leaders. They may also be unaware of the resources that are necessary, as well as have a limited grasp of what e-learning can provide. The vast majority of respondents said that the e-learning integration was adaptable and active. The study determined that the mode of operation of higher education institutions was self-motivated, with self-motivated entire structures and top management. According to the study's findings, educational excellence has become a dynamic and changing objective.

According to the findings of Alhabshi (2005), the primary focus has been on development, which is both adaptable and a common goal for educators. The e-learning procedure must be significantly more tailored to the complex features of learning courses, educators' abilities, and marketplace demands. The vast majority of respondents were adamant that the e-learning drill is more effective than simply reinforcing change factors. The vast majority of responders also strongly disagree that the e-learning integration schedule was delayed. This articulated the viewpoint that to compete in the higher education market, universities must embrace technological innovations and be consistent in their application of them to improve instructional and business operations. The e-learning project team should also consider that e-learning initiatives will not only provide universities with a new channel for STEM education deployment but will also aid in the formation of asynchronous discussion consortiums and networked communities, which will support strategic objectives. According to the findings, performance indicators and management data are frequently useful inputs for identifying areas for improvement and ensuring consistency. The shared purpose also aids in the implementation of a standardized procedure inside the institution.

Tacit knowledge, which is woven into daily work and contact, can be made explicit by modeling processes. To maximize utilization, these shared goals might be incorporated into a corporate information portal and customized for educators. The study found that the effectiveness of e-learning implementation is determined by the institutional structures that leaders construct inside their organizations to prepare for the adoption of new technological advancements. As a result, it is vital to investigate the structures in higher education institutions that facilitate the implementation of e-learning. A methodical approach to planning institutional change, learning and adaptation to new technology, faculty involvement, and a transfer of resources that should have supervision and champions are all characteristics of this process.

Conclusion

According to the findings of this study, the availability of skilled qualified staff and educators' working relationships with e-learning centers in each institution were found to be critical for the overall success of e-learning integration in STEM education among educators in higher education institutions. The study discovered that educators' resistance to change and feelings of uneasiness stemmed from a lack of creativity and unsuccessful roles in decision-making for e-learning acquisition. The study discovered that educators at Malaysian higher education institutions would use e-learning more effectively if the quality and standards in handling it were improved. As a final remark, the effective e-learning implementation amongst educators needs the intensive exertion of all stakeholders especially students to prepare and improve increasingly important skills, such as difficult problem-solving, communication, and collaboration for the IR4.0. Understanding change management is becoming increasingly crucial as the use of e-learning grows around the world. Given the tremendous growth and commercial potential, as well as the demand for professional development, it is critical that STEM education developers take note of the matter.

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