Trends on Using the Technology Acceptance Model (TAM) for Online Learning: A Bibliometric and Content Analysis

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***Abstract*—The technology acceptance model (TAM) is an information systems model that models how consumers use and accept technology. Scholars have implemented TAM widely to examine the effectiveness and ease of use of online learning. Therefore, this analysis comprehensively analyses TAM's role in accepting online learning platforms by conducting bibliometric and content analysis based on the PRISMA framework. Insights into technology acceptance models were determined by bibliometrics analysis with VosViewer and content analysis. Methods: This study expanded all research from 2002 to 2020. A sum of 120 publications was analysed in January 2022 as documented in the Scopus database after applying the including and excluding criteria in addition to the manual evaluation. Results: This review's findings identified the most compelling subjects covered by the journal. Most prolific countries, educational institutions, Journals, and authors were identified. Additionally, the results demonstrate several significant models for technology acceptance; several online learning environments were outlined (MOOC, Moodle, E-learning, flipped learning, and blended learning). Conclusion: The research presents a roadmap for potential researchers, concentrating on critical areas where success is possible. However, more research is required to utilize the TAM model and incorporate different online learning environments.**

***Index Terms*—Technology acceptance model, TAM, online learning acceptance, online learning adoption, A bibliometric analysis.**

I. Introduction

A. Online Learning Acceptance

Online learning in higher education institutions has recently been changing from one-way communication that relies on the instructor to two-way communication that relies more on the learners utilizing technology tools [1]. Online learning possesses many potential advantages for learners who can overcome conventional educational (face-to-face) settings [2]. To ultimately realize the online learning benefits, learners must be prepared to learn in online environments. Thus, online learning acceptance is a concept that was first specified by Warner, Christie, and Choy [3] through the Australian technical vocational education and training (TVET) department. Since that time, several scholars [4]-[6] have been studying the online learning acceptance concept and various dimensions. Thus, many terms and concepts have been validated and identified. On the other hand, Parasuraman [7] suggested that technology acceptance is "peoples' tendency to use and embrace innovative technologies to achieve certain objectives in both work and lifestyles." Integrating technology in any life sector is a complex procedure that requires preparations and readiness [8].

Online acceptance is the main component in improving behavioural intention about advanced technology products and services. Readiness of technology impact among learners requires further research [9], [10]. Optimism and innovation are essential to technology acceptance, while discomfort and insecurity generally prevent technology acceptance among users [11]-[15]. Accordingly, Parasuraman [7] proved that technology readiness is comparable to consumer behaviour. For this purpose, internal considerations need to be considered (e.g., learning, personality) as well as external considerations (e.g., culture, social status) to examine technology readiness among their users in general and learners when it comes to measuring their readiness measurements toward accepting online learning as a new standard style of teaching and learning.

B. Technology Acceptance Model

The Technology Acceptance Model (TAM), presented by Davis [16], is considered the most used model for innovation acceptance. Mainly, this model investigates technology acceptance in a cognitive and specific context. It is also used to examine various technology adoption [17], [18]. TAM is widely used in various construction industry studies, for instance, Building Information Modeling (BIM) acceptance [19], [20], innovative home technologies [21], [22], green infrastructures adoption [23], besides the use of specific Alternative Dispute Resolution (ADR) techniques [24]. Steinhardt conducted qualitative research and Manley [25] to clarify the Australian housebuilders' attitude regarding prefabrication based on TAM and the Theory of Planned Behaviour (TPB. The findings claimed a need for a quantitative to address the problem within the suggested framework [25].

Davis [26] developed TAM founded on Fishbein and Ajzen's [27] Theory of Reasoned Action (TRA) [27]. TAM investigates technologies and innovation adoption [14], [18]. TAM is an excellent base for quantitatively analyzing users' attitudes regarding innovative technologies and their acceptance and adoption [28]. Two significant variables in TAM determine how individuals adapt to technology or

Manuscript received June 14, 2022; revised July 20, 2022; accepted July 29, 2022.

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doi: 10.18178/ijiet.2023.13.1.1788

intend to use it. These variables are ease of use and perceived usefulness [26]. TAM assumes that if the technology enhances either efficiency or performance while posing low difficulty in use, the rate of acceptance increases [15], [26]. Even though the TAM model is reliable in earlier studies, it was also recommended to further expand this model by the other technological or individual specifications variables [29].

Consequently, for this purpose, this study aims to analyze publications in the TAM model and online learning acceptance, indexed in Scopus by using bibliometrics and visualization analysis. This research quantitatively examines the TAM model on online learning acceptance publications published between (2002-and 2020) to explore the research landscape comprehensively, particularly examining the role of the TAM model on online learning acceptance using content and bibliometrics analysis. A bibliometric analysis technique has been utilized in the research along with content analysis to answer this research questions, the most published areas, the journals that were jointly cited, and the most cited authors were studied, the association between authors, the most commonly used keywords, the used keywords in addition to the association between them, the most published journals, the most cited journals, the journals that published the most research papers on the research area, the publication cooperation between countries, the countries that contributed the most on the research area. The VOS Viewer software, a widely used program for visualizing bibliometric networks, has been utilized to expose network visualization in the current analysis.

II. Research Questions

Exclusively, we intended to answer the subsequent questions:

1) What is the distribution of publications about the TAM and online learning acceptance between 2002 – and 2020?
2) What are the most relevant Journals and authors about the TAM and online learning acceptance?
3) What are the TAM's most productive countries, academic institutions, and online learning acceptance research areas?
4) What are the primary research keywords concerning the TAM and online learning acceptance between 2002 – and 2020?
5) What were the most common models, instruments, and research approaches utilized regarding the TAM and online learning acceptance between 2002 – and 2020?

III. Materials and Methods

This review reveals the profile of the TAM studies in online learning acceptance between (2002- and 2021). To achieve that objective, bibliometric and content methods have been used jointly. Moreover, this study followed the PRISMA framework [30]. Also, Bibliometric analysis is constructed by tracking the research papers on a particular theme and discovering the results by analyzing these studies by different features [31]. Related publications in the Scopus database have been involved in this review to reach high-quality papers, excluding any conferences or proceedings. In the scan conducted on 17/01/2022, keywords were searched in the keyword, summary, or title sections by selecting the "Topic" option. English and open access articles were included in the study among the reports obtained after the search. "TAM," "Technology acceptance model," and "online learning acceptance" have been used as phrases and keywords that evoke them. Scopus has been used to obtain online learning acceptance journals in this research. It includes intelligent instruments to visualize, analyze, and track study output in different areas, such as humanities, technology, and science [32]. See the analytical flowchart of this review (Fig. 1).

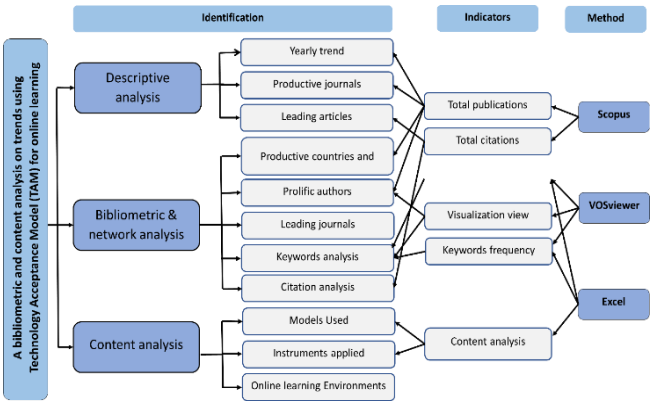

Fig. 1. The analytical flowchart of this review.

A. The Bibliometric Analysis

Bibliometrics analysis is a statistical method for quantifying and assessing the number of rising trends in a specific study area [32]-[34]. Bibliometrics analysis has been employed to determine academic outputs of numerous study disciplines [33], [35]. In addition, they were intended to evaluate the educational studies, for instance, based upon 3914 publications gathered from the Web of Science (WoS). Moreover, Song *et al*. [20] systematically analyzed online learning dialogue studies' intellectual structure, trends, and status by spotting the top journals and contributors and illustrating the scientific associations. [35] similarly examined computer and education research papers from a quantitative perspective regarding scientific collaborations, author profiles, and research topics.

This review is being carried out based on the following purposes. First, the TAM model and its utilization in online learning have evolved into a compelling research area with growing research numbers. Thus, it is required to investigate the thematic structure of such a study area by utilizing an accurate machine learning method that could spontaneously examine sizeable, documented literature data. Then, the current research is being carried out to help provide insights concerning what has been discussed, the trends in the TAM model, and its use in online learning. This objective is achieved by assessing relevant prominence patterns and the growing research areas. Additionally, implications and insights associated with the future studies performed by our analyses are intuitive in helping researchers with decision-making regarding research types in the fields to focus on. For this purpose, this study aims to analyze publications in TAM model and online learning acceptance,

indexed in Scopus by using bibliometrics and visualization analysis.

Moreover, all data have been collected from Scopus in the current study. Therefore, this research data included many leading journals in online learning and education technology resources. This analysis permitted us to understand how the research interests in online learning have been altered over time. Additionally, this research visualized and investigated the scientific collaborations among top contributors in online education that were unavailable in prior studies.

TABLE I: DATA SCREENING INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria	Online learning acceptance, online learning platforms, online learning environments.
	Technology acceptance model, TAM
Exclusion criteria	Online learning in (medical and engineering fields) It is not being used in the education context.
	Conference papers, proceedings papers, nonindexed publications

B. The Content Analysis

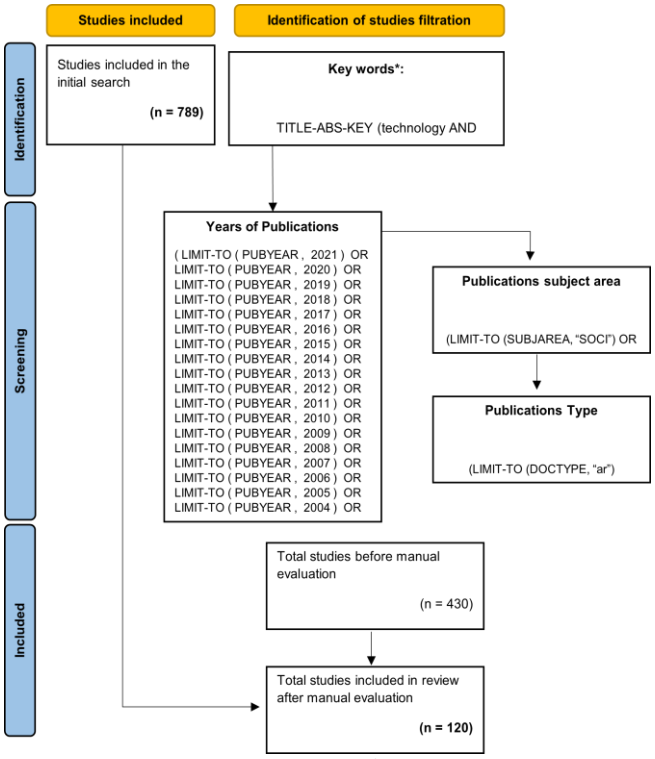

Fig. 2. The PRISMA framework.

Content analysis is a scientific research technique used extensively in social studies in recent years [36]. A more structured process guides content analysis using a directed approach than a conventional system [37]. The content analysis method demonstrated the most used technology acceptance models in the selected 120 articles in this research. Moreover, this approach highlighted the literature's most utilized online learning environments. Additionally, to guarantee the relative significance of the analyzed publications, we have carried out manual screening to exclude irrelevant publications following the PRISMA framework shown in Fig. 1 and the exclusion and inclusion criteria shown in Table I. In addition, the analytic research framework is illustrated in Fig. 2. Additionally, to guarantee the relative significance of the analyzed publications, we have carried out manual screening to exclude irrelevant publications following the PRISMA framework shown in Fig. 1 and the exclusion and inclusion criteria shown in Table I. In addition, the analytic research framework is illustrated in Fig. 2.

IV. FINDINGS

This review reveals the studies' online learning acceptance and TAM profile (2002-2021). The findings of this review were discussed based on the research questions.

A. The Distribution of Publications about the TAM and Online Learning Acceptance between 2002 – and 2020

To address the first finding, an analysis was conducted of the publication year of the articles from 2002 – to 2020. It was noticed that the papers were primarily published in the previous couple of years; in the year 2021, a total number of 168 publications were published concerning TAM and online learning acceptance; in the years 2020 and 2019, the same number of publications were published regarding TAM and online learning acceptance, which was 101 for each year, following by a total number of 65 publications in the year of 2018. The other publications were distributed for the rest of the years, as shown in Fig. 2. For example, the total number of TAM and online learning journals for 2020 was 330. Beginning With the analysis of the yearly distribution of TAM and online learning acceptance publications, it is worth mentioning that the study on TAM and online learning has obtained a dramatic increase in concern from scholars, demonstrating a promising growth trend.

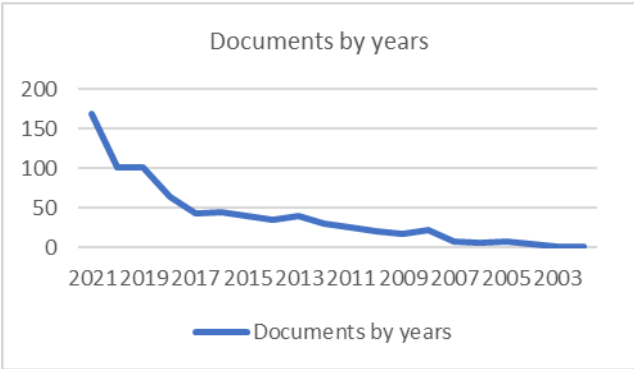

Fig. 3. Distributions by years.

B. The Most Relevant Journals and Authors about the TAM and Online Learning Acceptance

In the content analysis made for the most cited journals, "Total Publication," "Total Citation," "Cite Score of the journal," "The most cited article," "Times cited," and "Publisher" was chosen as the analysis criteria as presented in Table II.

Table II shows that the most productive journal concerning TAM and online learning acceptance was "Education and Information Technologies," with a total general publications number of 24.902 and a total citation of 97.894, in addition to 25 publications in TAM and online learning acceptance. Secondly, "Education and Information Technologies" with a total publications number of 890, a total citation of 5,276, and

22 publications in TAM and online learning acceptance. Thirdly, the "Lecture Notes in Computer Science" with a total publications number of 80.389 and a total citation of 157.342. in addition to 22 publications in TAM and online learning acceptance. Moreover, the distribution of the most productive journals concerning online learning acceptance is presented accordingly in Fig. 4. On the other hand, RQ2 also investigated the most prolific authors in the TAM and online learning acceptance research area. In the content analysis made for the prolific authors in the online learning acceptance research area, "Author," "Total Publications," "h-index," "Total citations," "current affiliation," and "country" was chosen as the analysis criteria as shown in Table III.

TABLE II: THE TOP 10 HIGHLY PRODUCTIVE JOURNALS ON TAM AND ONLINE LEARNING ACCEPTANCE IN THE YEARS (2002-2021)

Journal	TP	TP **	TC	Cite Score (2020)	Most cited publication	Times Cited	Publisher
Sustainability	24.902	25	97.894	3.9	Valverde-Berrocoso, *et al*., (2020).	61	Multidisciplinary Digital Publishing Institute (MDPI)
Education and Information Technologies	890	22	5,276	5.4	Salloum *et al*., (2019)	75	Springer Nature
Lecture Notes in Computer Science	80.389	19	157.342	2	Pedrotti and Nistor (2016)	14	Springer Nature
Computers and Education	823	17	15.057	14.4	Pitucha and kueiLeeb (2006)	514	Elsevier
Communications in Computer and Information Science	19.615	13	15.364	0.8	Hong Luk *et al*., (2018)	11	Springer Nature
Computers in Human Behavior	1934	11	26.743	13.8	Persico *et al*., (2014)	133	Elsevier
Turkish Online Journal of Educational Technology	1185	11	435	0.4	Alenezi *et al*., (2010)	93	Sakarya University
Interactive Learning Environments	303	10	1554	5.1	Rienties *et al*. (2016)	56	Taylor & Francis
Advances in Intelligent Systems and Computing	29.624	9	26.852	0.9	Salloum *et al*., (2019)	18	Springer Nature)
IEEE Access	41.670	9	201.619	4.8	Almaiah *et al*., (2019).	51	IEEE

TP= Total Publications, TC= Total Citation, TP**= Total Publication in the field of TAM and online learning acceptance

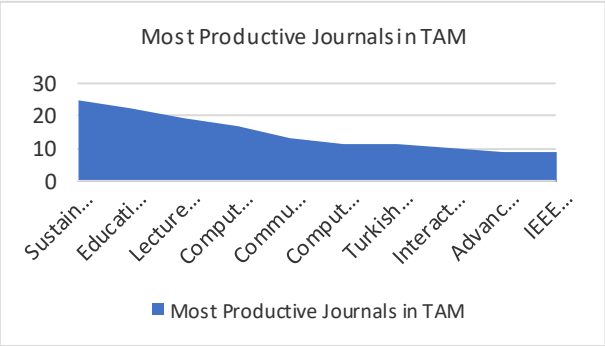

Fig. 4. Most productive journals in TAM.

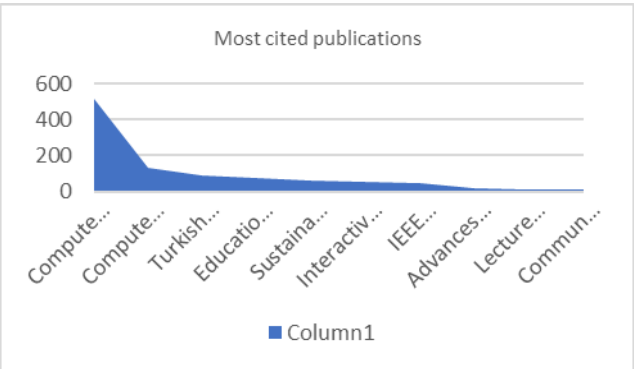

Fig. 5. Most cited publications in TAM.

Fig. 5 illustrates the most cited publications among the top 10 journals. Computer and education have the most cited publications in TAM and online learning acceptance with 514 citations, computers in human behavior, and the Turkish online journal of educational technology with 93 citations. Moreover, the list of the most cited publications among the top 10 journals is presented in Fig. 5.

Table III shows TAM's 15 most prolific authors and the online learning acceptance research area based on Scopus statistics. The table is arranged based on the author h index. Moreover, the most prolific author was "Huang, Y.M." with a total number of 595 publications, with an h-index of 29, and the author is from Taiwan. This is followed by "Bao, Y.." with 105 publications, an h-index of 29, and the author is from China. Followed by "Shaalan, K" with 212 publications, an h-index of 29, and the author is from the United Arab Emirates. Followed by "Al-Emran, M." with a total number of 91 publications, with an h-index of 25, in addition to 2219 citations, and the author is from the United Arab Emirates. Furthermore, from an H-index standpoint, the top three are different. In contrast, most H-index goes to "Huang, Y.M," and the author is from Taiwan, followed by "Bao, Y." from china, and "Shaalan, K.." from the United Arab Emirates; both authors have an h-index of 29. Moreover, other prolific authors in TAM and online learning acceptance research area data were presented in Table III.

TABLE III: LIST OF THE 15 MOST PROLIFIC AUTHORS IN THE TAM AND ONLINE LEARNING ACCEPTANCE

	Author	TP	h-index	Current affiliation	Country
1	Huang, Y.M.	595	47	National Cheng Kung University	Taiwan
2	Bao, Y.	105	29	Huazhong University of Science and Technology	China
3	Shaalan, K.	212	29	British University in Dubai	United Arab Emirates
4	Al-Emran, M.	91	25	British University in Dubai, Dubai,	United Arab Emirates
5	Salloum, S.A.	125	24	University of Salford	United Kingdom
6	Al-Rahmi, W.M.	78	22	University Technology Malaysia, Johor Bahru, Malaysia	Malaysia
7	Lai, I.K.W.	111	21	City University of Macau	China
8	Alshurideh, M.	83	17	University of Sharjah	United Arab Emirates
9	Nistor, N.	65	14	Ludwig-Maximilians-Universität München	Germany
10	Al Kurdi, B.	41	11	Hashemite University	Jordan

TP= Total Publications, TC= Total Citation

C. TAM's Most Productive Countries, Academic Institutions, and Online Learning Acceptance Research Areas

In the content analysis made for the most productive countries and academic institutions in TAM and online learning acceptance research area, "country," "Total Publications," "and "most productive academic institution" was chosen as the analysis criteria as shown in Table IV and Fig. 3.

TABLE IV: LIST OF THE 15 MOST PRODUCTIVE COUNTRIES AND ACADEMIC INSTITUTIONS

	Most productive academic institution	Country	TP
1	Universiti Teknologi Malaysia	Malaysia	18
2	Bina Nusantara University	Indonesia	15
3	National Cheng Kung University	Taiwan	13
4	King Saud University	Saudi Arabia	12
5	Huazhong Normal University	China	9
6	Universiti Sains Malaysia	Malaysia	8
7	Universiti Kebangsaan Malaysia	Malaysia	8
8	Universiti Teknologi MARA	Malaysia	8
9	University of Sharjah	Oman	8
10	Universiti Malaya	Malaysia	7
11	The University of Jordan	Jordan	7
12	Universiti Tun Hussein Onn Malaysia	Malaysia	7
13	Universiti Utara Malaysia	Malaysia	6
14	National Yunlin University of Science and Technology	Taiwan	6
15	Hashemite University	Jordan	6

TP= Total Publications

Table IV illustrates the 15 most productive countries and academic institutions. Then the online learning acceptance research area shows the distributions of the top prolific countries/regions and establishments of TAM. From a country standpoint, most listed countries/regions demonstrated a stable interest in TAM and acceptance of online learning in all the research matters. In contrast, various countries/ regions were interested in specific trends. For example, the most productive country was "Malaysia," with a total number of publications of 62 within six public universities. In contrast, the most prolific university in Malaysia in this research field was the university of technology Malaysia (UTM). They were followed by "Taiwan" with a total number of publications of 19 within the National Cheng Kung University and National Yunlin University of Science and Technology, followed by "Indonesia" with an unlimited number of publications of 15 within the Bina Nusantara University. Moreover, other prolific, productive countries in online learning acceptance research area data were presented in Table IV.

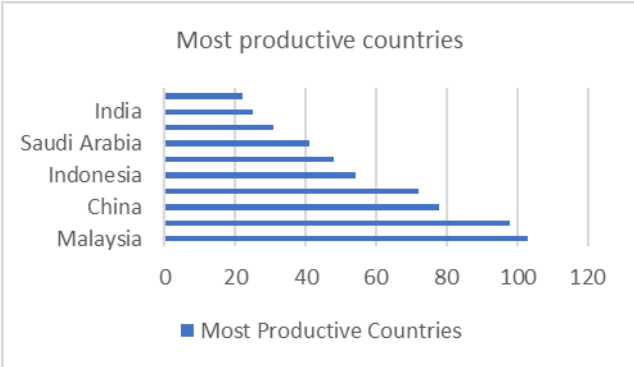

Fig. 6. Most productive countries.

Fig. 6 illustrates productive countries' analytical results in TAM and acceptance of online learning. Thus, in contrast to countries/regions, institutes listed in the figure presented more interest in specific matters; the most productive country was "Malaysia," followed by "The United States," followed by "China" Moreover, Taiwan, Indonesia, United Kingdom, Saudi Arabia, Australia, India, and Canada were listed as top 15 countries in the research field. Beginning With the analysis, it was noticed that the countries/ regions within the same institutions and continents from within the same countries/regions with comparable study interests tend to collaborate more in TAM and online learning acceptance research areas.

D. The Primary Research Keywords Concerning the TAM and Online Learning Acceptance between 2002 – and 2020

The most used keywords of the bibliometric analysis, "Co-occurrence," was selected as the analysis type, and "Authors keywords" was marked as the unit. In this context, 400 keywords have been identified from the data set, as shown in Fig. 7.

When Fig. 7 was analysed, the utilized keywords in the publications listed as "Technology acceptance model" (Occurences"Oc"=74), "technology adoption" (Oc=46), "e-learning" (Oc=29), "online learning" (Oc=25), "distance

learning" (Oc=24) and "ICT" (Oc=18). They were followed by e-learning, education, ICT adoption, technology adoption, and technology education. When the publications keywords were examined, it was noticed that approximately 61% (n = 135) words were used, such as online learning and technology adoption. In addition, those keywords such as satisfaction, achievements, ICT, and education technology research are less preferred in bibliometric analysis.

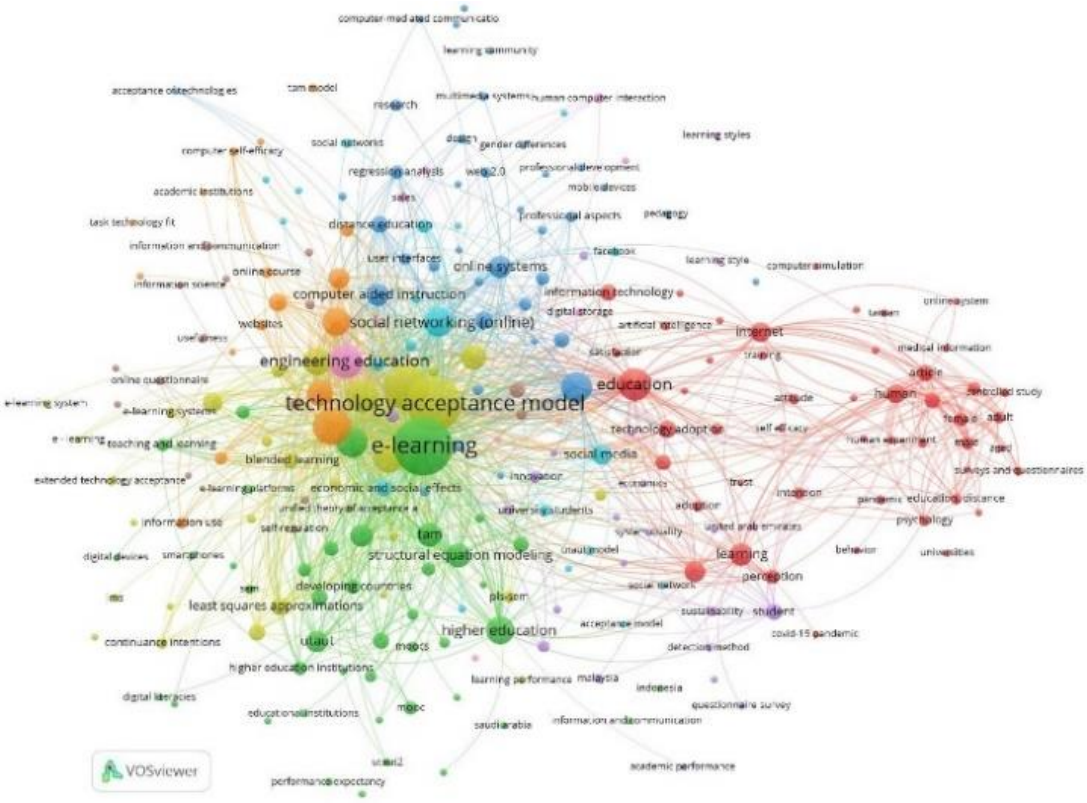

Fig. 7. Most frequently used keywords.

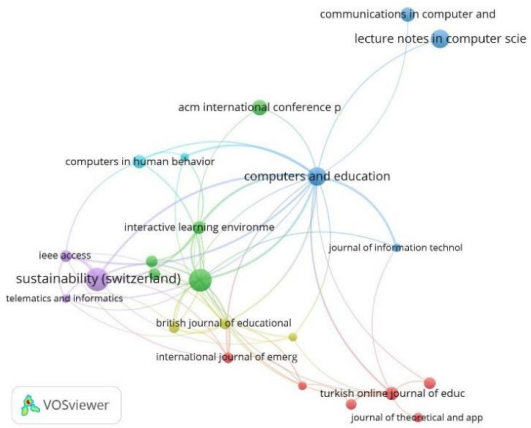

Fig. 8. Most productive journals.

When Fig. 8 was examined, the top four journals with the most citations were sustainability, Education and Information Technologies, and Lecture Notes in Computer Science. Followed by Computers and Education, Communications in Computer and Information Science, Computers in Human Behaviour, Turkish Online Journal of Educational Technology, Interactive Learning Environments, Advances in Intelligent Systems and Computing, IEEE Access. The Most cited journal (Co-Citation) analysis results are presented in Fig. 8.

E. The Most Common Models, Instruments, and Research Approaches Utilized Regarding the TAM and Online Learning Acceptance between 2002 – and 2020

For this part of the study, a content analysis was conducted manually, where all 120 publications were analyzed based on the instruments and the approaches of the study in this context; Table V illustrates the most common study model, tools, and techniques used in TAM and online learning acceptance publications.

TABLE V: LIST OF THE MOST COMMON MODELS, INSTRUMENTS, AND APPROACHES USED IN TAM ONLINE LEARNING ACCEPTANCE PUBLICATIONS

Study Model	The approach of the study	Instrument of the study	Sample of the study
(TAM)	Blended learning	questionnaire survey	college students and lecturers
The general extended technology acceptance model for e-learning (GETAMEL)	Online learning	questionnaire survey	college students and lecturers
(TAM3)	Blended learning	questionnaire survey	college students
(TTF) and (TAM)	E-learning (LMS)	questionnaire survey	college students
TAM	MOOC	questionnaire survey	college students
(TAM2)	flipped classes	questionnaire survey	college students
(TAM) and (ECM)	Online learning	questionnaire survey	college students
TAM	E-learning	questionnaire survey	college students
(UTAUT)	Online learning	questionnaire survey	college students

(UTAUT)	MOOC	questionnaire survey	college students
(TAM) with (ISSM).	Online learning	questionnaire survey	college students
(TAM) and (ECM)	web-based videoconferencing	questionnaire survey	college students
TAM	Google Glass	questionnaire survey	college students
(TAM), (ECM) and (UTAUT)	Online learning	questionnaire survey	college students

TABLE VI: MODELS USED IN RESEARCH IN ONLINE LEARNING

Model	Description	Number of studies
Acceptance technology Model (TAM)	The TAM was developed in the late 1980s based on Reasoned Action theory (TRA) and considerably explained and predicted mortal manners in diverse disciplines. Based on the TAM, learners' thoughts regarding the technological approach define their success in technology-based activities.	72
Acceptance technology Model 2 (TAM2)	Venkatesh and Davis (2000) presented two stages of different processes in TAM2 in comparison with TAM: Firstly, the Social Influence function, and secondly, the cognitive instrumental function.	1
Acceptance technology Model 3 (TAM)	An updated version of TAM2, introduced by Venkatesh & Bala (2008), TAM3 maintains considerable importance for administrative decision-making on IT execution in institutions.	1
The Information System Success Models (ISSM)	DeLone and McLean originally developed ISSM in 1992. This model demonstrated that system quality and information quality could influence both usage and user satisfaction, individually or in unison.	1
The Expectancy Confirmation Model (ECM)	ECT was developed by Bhattacherjee (2001) to understand users continued IS usage intention. ECT proposes that customers' reuse intention and satisfaction are defined by two primary constructs: initial anticipation of a service or product and the assurance rank. According to the ECT framework, customers anticipate the service or product before its actual use.	2
The Unified Theory of Acceptance and Use of Technology (UTAUT)	UTAUT was developed by Venkatesh *et al*. (2003) where "User acceptance of information technology: Toward a unified view." The UTAUT describes user intentions to use an information system and subsequent use intention.	32
The Task Technology Fit (TTF)	The Task-Technology Fit (TTF) theory was developed by Goodhue and Thompson (1995). TFF delivers a mechanism of quantifying the technology's effectiveness in a system by evaluating the association between the technology and the assignments it seeks to sustain.	7
The general extended technology acceptance model for e-learning (GETAMEL)	Abdullah and Rupert developed GETAMEL (2016) GETAMEL was suggested to identify the essential external aspects for acceptance. GETAMEL was developed based on the TAM model.	3

Table V and Table VI illustrate the most common models, instruments, and approaches used in online learning acceptance publications. Firstly, the researchers found different technology acceptance models in their studies from the table above. The first category from the table is the first technology Acceptance model (TAM); previous research that has utilized this model, for instance [38]-[55] these researchers have utilized TAM by their needs, whereas all of these studies were applied using questionnaire survey in blended learning environments. The sample in these studies were college students. The second category uses TAM in the same environment; however, the only difference was the survey sample, college students, and lecturers found in one study only [56]. In addition, few studies [57]-[60] utilized TAM in a different learning environment, which was an E-learning environment, yet the exact sampling and research approach was used in their studies.

The third category utilized the general extended technology acceptance model for e-learning (GETAMEL), these studies conducted their experiments on online learning environments using a questionnaire survey, and the sample were college students [38], [61], [62]. Fourthly, one study used technology acceptance model 3 (TAM3) with the same sample and research techniques [63]—Moreover, a survey by [64] utilized technology acceptance model 2 (TAM2). In contrast, the environment was different from the previous studies, as, in this study, flipped classes were used.

Moreover, several studies were found to utilize both Task Technology Fit (TTF) and Technology Acceptance Model (TAM) in the E-learning (LMS) environment, yet the exact sampling and research technique were applied in their studies [43], [65]-[69]. On the other hand, a study utilized the Technology Acceptance Model (TAM) and Expectancy Confirmatory Model (ECM), the only research to integrate these two technology acceptance models.

Furthermore, several studies [70]-[74] utilized the unified theory of acceptance and use of technology (UTAUT) in the online learning environment among their students. In addition, few studies used the model of UTAUT in the MOOC environment [75]. Moreover, a study by [76] used the integration of the technology acceptance model (TAM) with evaluation information system success models (ISSM) in his research. Furthermore, few studies used the integration of the Technology Acceptance Model (TAM) and the Expectancy Confirmation Model (ECM) in the web-based videoconferencing platform [28]. Additionally, A study by [77] used Google Class to apply TAM. Finally, [78] study found to integrate three models in their research which are the Technology Acceptance Model (EAM), Expectation Confirmation Model (ECM), and Unified Theory of Acceptance and Use of Technology (UTAUT). Fig. 9 illustrates the percentage of research papers related to each model of technology acceptance.

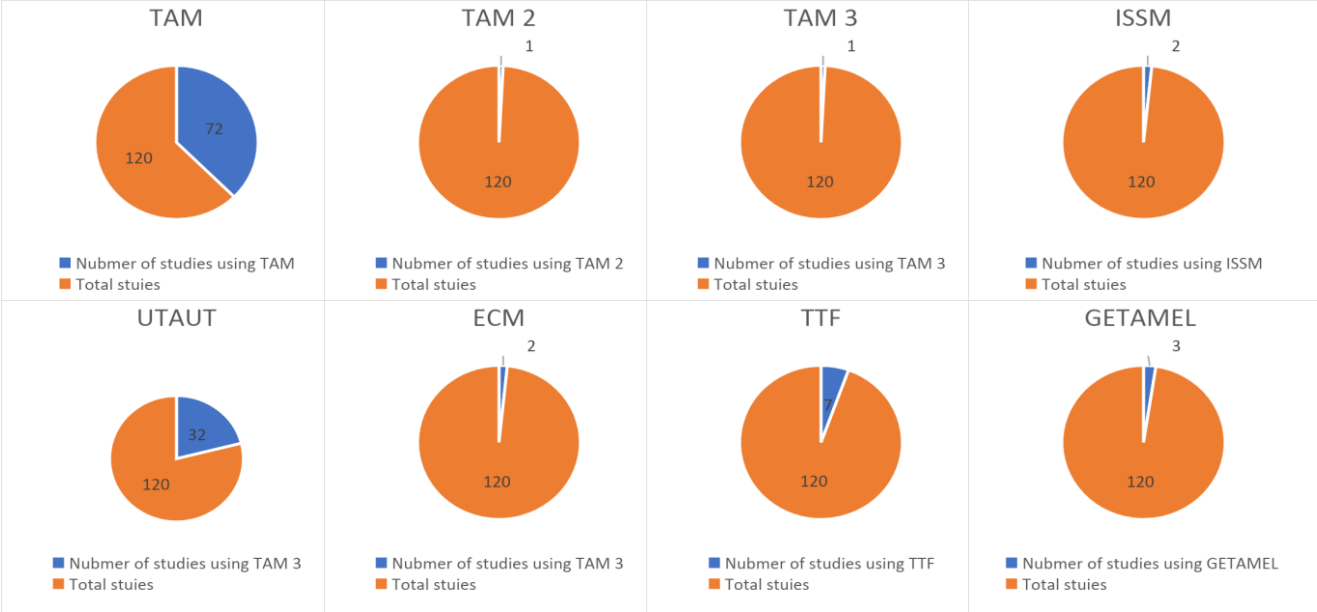

Fig. 9. Percentage of research papers related to each Model of technology acceptance models.

V. Discussion

According to the 120 research publications gathered from the Scopus database, this review presents an overview of TAM and online learning acceptance review utilizing content analysis and bibliometrics. This trend analysis of the research review reveals an increasing interest in online learning acceptance and the models integrated into the previous research as a promising field of study. Such an analysis of the publishing sources indicates that TAM and online learning acceptance is mainly welcomed by interdisciplinary fields concentrating on the relationship of technologies and their implications in education in general. (See Fig. 6).

Moreover, Scientific cooperation analysis shows that countries/regions (e.g., the UK, China, Taiwan, Jordan, the UAE, Malaysia, and Australia) presenting more interest in global cooperation are likely to evolve faster. Additionally, the collaborations among the same institutions or regions are much more significant. This study has identified the most related research topic in online learning acceptance, the most utilized models, research approaches, and instrumentations. These topics include (online learning acceptance, ICT adoption, and the utilization of technology in educational settings. Furthermore, the current study also illustrates that the tendencies and trends in online learning acceptance and models that were utilized in previous research, that could be divided into eight significant models, 1) the technology acceptance model (TAM), 2) TAM2, 3) TAM3, 4) The Information System Success Models (ISSM)., 5) the Expectancy Confirmation Model (ECM), 6) The Technology Acceptance Model (EAM), 7) Unified Theory of Acceptance and Use of Technology (UTAUT), 8) The Task Technology Fit (TTF), 9) The general extended technology acceptance model for e-learning (GETAMEL).

On the other hand, the current study also illustrates that the most tendencies and trends in online learning environments could be divided into seven significant territories, 1) Blended learning, 2) E-learning (LMS), 3) flipped classes, 4) web-based videoconferencing, 5) Google classes, 6) MOOC, and finally, 7) online learning.

This study contributes to the online learning research community as outlined below. On the one hand, this research is helping practitioners, policymakers, and scholars better understand the present, past, and potential online learning setting's academic structure, models, and instrumentations. On the other hand, considering the bibliometric analysis, as mentioned in the literature, for instance, [20] analyzed the performance of the top countries/regions and institutions may "assist people in identifying significant factors in the field from which they could learn" [32] Therefore, the findings of significant contributors in online learning acceptance research support academics to acknowledge potential countries/regions and institutions sharing online learning research experiences. Likewise, top countries/regions and institutions' results, in conjunction with the findings from scientific cooperation analysis, can assist scholars in identifying possible contributors to discover potential scientific collaborations on online learning acceptance research. Moreover, for the top countries/regions and institutions, topic distributions analysis exposes their research strength by providing emerging topics that are devoted and productive to the research area; in addition to further combining findings of scientific collaborations, this also reveals those institutions or countries "with the same research interests were more motivated to conduct collaborative research [35]. Therefore, according to earlier bibliometric reviews, e.g., [35], those findings support facilitating scientific associations by incorporating "the strengths of various research disciplines or units to conquer challenges and improve the whole research area" [34].

Primarily, technology has permeated online learning and the application and development of technologies for online education acceptance support, and thus, it will continue to be an active research field. Consequently, attention must extend beyond web-based and computer technologies to keep pace with the incorporation and application of various up-to-date technologies (e.g., online learning course design, communications channels among students and their

instructors, students' self-control, and students' self-learning efficacy) to help make learning environments more innovative and effective. Attention must similarly be given to how technologies can be combined into online learning platforms to ease teaching and learning [79]-[83], for instance, assessment and feedback, engagement and dropout recognition, critical thinking development, and learning style mining. It is essential to help teachers on using innovative technologies and help them consider technology functionality affordances regarding online teaching and learning, especially in integrating the best strategies such as blended learning and collaborative learning. Close cooperation among scholars from various disciplines is crucial to permit technological innovations to fulfil the needs and overcome the challenges in the online learning acceptance field.

A. Practical Implications of the Study

The annual number of online learning acceptance publications reveals this research field's dramatically increasing interest. Such active research on online learning acceptance indicates a promising expanding trend. Multidisciplinary journals focusing on technology and education are involved in online learning acceptance research. Universiti Teknologi Malaysia (UTM) was the most productive country and institution to publish online learning acceptance research. Global collaborations could contribute to better scientific performance. Keywords like "online learning acceptance," "technology acceptance model," "TAM," "online learning environments," and "E-learning platforms" were commonly mentioned and used in online learning acceptance journals. Major research topics include technology integration, Blended learning, and educational technology research. Most subjects, including online education, Blended learning, students' achievements, satisfaction, autonomy, and technology in education, have received growing attention from scholars devoted to online learning research.

B. Theoretical Contributions of the Study

The current research is intensifying a step forward by implementing the TAM model along with various technology acceptance models that could be divided into eight significant models, (1) the technology acceptance model (TAM), (2) TAM2, (3) TAM3, (4) The Information System Success Models (ISSM)., (5) the Expectancy Confirmation Model (ECM), (6) The Technology Acceptance Model (EAM), (7) Unified Theory of Acceptance and Use of Technology (UTAUT), (8) The Task Technology Fit (TTF), (9) The general extended technology acceptance model for e-learning (GETAMEL).

VI. Conclusion

This study has identified the most related research topic in online learning acceptance, the most utilized models, research approaches, and instrumentations. These topics include (online learning acceptance, ICT adoption, and the utilization of technology in educational settings. Thus, this reveals that learners first make sure whether using platforms of online learning were able to meet their study requirements or that using media of online learning is relevant to their study process before considering employing such technology in their study.

VII. Limitations of the Study

There are limitations to this research. Initially, the Scopus database only has been used for data collection. Thus, it does not cover all academic journals. Consequently, journals from another database, for example, the WoS, may not have been included in this analysis. Moreover, the most recent publications for 2021 in Scopus were disregarded. Nonetheless, such limitations will not likely impact the trends and patterns identified in this research. Additionally, only "online* learning*" and "technology* acceptance* model*" as search terms have been used in retrieving data. Though using precise search terms can result in a narrower data set. All future technologies which can be used for accomplishing online learning were considered, including "online* learning*," "blinded* classroom*," "learning analytics," "educational technology*," "education settings," and "online education.". Consequently, using more precise search terms were used in this analysis (i.e., "online* learning*" and "E-learning* acceptance*"), concentrating on the realization of online learning acceptance instead of the prospective methods that could be involved.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Hassan Abuhassna, the correspondence author led the team through this work of analysis and research. Moreover, all authors worked evenly in writing and approving the final version of the study.

Funding

The Malaysian Ministry of Higher Education funded this work under the Fundamental Research Grant Scheme (FRGS/1/2020/SSI0/UTM/02/8).

Acknowledgment

The Malaysian Ministry of Higher Education funded this work under the Fundamental Research Grant Scheme (FRGS/1/2020/SSI0/UTM/02/8).

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