Students' Intention to Learn Data Analytics using Learning Management Systems in UAE Higher Education Institutions: A Study on the Technology Acceptance Model

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Abstract: This study examined the factors influencing students' intention to learn data analytics using Learning Management Systems (LMS) in the United Arab Emirates (UAE). Drawing on the Technology Acceptance Model (TAM), an online survey was distributed to students in Higher Education Institutions (HEIs) in the UAE who had studied data analytics online. The survey evaluated the students' attitudes toward e-learning, their Self-Efficacy (SE) in using e-learning systems, and their perceptions of the usefulness and ease of use of the LMS. Descriptive statistics, reliability analysis, and linear regression were used to analyze the data and test the four hypotheses. The study discovered that using LMS was widely accepted among students and increased their SE in learning data analytics. Both male and female students reported that LMS made it easier to manage their tasks and improved their practical learning assessments. The study provides recommendations for policymakers, practitioners, and researchers in HEIs to improve the use of LMS for online learning, specifically for data analytics courses.

1. Introduction

Over the last three years, the global outbreak of the pandemic has profoundly impacted nations worldwide, necessitating significant adjustments in individual lifestyles. The global health crisis has significantly influenced education, requiring rapid adaptations by institutions to distant learning models and curricular delivery revisions to avoid disruption. To ensure continued education amid challenging times and mitigate the severe effects of the situation on people's lives and significant financial challenges, most academic institutions worldwide have minimized in-person operations and shifted to a virtual learning environment. Hence, distance education allows institutions to continue to provide students with resources and a high-quality education by employing various technologies such as video conferencing.

This research examined the resulting changes and their implementation within the education sector, specifically in the United Arab Emirates (UAE), where the education industry holds immense importance. Given the global difficulty in providing suitable educational environments for individuals, regardless of the nation's level of development, this study highlights the noteworthy leadership of the UAE in adopting a distance learning system, particularly in the aftermath of the pandemic. The swift

action taken by the UAE government to temporarily close schools and universities while ensuring uninterrupted education through virtual learning warranted this investigation. In fact, Higher Education Institutions (HEIs) in the UAE acted swiftly by transitioning from face-to-face education to distance learning as part of their contingency plans. The Ministry of Education in the UAE promoted new educational technologies and teaching pedagogies among teachers and students. According to the Khaleej Times news report by Sebugwaawo (2022), the crisis presented a unique opportunity for all stakeholders in the education sector to re-evaluate the management and delivery of education. In response to the challenging circumstances, educational institutions, ranging from schools to universities, transitioned from traditional learning approaches to a more adaptable and flexible style that aligns with the current crisis and beyond it (Bawa'aneh, 2021). Notably, the increased information and communication also promoted the extensive use of online technologies to enhance teaching and learning (Ismail et al., 2023). Similarly, Al-Karaki et al. (2021) examined the effectiveness of distance learning in higher education during the global crisis among UAE educators. The findings revealed a consensus among almost all participants that online learning served as an excellent alternative to traditional face-to-face approaches. However, the study also highlighted variations in teaching models regarding promoting student participation and engagement. Consequently, students and instructors are discovering new opportunities and exploring innovative teaching delivery and learning methods, as Abdullah et al. (2023) highlighted. As a result, the absence of adequate infrastructure at home poses a significant obstacle, particularly in courses that involve hands-on components, thereby hindering connectivity.

1.1   Utilizing Learning Management Systems (LMS) for Data Analytics Education

The recent global health crisis has introduced numerous challenges in learning data analytics courses through Learning Management Systems (LMS). Educational institutions can utilize LMS to primarily focus on managing the education process rather than just delivering the course electronically. Figure 1 illustrates the components of an LMS that are essential for effective online learning management (Landeros et al., 2016). Williams and Ryan (2021) highlighted that one prominent issue is sustaining student engagement within the virtual classroom environment. The absence of face-to-face interactions and the shift to online platforms have presented hurdles in fostering active student participation and collaboration. Furthermore, the lack of immediate feedback and the limited opportunities for real-time discussions hinder the depth of engagement, making it challenging for learners to grasp complex concepts effectively. Additionally, another challenge arises from the inherent difficulty of utilizing software tools remotely (Williams and Ryan, 2021). Data analytics courses heavily rely on practical application and hands-on experience with software programs. However, remote learning often leads to limited access to necessary software and technical support, impeding students' ability to practice and develop proficiency using these tools. Consequently, finding innovative approaches to enhance student engagement and overcoming the barriers associated with software tools becomes paramount in pursuing effective data analytics education during these unprecedented times.
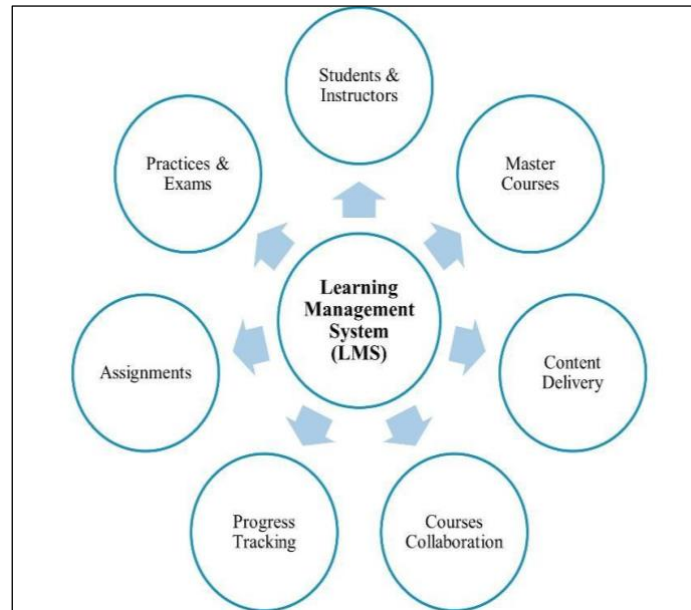
Fig. 1 Learning Management System's Components (adapted from Landeros et al., 2016)

This research study aims to explore and determine students' intentions to use LMS for learning data analytics courses. Presently, there is a shortage of studies focusing on using LMS specifically for data analytics courses. Note that several studies have examined the use of LMS for a range of courses, including business and accounting (Chen, 2013; Smart and Cappel, 2006; De Lange et al., 2003), fashion design (Elfeky and Elbyaly, 2023), and various courses offered by institutions (Al-Fraihat et al., 2020; Chang and Tung, 2008; Bates and Khasawneh, 2007). The research will be valuable in comprehending students' perspectives on the current learning systems' effectiveness, providing insights into how to improve the systems' functioning in data analytics courses. Additionally, the research findings will serve as a valuable resource for HEIs and policymakers in making informed decisions about learning systems. In addition, the findings will play an essential role in predicting the future operation of these systems. This research is particularly significant as it aims to evaluate and study students' current behavior and practices toward online learning of data analytics courses.

The study will provide evidence-based research for policymakers in the educational sector, which may also forecast future scenarios based on the current results. Hence, the study aims to achieve the following objectives:

1. To investigate the influence of external factors, such as institutional support and technological infrastructure, on students' intention to use LMS platforms for learning data analytics courses.
2. To measure and evaluate students' Behavioral Intentions (BI) towards learning data analytics courses via the LMS platform.

Research objective 1 is to answer hypotheses 1, 2, and 3, while research objective 2 is to answer hypothesis 4, as in the discussion below.

2. Literature Review and Hypotheses Development

2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical model invented by Davis in 1989 and was introduced as one of the well-known models linked to technology acceptance and utilization (Hussein, 2017). TAM has been widely utilized in different fields to understand and evaluate how users come to accept the use of technology. According to Davis, the model focuses on the process of using technology where Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the two key factors

that affect an individual's intention to use technology (Liu et al., 2010). Legris et al. (2003) indicated that adopting TAM as a theoretical model can easily predict the user's BI toward using technology. This model has proven useful in determining which elements predict new technology acceptance and providing a foundation for tracing how external variables impact belief, attitude, and intention to use. According to Park et al. (2012), employing the TAM as a predictive tool for assessing satisfaction and retention rates in the UAE education system instead of relying solely on traditional quality factors can enhance our comprehension of effective strategies for fostering high-quality education.

The TAM model seeks to comprehend the nature of interactions between its independent variables known as PEOU and PU (Al-Hawari et al., 2021). In this research, we will employ the TAM as the theoretical framework to analyze higher education students' BIs and acceptance of technology. This model is widely used in the educational sector to explore and assess the factors influencing students' intentions to use online learning tools. Specifically, our focus will be on examining the determinants of PU, PEOU, and attitudes toward the usage of LMS. Based on the TAM depicted in Figure 2, user acceptance of technology, as indicated by their intention to utilize the technology, is influenced by two beliefs: PEOU and PU. These two beliefs act as mediators for the impact of external variables on usage intention. Furthermore, it is worth noting that PEOU also influences PU, as Tao (2008) mentioned in his study. TAM proposes that PEOU and PU of technology are predictors of user attitude towards accepting and using the technology, subsequent BI, and actual usage. According to TAM, a user's actual usage of a technological system is impacted directly or indirectly by their behavioral objectives, attitude, PU of the system, and perceived ease of the system, according to Davis (1989). Note that TAM is one of the most dependable and strong measures for predicting and explaining information technology adoption and usage across a wide range of applications and user groups (Park, S.Y., 2009).

According to the TAM, external influences and factors can have a moderated effect on PU and PEOU, influencing intention and actual usage. The original TAM is illustrated in Figure 2 (Davis, 1989). The user's BIs are influenced by two external variables: e-Learning Self-Efficacy (EL-SE) and System Accessibility (SA) (Khamaruddin et al., 2017).
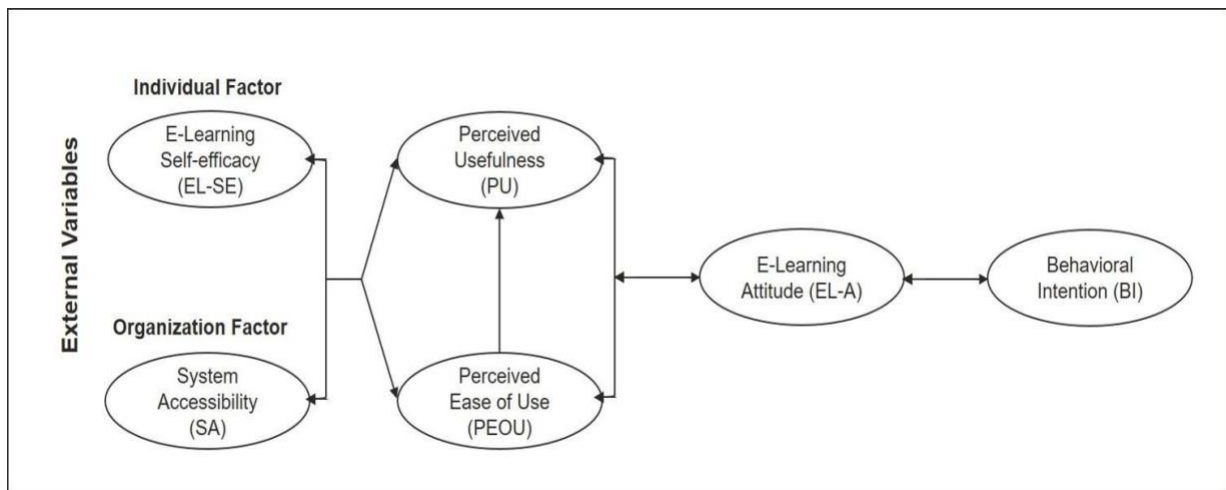

Fig. 2 Technology Acceptance Model (Davis, 1989 and Khamaruddin et al., (2017)

2.2 Hypotheses Development

2.2.1 E-Learning Self-efficacy (EL-SE) and System Accessibility (SA)

Self-efficacy (SE) and SA have been identified as critical external variables influencing PU and PEOU (Opoku and Enu-kwesi, 2019). The term SE was originally defined by Bandura (1977) as a person's particular set of beliefs that determine how well one can execute a plan of action in prospective situations. In other words, SE refers to a person's belief and confidence in their capacity to perform actions to achieve goals and overcome any obstacles. SE might influence whether someone reaches

their life's objectives. As the technology evolved, the term SE extended to technology-related competency, where Computer Self-Efficacy (CSE) was introduced by Bandura (1977), which refers to a judgment of one's capability to use a computer. EL-SE is the confidence people have in their abilities that enable them to successfully engage in academic activities using e-learning technology, maintain their academic commitment, and produce better academic results (Bubou and Gabriel, 2022). EL-SE pertains to an individual's perception of their capabilities in effectively utilizing online learning systems, encompassing the Internet, computers, web-based instructional materials, and other forms of instructional media, to facilitate their learning process.

SA, as a second external variable in this research, is an organization factor that refers to the obligation of HEIs to provide access to the LMS to be used by students. It is a key factor that can impact the overall user experience and the PEOU and PU of e-learning systems. Furthermore, it is part of the organizational perspective where the organization plays a role in how effective and efficient the e-learning accessibility is provided to the university students (Park, 2009). Additionally, students have expressed various concerns about issues related to internet stability, network coverage, and the compatibility of the device during online learning (Hashim et al., 2023).

2.2.2 Perceived Usefulness (PU)

The degree to which a user believes that employing and adopting technology will increase and enhance their work performance is referred to as PU (Masrom, 2007). It is one of the independent variables in the TAM model, in which users feel that incorporating technology into their daily lives would boost their productivity. The TAM also proposes that PU mediates the relationship between PEOU and BI to use the technology. This mediation effect may be observed when technology is easy to use but not useful to a person. However, no matter how simple the technology is to be used, if it is not considered beneficial and useful, the end user will not continue to use it (Mailizar and Maulina, 2021). If individual performance at work increases, there is a positive influence on using technology, and individual behavior will also change positively (Ritter, 2017). Thus, the first hypothesis is formulated as follows:

H1: The degree of students' PU of learning data analytics using LMS is associated with EL-SE and SA in UAE HEI.

The first hypothesis examines the connection between the PU of LMS and their SE in e-learning and its SA. This study aims to evaluate the PU of LMS, which is affected by SA and EL-SE. Adopting TAM can validate students' SE effectively. It also proves valuable in identifying negative patterns exhibited by students. Moreover, the utilization of TAM positively influences students' behavior, as it empowers them to proactively navigate their knowledge base by leveraging predictive information resources. In addition, one of the significant advantages of TAM lies in its ability to enhance students' personal control and flexibility, thus augmenting their overall learning experience through SA.

2.2.3 Perceived Ease of Use (PEOU)

The degree to which a person feels that utilizing a certain technology would be pleasant and free of effort is defined as PEOU (Davis, 1989; Kusumadewi et al., 2021). PEOU is the second factor in the TAM, which refers to how simply the user believes utilizing technology will be helpful in their life's objectives. It also assumed that PEOU influences PU and attitude toward utilizing technology (Masrom, 2007). Notably, PEOU has been proven in several studies to have a positive and significant influence on user adoption or acceptance of technology and behavior (Ritter, 2017). Therefore, the second hypothesis was developed:

H2: The degree of students' PEOU in learning data analytics using LMS is associated with PU, EL-SE, and SA in UAE HEI.

The second research hypothesis looks at the connection between how easy it is to use the LMS with the integration to the usefulness, their SE, and its accessibility to the LMS. It primarily evaluates how easy an LMS is to be used to learn data analytics courses. The usage of technology acceptance can hamper the student's competency to learn and acquire knowledge. Their social interaction also deteriorates with the usage of this model. Additionally, it impacts the implementation of new procedures

for the students as they get habituated to the same model concept. Without the skills and techniques to use the model, it would be extremely difficult to predict how the efficiency of the model can turn out to be and how relevant it can be to the purpose it aims to achieve.

2.2.4 E-learning Attitude (EL-A)

Users' attitudes toward using technology are predicted by PU and PEOU, which in turn affects their behavior intentions (Park, S.Y, 2009). The external factors and actual use of the technology and how it can be effort-free will have a major effect on the student's attitude, directly affecting and shaping their BI to use a certain system or to accept the e-learning system. The assumption of supporting elements that impact patterns is explained as BI using the technology. This assumption may be quantified and measured by how much the individual intends to spend on technological support equipment. Furthermore, individuals' positive and negative emotions and feelings may be related to their BI when utilizing or performing activities (Ritter, 2017). Therefore, the following hypothesis was derived:

H3: The degree of students' EL-A in learning data analytics using LMS is associated with their PU, PEOU, EL-SE, and SA in UAE HEI.

The third research hypothesis aims to identify how online LMS affects the students' attitude toward learning data analytics in connection to the fundamental elements of the TAM. LMS basically has a positive impact on education. However, somehow, it has negatively affected the students. This is attributed to the fact that the students learn to study only through technology. This eventually affects their learning capability. The coaching experience is minimized in LMS among students. They do not get the required checks on the progress in the normal education system. This eventually affects their performance in exams. Accordingly, the training for the students has become ineffective, as with LMS, and they might not be able to understand all the given details. On the contrary, through the traditional teaching methods, the students can directly ask the teacher if they have any queries. Apart from that, course management becomes problematic if the students are unable to remember the materials shared in LMS. The negative impact of LMS on the regular life of students in terms of education and learning is quite significant, considering the high level of technological interaction the students are putting themselves into. Thus, it is becoming increasingly important to be careful with technological integration into education since it reduces the retention capabilities of the students and makes the learning process inefficient in terms of knowledge retention.

2.2.5 Behavioral Intention (BI)

According to Mailizar and Maulina (2021), as supported by Davis (1989), BI is influenced by attitude toward the use of technology and is either directly or indirectly affected by PEOU and PU. User attitudes will be shaped and measured based on those external variables and cognitive domains that play a huge role in their BI in accepting or rejecting the use of technology. In consequence, the following hypothesis was formulated:

H4: The degree of students' BI of learning data analytics using LMS is associated with EL-A, PU, PEOU, EL-SE, and SA in UAE HEI.

The fourth research hypothesis looks at how students' behavior in wanting to learn data analytics affects five crucial variables: EL-A, PU, PEOU, EL-SE, and SA. The impact of data analytics on higher education in the UAE cannot be overstated. LMS, which are software platforms designed to manage the learning process, have emerged as crucial tools in this context. Notably, LMS platforms offer various benefits that enhance collaboration and communication between instructors and students, thereby improving the overall educational experience. In the UAE's higher education landscape, LMS platforms have facilitated the effective distribution of class materials and resources. Moreover, assessments have become more diverse, and feedback has become transparent, leading to improved communication and a smoother education system. The increasing adoption of LMS platforms has significantly benefited students, as technology integration in education has enhanced efficiency within the industry. Consequently, LMS has made the lives of UAE higher

education students easier and more efficient while simultaneously enriching the traditional learning process. Figure 3 below presents the research framework that guided the hypothesis development.
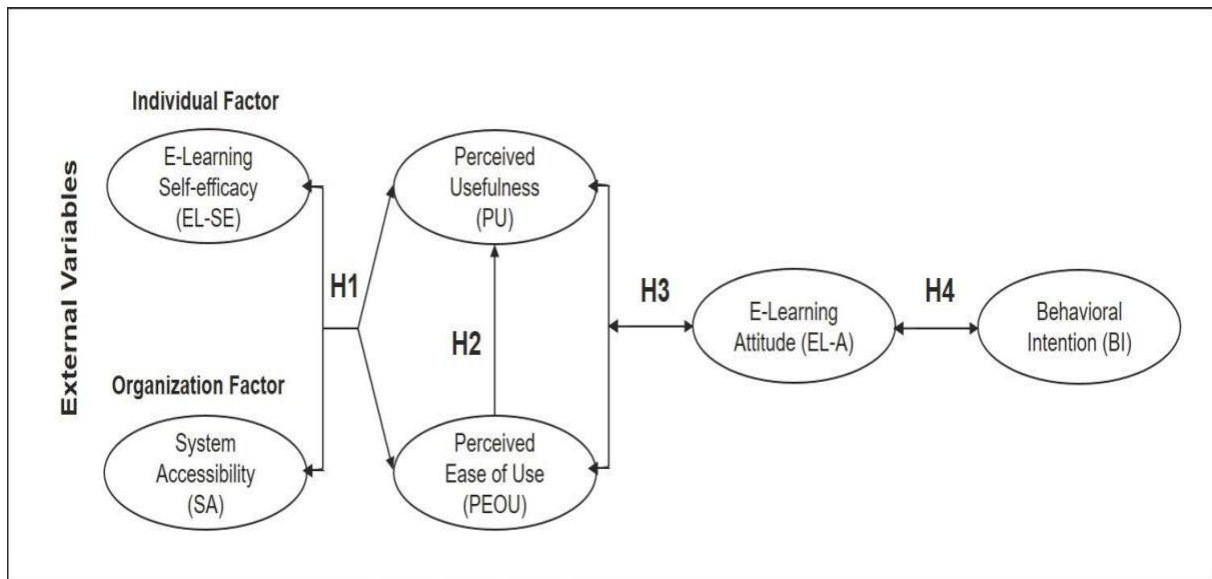

Fig. **3** Research Framework

3.   Research Methodology

3.1   Procedures and Samples

The preferred data collection method used in this study is the quantitative method via survey. It was chosen to work on due to its efficacy when something requires to be measured (Shields and Twycross, 2003). To obtain the data collection, an online survey was issued with multiple choice questions and a Likert scale question, which was distributed to the students who enrolled in data analytic courses from various HEIs in the UAE. A survey comprising 24 items was developed using an online survey instrument. The first section of the questions consisted of the demographic profile of the respondents, such as gender, institution name, level of study, and duration of study online. This part of the questions helps to identify and understand the groups or samples that have responded to the questionnaire (Hughes, 2016).

A total of 300 students who participated in our survey and enrolled in online data analytics courses throughout the outbreak were to make up the sample size. From the data collection, 160 of the 300 students enrolled in online data analytics courses, making up 53.3% of our sample size. Out of 160 students, 132 students, or 82.5%, completed data analytics courses and were included in the study, and 28 students, or 17.5%, were excluded since they did not complete the survey. Notably, the sample size in this study was determined by the scope of the investigation since the objective was to concentrate on and assess the BI of the students who only learned data analytics.

Figure 4 displays the percentage of the students from which university they are studying. This accounted for 70% of respondents' studies in HEI A, 22% were from HEI B, 6% were from HEI C, and 2% were from other HEI. 71.3% of the respondents are females, while 28.7% are male respondents *(n = 132).*
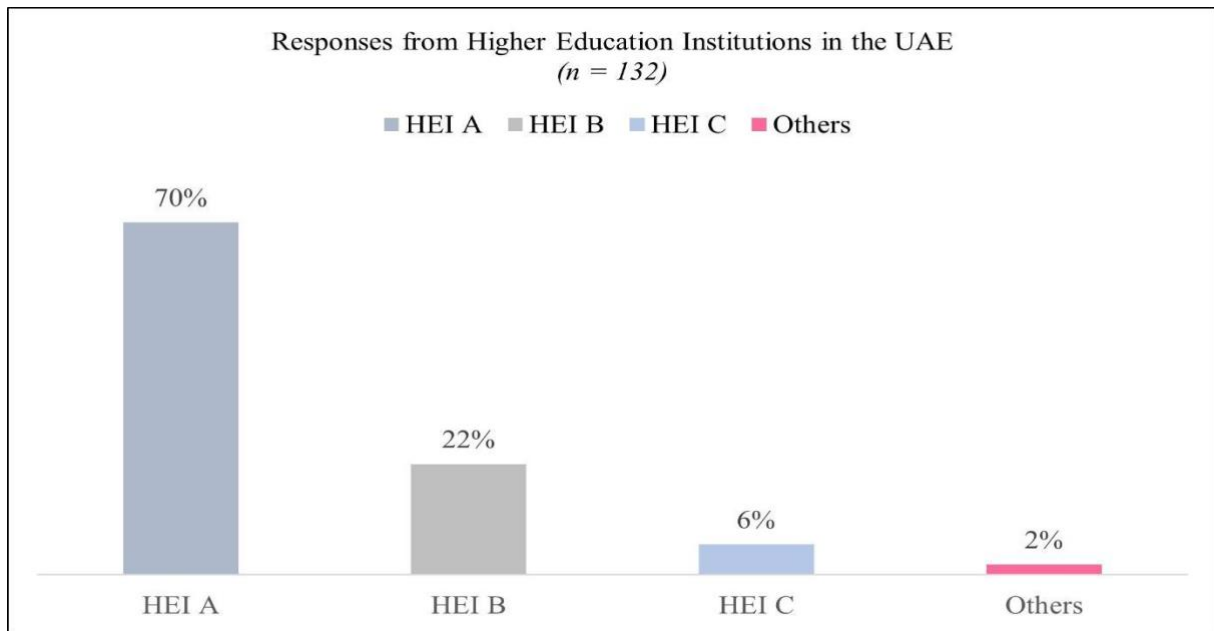
Fig. 4 Respondent's institution

The survey is divided into six sections. The survey's substance begins with six fundamental demographic questions that investigate the targeted population sample. Consequently, it is followed by five items in Section 1 (PEOU), four items in Section 2 (PU), two items in Section 3 (EL-SE), three items in Section 4 (EL-A), five items in Section 5 (BI) and five items in Section 6 (SA), as summarized in Table 1 below.

Table 1. Survey Instruments

Construct		Item
Section 1: Perceived Ease of Use (PEOU)	PEOU 1	It is easy for me to use an LMS to learn data analytics courses.
	PEOU 2	Using LMS will make my study flexible to learning data analytics courses.
	PEOU 3	Using LMS will make my study easier to learn data analytics courses.
	PEOU 4	Using LMS to learn data analytics will boost students' analysis skills.
	PEOU 5	Using LMS to learn data analytics will make communication between students and teachers easier.
Section 2: Perceived Usefulness (PU)	PU1	Using LMS to learn data analytics would be useful to accomplish my tasks.
	PU2	Using LMS to learn data analytics would improve the quality of my tasks.
	PU3	Using LMS will improve my performance in learning data analytics.
	PU4	Using LMS to learn data analytics would increase my academic productivity.
Section 3: E-learning Self-efficiency (EL-SE)	EL-SE1	Using LMS will make me feel comfortable learning data analytics courses.
	EL-SE2	Using LMS is helpful for doing practical data analytics assessments.
Section 4: E-learning Attitude (EL-A)	EL-A1	Using LMS makes me feel satisfied learning data analytics courses.
	EL-A2	Using LMS motivates me to continue learning about data analytics.
	EL-A3	Using LMS is a good idea for submitting my data analytics tasks.

Construct		Item
	BI1	I intend to use LMS to improve my data analytics skills.
Section 5:	BI2	I intend to use the LMS to assist my data analytics activities.
Behavioral Intention (BI)	BI3	I believe that using LMS will provide me with variable information.
	BI4	I intend to use LMS to learn data analytics courses.
	BI5	I recommend using LMS to learn data analytics courses.
	SA1	I believe that I can access the LMS easier at any time.
Section 6:	SA2	I believe that I can access the LMS faster at any time.
System Accessibility (SA)	SA3	I do not have any difficulties accessing LMS to learn data analytics courses.
	SA4	I believe that using LMS improves communication between students and teachers.
	SA5	Internet connection issues did not affect my accessibility to LMS to learn data analytics courses.

3.2 Variables

In this research, two independent variables are considered to investigate the relationship between LMS and e-learning outcomes. The independent variables of LMS are PU and PEOU. PU refers to the participant's perception of the LMS as a valuable and beneficial tool, particularly in the context of data analytics, which is considered significant in the 21st century. PEOU, on the other hand, focuses on the participants' engagement with the user-friendly tools and systems within the LMS.

Four dependent variables in this study include e-Learning Attitude (EL-A), EL-SE, BI, and SA. EL-A examines the students' attitude towards internet-based learning, with a specific emphasis on data analytics learning. Meanwhile, EL-SE refers to the development of students' self-confidence and belief in their ability to learn effectively through e-learning tools, particularly from the perspective of data analytics or other subjects. BI assesses the students' willingness and intention to engage in a classroom that transcends physical boundaries and fosters worldwide engagement. Finally, SA examines the broader and improved accessibility the digital learning system provides, especially in the context of data analytics learning.

3.3 Data Analysis

The research model underwent rigorous testing using a range of statistical techniques to ensure its validity and reliability. Several analysis methods were employed, including reliability testing, correlation analysis, and linear regression, to assess the relationship between the theoretical model and the measurable variables. Commonly accepted evaluation measures were adopted in this research, such as a coefficient value greater than 0.80 and a significant *p*-value below 0.01. These criteria were employed to determine the strength and significance of the relationships between the variables, ensuring robust findings and enhancing the credibility of the study.

4. Results

Cronbach's Alpha reliability coefficients of the survey items were assessed. It consists of 24 items and has six constructs prepared based on the original measurement item's scales in TAM and with reference to the other literature (Khamaruddin, 2017). The result of the reliability analysis revealed acceptable reliability (> .80) for each of the constructs in the study. Results are summarized in Table 2 below.

Table 2. Cronbach's Alpha reliability coefficients of the survey items

Construct	No. of Item	α
PEOU	5	0.81
PE	4	0.86
EL-SE	2	0.83
EL-A	3	0.84
BI	5	0.88
SA	5	0.84
Total	24	0.84

The correlation analysis presented in Table 3 provides insights into the relationships between the study variables. The results reveal that all variables exhibit positive correlations with each other, as indicated by the positive Pearson's correlation coefficients. The correlation coefficients quantify the strength and direction of the relationship between two variables. In this case, all correlations' R-values are close to +1, suggesting a positive and strong association between variables. Furthermore, the *p*-values associated with each correlation are reported to be significant at the $p < .001$ level. This indicates that the observed correlations are unlikely to have occurred by chance and are statistically significant.

The correlation between PEOU and PU is reported as .75***. This suggests a strong positive relationship between these variables. Similarly, the correlations between PEOU and EL-SE, EL-A, SA, and BI are all significant and positive, with correlation coefficients of .76***, .74***, .64***, and .72***, respectively. The correlations between other pairs of variables, such as PU and EL-SE, PU and EL-A, EL-SE and EL-A, EL-SE and SA, EL-A and SA, and EL-A and BI, are also reported to be significant and positive. These correlation results provide evidence for the presence of strong positive relationships among the study variables. The findings suggest that all variables are interrelated constructs that influence each other in a meaningful way.

Table 3. Correlation for study variables

Variables	Pearson's Correlations					
	PEOU	PU	ELSE	ELA	SA	BI
PEOU	-	.75***	.76***	.74***	.64***	.72***
PU		-	.86***	.83***	.76***	.80***
ELSE			-	.89***	.74***	.83***
ELA				-	.76***	.83***
SA					-	.78***

Note: *** correlation is significant at the *p* < .001 level (2-tailed) *n* = 132

This study is using multiple linear regression analysis to test the four hypotheses. The test examines whether a linear statistical relationship exists between the response variables and at least one of the predictor variables. The detailed analysis results for each hypothesis are reported below and summarized in Table 4 below.

Hypothesis 1: The degree of students' PU of learning data analytics using LMS is associated with EL-SE and SA in UAE HEI.

The analysis revealed a significant positive association between PU and EL-SE (β = 0.66, *p* = 0) and SA (β = 0.27, *p* = 0). These results suggest that students' PU of LMS is positively associated with their EL-SE and SA in UAE HEI.

Hypothesis 2: The degree of students' PEOU in learning data analytics using LMS is associated with PU, EL-SE, and SA in UAE HEI.

Results indicated a significant positive association between PU (β = 0.35, *p* = 0.003) and EL-SE (β = 0.41, *p* = 0) with PEOU, while no significant association was discovered between SA and PEOU (β = 0.07, *p* = 0.43).

Hypothesis 3: The degree of students' EL-A in learning data analytics using LMS is associated with their PU, PEOU, EL-SE, and SA in UAE HEI.

The results revealed a significant positive association between EL-SE (β = 0.58, *p* = 0) and SA (β = 0.18, *p* = 0.003) with EL-A. However, there was no significant association between PU (β = 0.14, *p* = 0.09) and PEOU (β = 0.08, *p* = 0.19) with EL-A.

Hypothesis 4: The degree of students' BI in learning data analytics using LMS is associated with EL-A, PU, PEOU, EL-SE, and SA in UAE HEI.

The analysis revealed a significant positive association between BI and EL-SE (β = 0.24, *p* = 0.03), SA (β = 0.25, *p* = .001), and EL-A (β = 0.26, *p* = 0.01). However, there was a negative association between BI and PU (β = -0.11, *p* = 0.25) and PEOU (β = -0.11, *p* = 0.12). These findings suggest that students' BI in learning data analytics is positively influenced by their EL-SE, SA, and EL-A but negatively influenced by their PU and PEOU in UAE HEI.

Table 4. The result of tested hypotheses using Multiple Regression

Hypothesis		Path	Standard Beta (β)	Standard Error	T - value	p - value	Findings
H1: PU	∧	EL-SE	0.66	0.06	10.52	0.00	Associated
	∧	SA	0.27	0.07	4.27	0.00	Associated
H2: PEOU	∧	SA	0.07	0.09	0.80	0.43	Not Associated
	∧	PU	0.35	0.11	3.03	0.003	Associated
	∧	EL-SE	0.41	0.09	3.67	0.00	Associated
	∧	PU	0.14	0.09	1.70	0.09	Not Associated
H3: EL-A	∧	EL-SE	0.58	0.08	7.18	0.00	Associated
	∧	SA	0.18	0.07	3.01	0.003	Associated
	∧	PEOU	0.08	0.07	1.32	0.19	Not Associated
	∧	EL-A	0.26	0.09	2.60	0.01	Associated
	∧	PU	0.11	0.09	1.16	0.25	Not Associated
H4: BI	∧	PEOU	0.11	0.08	1.58	0.12	Not Associated
	∧	EL-SE	0.24	0.10	2.17	0.03	Associated
	∧	SA	0.25	0.08	3.46	0.001	Associated

5.   Discussion

The primary aim of this study is to examine the impact of external factors, specifically institutional support and technological infrastructure, on students' intention to use LMS platforms for data analytics courses. Additionally, the study seeks to assess and evaluate students' BIs toward engaging with data analytics courses through LMS platforms. By investigating these aspects, the research aims to provide insights into the role of external factors and students' intentions in adopting and utilizing LMS platforms for effective data analytics learning during challenging circumstances. The samples involved in this study consist of students from HEIs in the UAE from various levels of study, year of study, and gender.

The results indicate several significant associations between the variables under investigation. Firstly, H1 discovers that students' PU of LMS platforms exhibited a positive association with their EL-SE, corroborating the findings of Park (2009), as well as SA, in alignment with the findings of Khamaruddin (2017). Additionally, H2 validated that PEOU demonstrates a positive association with PU, as supported in a study by Hashim (2023), Kerzˇič (2019), and Budu (2018), as well as with EL-

SE (Park, 2009). However, H3 demonstrates no significant association was discovered between PEOU and SA, contradicting the findings of Khamaruddin (2017) and Park (2009). Furthermore, EL-A exhibits positive associations with EL-SE and SA, consistent with Khamaruddin's findings (2017). Nevertheless, it did not demonstrate a significant association with PU and PEOU, as supported by Khamaruddin (2017). Lastly, H4 proves that students' BI to learn data analytics demonstrated a positive association with EL-A, EL-SE, and SA. Note that no significant associations were discovered between BI and PU or PEOU, aligning with the findings of Park (2009). Nonetheless, the results diverged from those of Budu (2018) and Rosli and Saleh (2022).

The findings of this study provide valuable insights into the associations between various variables in the context of students' perceptions of LMS. The positive associations observed between PU and EL-SE, as well as between PEOU and EL-SE, highlight the importance of these factors in enhancing students' engagement and effectiveness in data analytics e-learning environments. Meanwhile, the positive associations between EL-A, EL-SE, and SA emphasize the role of these variables in shaping students' attitudes and intentions toward e-learning. However, the discrepancies with prior literature, particularly the non-supportive findings of Al-Hawari (2021), Park (2009), Budu (2018), and Rosli and Saleh (2022) suggested the need for further research to reconcile the divergent results and enhance our understanding of these associations. Therefore, future studies could explore additional factors or employ different methodologies to provide a comprehensive understanding of the complex relationships among variables in the domain of e-learning.

5.1   Theoretical and Practical Implication of the Work

The results of this study have crucial theoretical and practical implications for understanding students' perceptions of learning data analytics using LMS and their implications for e-learning. The findings contribute to existing theoretical frameworks by providing empirical evidence on the associations between various variables in the context of e-learning. The positive associations observed between students' PU of LMS platforms and their EL-SE support the theoretical argument that when students perceive the LMS as useful, it enhances their confidence in their ability to engage in e-learning activities effectively. In addition, this finding aligns with the Social Cognitive Theory, which posits that individuals' SE beliefs play a crucial role in their motivation and performance in specific domains. Furthermore, the positive associations between PEOU and PU, as well as with EL-SE, validate the TAM's proposition that ease of use is an important determinant of users' PU and adoption of technology. Accordingly, these findings highlight the significance of designing user-friendly LMS to enhance students' PEOU and their PU and SE in e-learning.

The findings of this study have practical implications for educators, instructional designers, and administrators involved in designing and implementing e-learning platforms specifically for data analytics courses. Firstly, the positive associations between PU and EL-SE suggest that efforts should be made to highlight LMS's practical benefits and advantages to students learning technical courses. Notably, emphasizing how the system can support and enhance their learning experiences may foster a sense of confidence and competence among students. Secondly, the positive associations between EL-A, EL-SE, and SA emphasize the importance of creating an inclusive and accessible e-learning environment. Hence, providing students with user-friendly interfaces, clear instructions, and technical support can improve their positive attitudes toward e-learning and enhance their SE. Additionally, ensuring SA for all students, including those with disabilities or diverse learning needs, is crucial for promoting equal opportunities and inclusivity in data analytics of e-learning settings. Finally, the non-significant associations discovered between PEOU and SA, as well as between EL-A and PU, suggest that these variables may not directly influence each other in the context of LMS. Nevertheless, educators and administrators should consider other factors in data analytics courses, such as pedagogical design, instructional strategies, and course content, that may influence these relationships.

6.   Conclusion

This study examined the influence of external factors, specifically institutional support and technological infrastructure, on students' intentions to use LMS platforms for data analytics courses. The study also assessed students' BIs about enrolling in data analytics courses via LMS platforms under

challenging conditions. Accordingly, several significant associations were discovered between the investigated variables.

The positive associations between students' perceptions of LMS platforms' usefulness and their EL-SE, as well as SA, emphasize the significance of these factors in enhancing students' engagement and effectiveness in data analytics e-learning environments. Additionally, the positive associations between PEOU and PU, as well as with EL-SE, validate the importance of user-friendly LMS platforms to improve students' PEOU, PU, and EL-SE. These findings enhance the current theoretical frameworks, namely the Social Cognitive Theory and the TAM, by substantiating them with empirical evidence that elucidates the interconnections among different variables within the realm of e-learning. In addition, the theory highlights the significance of students' perceptions of usefulness, usability, and SE in influencing their attitudes and intentions toward e-learning.

Despite its valuable insights, this study has some limitations that should be acknowledged. Firstly, the research focused on students from HEIs in the UAE who specifically enrolled in data analytics courses, which may limit the generalizability of the findings to other contexts or populations. Hence, future studies should consider incorporating a more diverse sample to enhance the external validity of the results. Additionally, the study primarily focused on the impact of institutional support and technological infrastructure on students' intentions to use LMS platforms. At the same time, other factors, such as instructional design, course content, and social interaction, were not extensively explored. Therefore, further research should consider examining the influence of these additional variables to provide a more comprehensive understanding of the factors affecting students' engagement in e-learning.

7.   Co-author Contribution

All authors have declared that there is no conflict of interest in this article. Author 1 conducted the statistical analysis and completed the write-up of the article, while authors 2 and 3 conducted the fieldwork and prepared the literature review.

8.   Acknowledgment

9.   References

Abdullah, F., Ward, R., & Ahmed, E. (2016). Investigating the influence of the most commonly used external variables of TAM on students' Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) of e-portfolios. *Computers in Human Behaviour*, Vol. 63, pp. 75-90.

Abdullah, H., Sahudin, Z., Bahrudin, N. Z., Bujang, I., & Khalid, K. (2023). Determinants of Educational Technology Acceptance: An Integration of TAM and UTAUT. *Asian Journal of University Education*, Vol. 19 No. 4, pp. 638-650.

Al-Fraihat, D., Joy, M., & Sinclair, J. (2020). Evaluating E-learning systems success: An empirical study. *Computers in human behavior*, Vol. 102, pp. 67-86.

Al-Hawari, F., Barham, H., Al-Sawaeer, O., Alshawabkeh, M., Alouneh, S., Daoud, M. I., & Alazrai, R. (2021). Methods to achieve effective web-based learning management modules: MyGJU versus Moodle. *PeerJ Computer Science*, Vol. 7, pp. 498.

Al-Karaki, J. N., Ababneh, N., Hamid, Y., & Gawanmeh, A. (2021). Evaluating the Effectiveness of Distance Learning in Higher Education during COVID-19 Global Crisis: UAE Educators' Perspectives. *Contemporary Educational Technology*, Vol. 13 No. 3.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, Vol. 84 No. 2, pp. 191.

Bates, R., & Khasawneh, S. (2007). Self-efficacy and college students' perceptions and use of online

learning systems. *Computers in Human Behavior*, Vol. 23 No. 1, pp. 175-191.

Bawa'aneh, M. S. (2021). Distance learning during COVID-19 pandemic in UAE public schools: Student satisfaction, attitudes and challenges. *Contemporary Educational Technology*, Vol. 13 No. 3.

Bubou, G. M., & Job, G. C. (2022). Individual innovativeness, self-efficacy and e-learning readiness of students of Yenagoa study centre, National Open University of Nigeria. *Journal of Research in Innovative Teaching & Learning*, Vol. 15 No. (1), pp. 2-22.

Budu, K. W. A., Yinping, M., & Mireku, K. K. (2018). Investigating the effect of behavioral intention on e-learning systems usage: Empirical study on tertiary education institutions in Ghana. *Mediterranean Journal of Social Sciences*, Vol. 9 No. 3.

Chang, S. C., & Tung, F. C. (2008). An empirical investigation of students' behavioural intentions to use the online learning course websites. *British Journal of Educational Technology*, Vol. 39 No. 1, pp. 71-83.

Chen, C. C., Jones, K. T., & Moreland, K. A. (2013). Online accounting education versus in-class delivery: Does course level matter?. *Issues in Accounting Education*, Vol. 28 No. (1), pp. 1-16.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial
test. *MIS quarterly*, pp. 189-211.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, pp. 319-340.

De Lange, P., Suwardy, T., & Mavondo, F. (2003). Integrating a virtual learning environment into an introductory accounting course: determinants of student motivation. *Accounting Education*, Vol. 12 No. 1, pp. 1-14.

Elfeky, A. I. M., & Elbyaly, M. Y. H. (2023). The use of data analytics technique in learning management system to develop fashion design skills and technology acceptance. *Interactive Learning Environments*, Vol. 31 No. 6, pp. 3810-3827.

Hashim, H., Mohamad, S. A., Hamzah, H. C., Halid, R. A., & Azer, I. (2023). The Role of Perceived Usefulness and Confirmation in Influencing Student's Satisfaction on Online Distance Learning. *Asian Journal of University Education*, Vol. 19 No. 2, pp. 294-306.

Hughes, J. L., Camden, A. A., & Yangchen, T. (2016). Rethinking and updating demographic questions: Guidance to improve descriptions of research samples. *Psi Chi Journal of Psychological Research*, Vol. 21 No. 3, pp. 138-151.

Hussein, Z. (2017). Leading to intention: The role of attitude in relation to technology acceptance model in e-learning. *Procedia computer science*, Vol. 105, pp. 159-164.

Ismail, M. H., Hassan, S., & Ali, S. N. D. H. M. (2023). Assessing foundation students' acceptance in using Video Conferencing Technologies (VCTs) as online learning platforms during the pandemic. *Asian Journal of University Education*, Vol. 19 No. 1, pp. 195-207.

Keržič, D., Tomaževič, N., Aristovnik, A., & Umek, L. (2019). Exploring critical factors of the perceived usefulness of blended learning for higher education students. *PloS one*, Vol. 14 No. 11, e0223767.

Khamaruddin, P. F. M., Sauki, A., Kadri, N. H. O., Rahim, A. N. C. A., & Kadri, A. (2017, November). Technology Acceptance Model Analysis on Students' Behavioral Intention of Using Moodle for FYP. In *2017 7th World Engineering Education Forum (WEEF)*, pp. 724-727. IEEE.

Kirch, W. (Ed.). (2008). *Encyclopedia of Public Health,* Vol. *1*: A-H Vol. 2: I-Z. Springer Science & Business Media.

Kusumadewi, A. N., Lubis, N. A., Prastiyo, R., & Tamara, D. (2021). Technology acceptance model (TAM) in the use of online learning applications during the Covid-19 pandemic for parents of elementary school students. *Edunesia: Jurnal Ilmiah Pendidikan*, Vol. 2 No. 1, pp. 272-292.

Landeros, J. R., & Fuentes, M. D. L. M. (2016). Development of a Framework for the Use of a Tool for Machine Learning and Data Mining. *Res. Comput. Sci.*, Vol. 122, pp. 127-139.

L Ritter, N. (2017). Technology acceptance model of online learning management systems in higher education: A meta-analytic structural equation model. *International Journal of Learning Management Systems*, Vol. 5 No. 1, pp. 1-16.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, Vol. 40 No. (3), pp. 191-204.

Liu, I. F., Chen, M. C., Sun, Y. S., Wible, D., & Kuo, C. H. (2010). Extending the TAM model to explore the factors that affect intention to use an online learning community. *Computers & Education*, Vol. 54 No. 2, pp. 600-610.

Mailizar, M., Burg, D., & Maulina, S. (2021). Examining university students' behavioural intention to use e-learning during the COVID-19 pandemic: An extended TAM model. *Education and Information Technologies*, Vol. 26 No. 6, pp. 7057-7077.

Masrom, M. (2007). Technology acceptance model and e-learning. *Technology*, Vol. *21 No.* 24, pp. 81.

Opoku, M. O., & Francis, E. K. (2019). Relevance of the technology acceptance model (TAM) in information management research: A review of selected empirical evidence. *Research journal of business and management*, Vol. 7 No. 1, pp. 34-44.

Park, S. Y., Nam, M. W., & Cha, S. B. (2012). University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. *British journal of educational technology*, Vol. 43 No. 4, pp. 592-605.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Journal of Educational Technology & Society*, Vol. 12 No. 3, pp. 150-162.

Rosli, M. S., & Saleh, N. S. (2023). Technology enhanced learning acceptance among university students during Covid-19: Integrating the full spectrum of Self-Determination Theory and self-efficacy into the Technology Acceptance Model. *Current Psychology*, Vol. 42 No. 21, pp. 18212-18231.

Sebugwaawo, I. (2022, Jan 25). Covid-19 in UAE: Pandemic challenges spur digital transformation in the education sector. *Khaleej Times*, pp.12

Shields, L., & Twycross, A. (2003). The difference between quantitative and qualitative research: *Paediatric nursing*, Vol. 15 No. 9, pp. 24-25.

Smart, K. L., & Cappel, J. J. (2006). Students' perceptions of online learning: A comparative study. *Journal of Information Technology Education: Research*, Vol. 5 No. 1, pp. 201-219.

Tao, D. (2008). Understanding intention to use electronic information resources: a theoretical extension of the technology acceptance model (TAM). In *AMIA Annual Symposium Proceedings* (Vol. 2008, p. 717). American Medical Informatics Association.

Williams, B., & Elmore, R. (2021). Teaching business analytics during the COVID-19 pandemic: A tale of two courses. *Communications of the Association for Information Systems*, Vol. *48 No.* 1, pp. 1.