

Research trend on the application of “E-Learning Adoption Theory” : A scientometric study during 2000-2019, based on Web of Science and SCOPUS

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Bibliometric study of the research trend on e-learning adoption theory is essential to investigate the existing literature to identify a suitable theory for new research. Objective of this study is to explore the research trend in scientific literature on e-learning adoption theory. Search of Web of Science and SCOPUS were carried out to find papers dealing with the contours of e-learning adoption theory. This study retrieved 84 research papers from Web of Science and 324 from SCOPUS on the “e-learning adoption theory.” USA and Taiwan accounted for the highest number of publications with 39 papers (12.03%) and 19 papers (22.62%) in SCOPUS and Web of Science respectively. Computer Science has the highest number of papers in SCOPUS whilst Education and Educational Research is the top in Web of Science. China Agricultural University and Universiti Teknologi Malaysia have the highest number of publications four and seven in Web of Science and SCOPUS respectively. National Central University and China Agricultural University are the most productive organization as they have received 321 and 69 citations on e-learning adoption theory in Web of Science and SCOPUS respectively. Among the authors, Tarhini Ali of Brunel University, London has published the highest number of papers (five) on e-learning adoption theory in Web of Science and received 124 citations. Despite, Giannakos, M.N. and Pappas, I.O. have published the same quantity of papers (five) in SCOPUS, they have received only 47 and 22 citations respectively. Journal namely Computers and Education have published the highest number of papers in both databases at 13 (16.05%) and 14 (4.32%) received the highest number of citations at 996 (53.04%) and 1487 (39.37%) for those papers in Web of Science and SCOPUS respectively. Among the technology adoption theories, the Decomposed Theory of Planned Behaviour is more suitable to study e-learning behavior of individuals.

Keywords: Scientometric study, Learning theories, Educational Technology, Technology Acceptance Theories. Online learning

1. Introduction

E-learning was defined by several authors in different way. However, this study considers the most recent definitions. "E-learning is the product of digital technology that turns traditional courses into virtual courses. The concept of an online course is the use of virtual environments to replace a part of the physical classrooms" [1]. Another most concise definition is "E-Learning is learning which is enhanced, supported, mediated or assessed by the use of electronic media"[2]. Most of the universities around the world are moving towards e-learning [3,4,5]. This approach to teaching and learning has taken root in the developing countries as well [6,7]. E-Learning adoption studies have been carried out by several researchers from various geographical locations. Even the situation in some developing countries has been studied. Since e-learning practice is a new trend in the higher education systems, exploring the existing literature is essential for furthering research in this area. Previous literature on e-learning suggested that adoption seemed poor in some universities. This can be taken as evidence that "though introduced approximately 20 years ago, online learning has not yet matured fully" [8]. Traditional practices of teaching and learning still remain dominant, according to Lakshman and Schubert [9]. Therefore, it is important to do research on 'factors affecting e-learning adoption' in the academic institutions of various countries. So far, scientometric reviews on e-learning adoption theories have rarely been studied. Therefore, a deep and extensive bibliographical review is essential to learn more about e-learning adoption theories. This research study has the following research questions relating to this matter.

1. What are the categories of documents on the broad subject area of 'e-learning adoption theory' that exist globally, with details of publication languages, and geographical location of research?
2. How satisfactory is the research productivity, scientific impact and growth trend of literature on 'e-learning adoption theory'?
3. What are the theories used by researchers so far to do research on e-learning adoption?
4. Is Decomposed Theory of Planned Behaviour (DTPB) suitable for e-learning adoption studies?

1.1 Objectives

The main objective of this study is to identify the growth pattern of Scientific Literature published globally on 'e-learning adoption theories' over the period 1989 to 2019 and indexed in the Web of Science and SCOPUS database. In addition, this study aims to identify the various types of theories applied when researching e-learning and examines the suitability of DTPB for e-learning adoption.

Specific Objectives:

1. To identify the various types of literature on e-learning adoption theories published from 2000 to 2019 August.
2. To identify the geographical origin, language of publication, broad subject area and growth trend of the literature on e-learning adoption studies.
3. To identify the most productive country, institution, journal and author/s with the highest number of published research papers on e-learning
4. To identify the citation pattern and the most highly cited paper on e-learning
5. To explore the theories that were applied for e-learning adoption studies
6. To find the suitability of DTPB for e-learning adoption

1.2 *Review of related research*

E-Learning was defined by several authors in various aspects. Zetian, Fu et al., [10] defined as “e-learning can be viewed as the delivery of course content via electronic media, such as internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV and CD-ROM”. Though the mode of delivery varies, the basic concept of e-learning is, learning by using innovative technology rather than face-to-face mode. Most of the higher learning institutions around the world are moving towards e-learning, [11,12]). This can be described as one of the prominent paradigm shift in education sector. However, the adoption rate is not much encouraged. Researchers are interested on examining the factors associated with poor adoption rate and they are utilizing different models and theories, [6, 10, 13, 14, 15]. However, there is not a single bibliometric study has been carried out to study the research trend on e-learning adoption theory though bibliometric study have been conducted on mobile learning [16, 17, 18]. Therefore, this study will be very useful to explicit the growth of research on e-learning adoption.

2. Methodology

First of all, a comprehensive review of the literature on the main models of adoption with respect to new technologies and their applications in the studies on e-learning adoption theories was carried out. Specifically, the purpose of this bibliographical review was to position a research study on ‘factors affecting e-learning adoption’ within the existing literature and to justify its importance from the empirical and theoretical perspectives. Secondly, on the basis of this reviewed literature, a suitable theory on the adoption of new technologies is selected, which can serve as a preliminary model for the quantitative phase of the e-learning adoption research.

Bibliographic search was carried out by using the Web of Science (WoS) and SCOPUS database in January 2020. These bibliographic databases are considered not only as the most representative but also as very comprehensive for Social Science researchers. The

keywords used for this search were “e-learning”, “adoption” and “theory”. The research process consisted of three phases:

- (1) A systematic compilation of the articles identified by the keywords, “e-learning adoption theory”.
- (2) Individual evaluation of the contents of the abstracts of retrieved research papers.
- (3) Refined search with technology/ innovation adoption theories by using the AND Boolean operator.

Only studies addressing the ‘e-learning adoption theory’ from behavioural or attitudinal perspectives were selected. From each article, information was extracted according to three main criteria, which were: the geographic scope, broad disciplines and theory applied.

As e-learning adoption refers to an innovative, technology based system usage, theories related to technological acceptance, such as “Technology Acceptance Model (TAM),” “Unified Theory of Acceptance and Usage of Technology (UTAUT),” “Information System (IS) Success Model,” “Diffusion of Innovation Theory (DOI),” “Theory of Planned Behaviour (TPB)” and “Decomposed Theory of Planned Behaviour (DTPB)” were also used to refine a promising result.

3. Results and Discussion

Results show the documents that were retrieved by using the keywords applied to perform the searches from Web of Science and SCOPUS database. The major objective of this research was to identify the factors influencing e-learning adoption studies, ‘e-learning adoption’ was used as the search term. The search for e-learning adoption returned 289 results from Web of Science and 1864 from SCOPUS. As the main focus of this study was to identify the literature on ‘e-learning adoption theory’, this specific terminology returned

Table 1

Summary of Search Results for e-learning adoption theory from Web of Science Co-collection and SCOPUS

Term used for search	Web of Science				SCOPUS			
	No. of papers	h-index	Average Citations per publications	No. of times cited	No. of papers	h-index	Average Citations per publications	No. of times cited
e-learning adoption	289	42	22.89	6,616	1,864	52	7.79	14,516
e-learning adoption theory	85	25	32.18	2,735	324	28	11.66	3,777

Table 2
Types of documents available in Web of Science and SCOPUS on e-learning

No.	Web of Science			SCOPUS	
	Document type	Number of Publications	Percentage	Number of Publications	Percentage
1	Article	80	94.12	153	47.08
2	Review	2	2.35	4	1.23
3	Conference Review	-	-	18	5.54
4	Correction	1	1.18	-	-
5	Early access	1	1.18	-	-
6	Proceedings paper	1	1.18	141	48.39%
7	Book chapter	-	-	7	5.54

84 and 324 results from Web of Science and SCOPUS respectively, (refer table 1). All 84 papers of WoS had been published in English, whilst in SCOPUS 321 papers were in English language and one on each Chinese, French and Portuguese were also appeared.

Bibliometric analysis on e-learning adoption theories in respect of publication categories, publication productivity, most productive countries, most productive institutions, most productive journal, most productive author/s, language used, average citations per paper and the most frequently cited paper were carried out.

3.1 Document type

Out of the 84 papers of WoS, 80 (94.12%) journal papers had been published in 42 Journals, one proceedings paper, two reviews, one Correction and early access paper as shown in Table 2. These publications had received 2735 Citations at a rate of 32.18 per paper up to December 2019. On the other hand, out of the 324 papers of SCOPUS, only 153 (47.08%) were journal papers, 141 (43.39%) proceedings papers, 18 conference reviews, four reviews and seven book chapters were available as shown in Table 2. These publications had received 3,777 citations at a rate of 11.66 per paper up to December 2019.

3.2 Geographical distribution

There were 84 publications of WoS on e-learning adoption theory that had originated from 23 countries, (refer figure 1). From Taiwan 18 (22.22%), England 13 (16.05%), USA 12 (14.82%), China nine (11.11%) and Malaysia, South Korea and Spain five (6.17%) each. Considering SCOPUS results 39 papers were from USA, 36 from UK, 26, from Malaysia and 23 from Taiwan. This diversity in the geographical distribution reveals the essence of the area of research. The majority of studies, which numbered 18 papers (22.22%) of Web of Science originated from Taiwan while 39 papers (12.04%) were originated from USA.

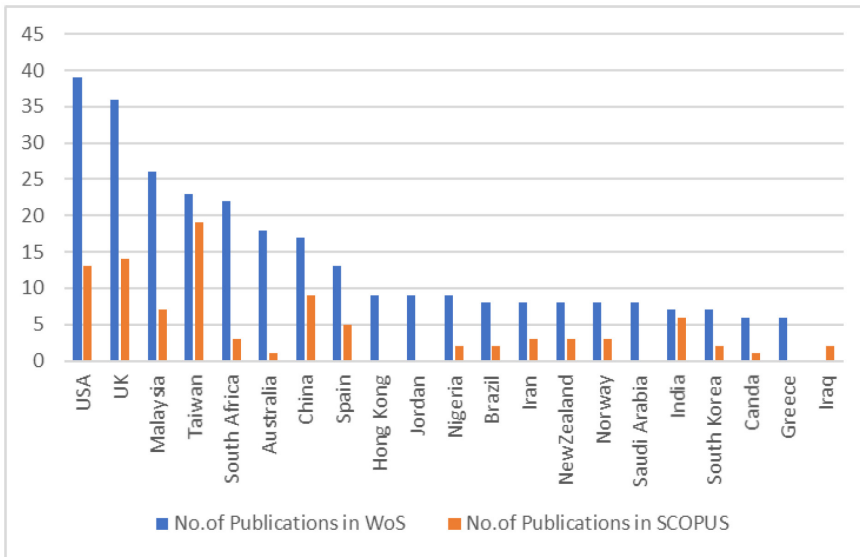


Figure 1
Bar chart for geographical distribution of literature

3.3 Growth trend of Literature on e-learning adoption theories

Table 3 and 4 summarizes the growth trend of literature on e-learning adoption theories from 2000 to 2019 appears in Figure 2. WoS had experienced exponential growth throughout the years from 2005 to 2013. However, there was a decline in the growth of research papers in 2014, but from 2015 onwards the growth rate picked up. SCOPUS

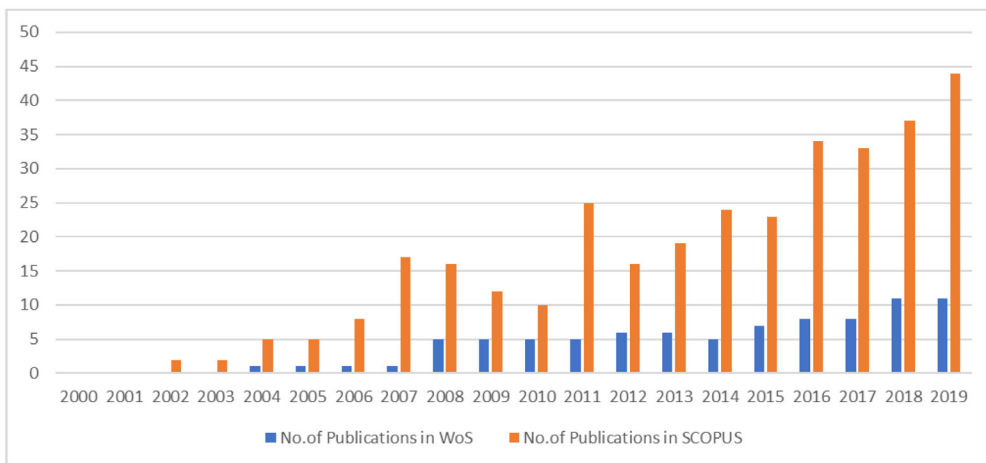


Figure 2
Annual growth trend from 2000 to 2019

database also had peaks and falls. Therefore, research on e-learning adoption theory has no definite growth pattern. The highest growth rate was observed for the year 2018 and 2019 for WoS, at 11 papers (13.58%), whilst in SCOPUS it was 44 papers (13.58%) in 2019. It appears that an exponential growth trend may be observed even in 2019 and subsequent years as this is an important area in which most of the e-learning researchers are taking a big interest at present. 2019 has been the most productive year of all.

3.4 Broad Subject area of e-learning research

Considering the broad subject area of WoS, 43 papers (51%) of the publications fall into Educational research and the rest are categorized as Computer Science, Library & Information Science, and Computer Science & Information Systems. Moreover, in SCOPUS database 241 papers (74%) were classified into Computer Sciences and the rest are Social Sciences, Engineering, Business, Management & Accountancy, Decision Sciences and Mathematics. Others fall into various disciplines as depicted in the figure 3 and figure 4. WoS and SCOPUS database has differently classified the papers.

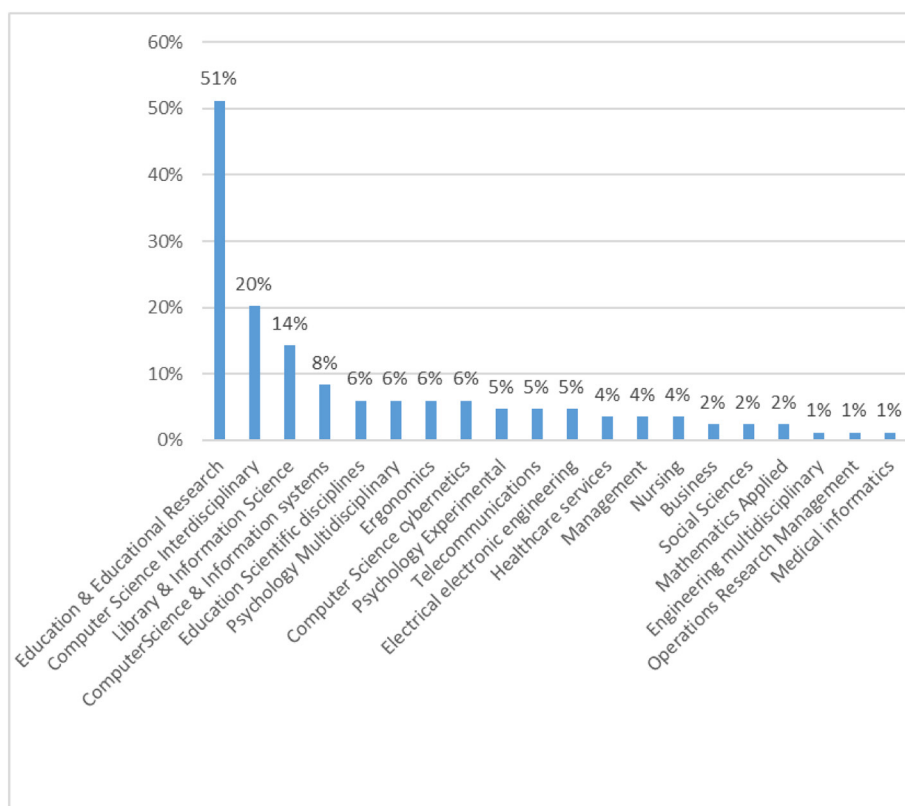


Figure 3
Broad disciplines of the e-learning research papers in WoS

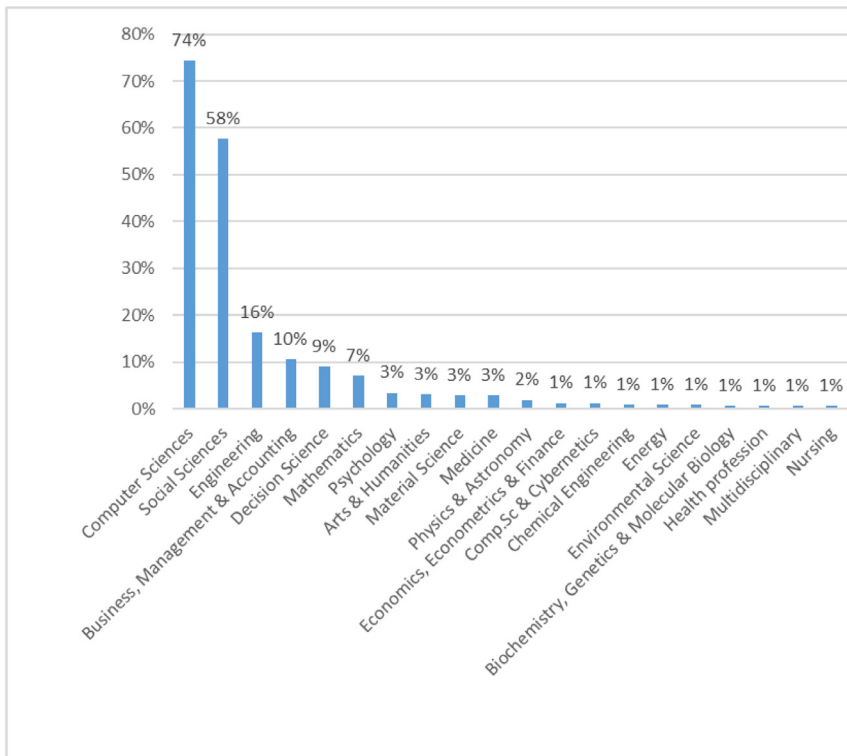


Figure 4
Broad disciplines of the e-learning research papers in SCOPUS

3.5 Most productive institution

Most of the publications on e-learning adoption theories indexed in the Web of Science and SCOPUS database have been contributed by 130 institutions, with the top 10 organizations having produced 24 papers (29.63%) in WoS and 70 papers (21.60%) in SCOPUS on this subject. China Agricultural University has published four (4.94%) articles in WoS and Universiti Teknologi Malaysia seven (2.16%) in SCOPUS, which were the highest number of publications by an institution on this topic. Trying for the next position are Brunel University and the University of Malaya, each of which has three (3.70%) publications in WoS as well as Norges Teknisk-Naturvitenskapelige Universitet and University of Sheffield has six (1.85%) of each in SCOPUS, on e-learning adoption theories. Details are shown in Table 3 and 4.

In terms of citations received by the top ten institutions, National Central University has earned 321 citations at a rate of 160.5 in Web of Science. Moreover, these ten organizations have received a total of 628 citations, which correspond to 33.44% of the total citations received by WoS.

Table 3

Top 10 Institutions that have achieved the highest productivity in e-learning research –WoS database

Institution	Number of Publications	Percentage	Average citations per publications	Citations received without self
China Agricultural University	4	4.94	19	65
Brunel University	3	3.70	42	110
Universiti Malaya	3	3.70	11	33
Autonomous University of Madrid	2	2.47	2	4
Chaoyang University of Technology	2	2.47	20.5	41
Coventry University	2	2.47	1	2
K N Toosi University of Technology	2	2.47	8.5	16
King Saud University	2	2.47	6.5	11
National Central University	2	2.47	160.5	321
National Cheng Kung University	2	2.47	12.5	25
Total	24	29.63	-	628 (33.44%)

Table 4

Top 10 Institutions that have achieved the highest productivity in e-learning research –SCOPUS database

Institution	Number of Publications	Percentage	Average citations per publication	Citations received
Universiti Teknologi Malaysia	7	2.16	1	7
Norges Teknisk-Naturvitenskapelige Universitet	6	1.85	3.67	22
University of Sheffield	6	1.85	2.5	15
University of South Africa	5	1.54	2.6	13
Universiti Malaysia Pahang	5	1.54	4.8	24
Covenant University	5	1.54	6.8	34
Universiti Kebangsaan Malaysia	4	1.23	2.7	11
Victoria University of Wellington	4	1.23	6.25	25
Universiti Utara Malaysia	4	1.23	11.25	45
University of Fort Hare	4	1.23	5	20
Hong Kong Politechnic uni	4	1.23	1	4
China Agricultural Uni	4	1.23	17.25	69
Intl Islamic University, Malaysia	4	1.23	1.25	5
University of New South Wales Australia	4	1.23	2	8
King Faisal university	4	1.23	2.25	9
Total	70	21.60	-	311(8.23%)

China Agricultural University has earned 69 at a rate of 17.25 in SCOPUS. In addition, a total of 311 citations which correspond to 8.23% to the number of papers published by the top ten institutions in SCOPUS. Comparing the rate of citations; WoS database has earned around four times higher than the SCOPUS.

3.6 *Journals that publish papers related to e-learning adoption theories*

Forty journals have published research papers on e-learning adoption theory in WoS. A journal titled “Computers & Education” has published the highest number of papers, numbering 13 (16.05%) on e-learning. Both the British Journal of Educational Technology and Computers in Human Behaviour have published the second highest number at five for each (6.17%). These top 10 journals have contributed a considerable volume of papers, numbering 45 (55.58%), to the literature on e-learning adoption theory. The rest of the papers were published in various other journals. (Refer table 5).

Table 5
Top 10 sources that published papers on e-learning adoption Theory in WoS

Title of Journal	Number of Published Papers	Percentage	Citations Received	Percentage
Computers & Education	13	16.05	996	53.04
British Journal of Educational Technology	5	6.17	76	4.05
Computers in Human Behaviour	5	6.17	293	15.60
Interactive Learning Environments	4	4.94	31	1.65
Behaviour Information Technology	3	3.70	24	1.28
IEEE Access	3	3.70	10	0.53
Information Development	3	3.70	12	0.64
International Review of Research in Open and Distributed Learning	3	3.70	13	0.69
Journal of Educational Computing Research	3	3.70	40	2.13
Nurse Education Today	3	3.70	46	2.45
	45	55.56	1541	82.05

Table 6
Top 10 sources that published papers on e-learning adoption Theory in SCOPUS

Title of Journal	Number of Published Papers	Percentage	Citations Received	Percentage
Proceedings Of The International Conference On E Learning ICEL	20	6.17	34	0.90
Computers and Education	14	4.32	1,487	39.37
Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics	8	2.47	63	1.68
IEEE Access	6	1.85	56	1.48
17th Americas Conference On Information Systems 2011 Amcis 2011	5	1.54	0	0.00
ACM International Conference Proceeding Series	5	1.54	12	0.32
Communications In Computer And Information Science	5	1.54	0	0.00
Proceedings Of The European Conference On Games Based Learning	5	1.54	1	0.03
British Journal Of Educational Technology	4	1.23	72	1.90
Computers In Human Behavior	4	1.23	126	3.34
	76	23.46	1,851	49.00

Considering the SCOPUS database, a proceedings titled ‘Proceedings of the International Conference on E- Learning ICEL’ has published 20 papers. Anyhow, Computers & Education is the journals contributed highest number of papers among the journals which has 14 (4.32%) of the total contributions of the top ten sources. The rest of the papers were published in various other journals. These top ten sources have contributed a volume of 76 papers (23.46%), to the literature on e-learning adoption theory. The rest of the papers were published in various other journals. (Refer table 6).

3.7 Authors with the highest number of published papers and their research productivity

The study further analyzed the authors, their affiliations and their productivity in terms of the number of published papers and number of citations received. Table 7 depicts the achievements of the top ten authors publication-wise. Tarhini, Ali from Brunel University of London, comes first in the top ten as he has published five papers and received 124 citations with 28.8 being the average citation per paper. Kate Hone and Xiaohui Liu from the same Brunel University have received somewhat fewer citations (109) but scored the

Table 7
Top Ten Authors and their productivity based on WoS

Author's Name	Institution	No. of papers	h-index	Average Citations per paper	Citations Received
TARHINI A ((Tarhini, Ali)	Brunel University, London	5	2	28.8	124
FU ZT(Fu, Zetian)	China Agricultural University, China	4	4	19	65
HONE K. (Hone, Kate)	Brunel University, England	3	3	41.67	109
LI DL (Li, Daoliang)	China Agricultural University, China	3	3	17.67	45
LIU XH (Liu, Xiaohui)	Brunel University, London	3	3	41.67	109
AL-RAHMI WM (Al-Rahmi, Waleed Mugahed)	University of Technology, Malaysia	2	2	6.5	10
CHAVOSHI A	KN Toosi Univ of Technology, Iran	2	1	8.5	16
CHENG Yong Ming	Chaoyang Univ Technology, Taiwan	2	2	20.5	41
DOS SANTOS LMR (Renda dos Santos, Luiz Miguel)	Univ Fed Mato Grosso do Sul, Brazil	2	2	2	4
DUAN YQ (Duan, Yanqing)	University of Bedfordshire, England	2	2	24.5	46
		28(34.57%)			569 (29.7%)

highest average of 41.67 citations per paper. Zetian Fu from China Agricultural University, obtained the highest value for H-index (four) for his four publications. Altogether, publications of the top ten authors accounted for 34.57% of the total research papers published and 29.70% of total citations received. Table 7 tabulates the detail.

Table 8 depicts the achievements of the top ten authors of SCOPUS. Giannakos, M.N. and Pappas, I.O. from Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway come first in the top ten as they have published five papers and received 47 and 22 citations with 9.4 and 4.4 as being the average citations per paper, respectively. Ali Tarhini has received the highest number of citations (118) for his four papers which has 29.50 as average. Zetian Fu from China Agricultural University, China and Tarhini, Ali from Brunel University of London, have obtained the highest value for H-index (three) in SCOPUS. Altogether, publications of the top ten authors accounted for 12.65% of the total research papers published and 10.33% of total citations received.

Comparatively the contribution of top ten authors in terms of publications and citations received were much higher in Web of Science than SCOPUS. Tarhini Ali of Brunel University, London has published the highest number of papers (five) on e-learning adoption theory in Web of Science and received 124 in Web of Science and 118 citations in SCOPUS, which work out to 28.8 per paper in Web of Science and 29.5 in SCOPUS.

Table 8
Top Ten Authors and their productivity based on SCOPUS

Author's Name	Institution	No. of papers	h-index	Average Citations per paper	Citations Received
Giannakos, M.N.	Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway	5	2	9.4	47
Pappas, I.O.	Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway University of Agder, Kristiansand, Norway	5	2	4.4	22
Fu, Z.	China Agricultural University, Beijing Laboratory for Food Quality and Safety, Beijing, China	4	3	17.25	69
Martins, J.T.	Universidade Federal de Lavras, Undergraduate School of Chemical Eng., Lavras, Brazil	4	1	2.25	9
Nunes, M.B.	Sun Yat-Sen University, School of Information Management, Guangzhou, China	4	1	2	8
Tarhini, A.	Sultan Qaboos University, Department of Information Systems, Muscat, Oman	4	3	29.5	118
Al-Rahmi, W.M.	Universiti Teknologi Malaysia, Faculty of Education, Johor Bahru, Malaysia	3	2	10	30
Alamri, M.M.	King Faisal University, Department of Educational Technologies, Al-Ahsa, Saudi Arabia	3	1	2.67	8
Kamaludin, A.	Universiti Malaysia Pahang, Kuantan, Malaysia	3	1	0.67	2
Li, D.	China Agricultural University, China	3	3	22.67	68
Mikakef, P.	Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway University of Agder, Kristiansand, Norway	3	2	3	9
		41 (12.65%)			390 (10.33%)

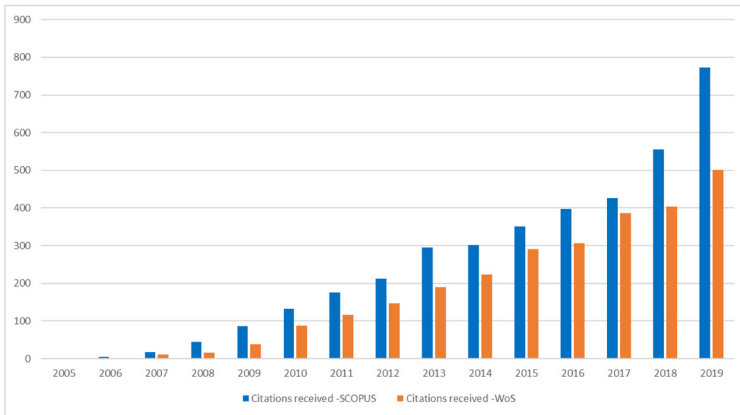


Figure 5

Citation pattern of research papers on e-learning adoption theory

3.8 *Research Impact and Citation Pattern*

A total of 84 papers of WoS and 324 papers of SCOPUS database have earned research impact in terms of citations. WoS has obtained 2,735 and SCOPUS has 3,777 where the average citation per item is 30.27 and 11.66 respectively. Upon studying the citation pattern of the e-learning research papers it was observed that an exponential growth had taken place. This is clear evidence of the significance of this area of research globally.

The top ten papers received the highest number of citations, adding up to 1,620 which accounted for 59.23% of the total citations received in Web of Science. Similarly 1934 citations were earned by the top ten papers of SCOPUS, which accounted for 51.20% of total citations received by 324 papers. *“The Acceptance and Use of a Virtual Learning Environment in China”* authored by van Raaij, Erik M. and Schepers, Jeroen J. L., published in *Computers & Education*, Volume 50, Issue 3 in 2008 received the highest number of citations in both databases totaling 330 and 399 in WoS and SCOPUS respectively. The top ten papers that earned the highest number of citations are listed in Table 9.

Table 9

Top Ten Research papers of with highest impact in terms of number of citations

Title of the papers	Author/s	Source Title	Citations in WoS and the rank	Citations in SCOPUS and the rank
The acceptance and use of a virtual learning environment in China	van Raaij, Erik M.; Schepers, Jeroen J. L.	Computers & Education	330 (1)	399 (1)

Contd...

Usability, quality, value and e-learning continuance decisions	Chiu, CM; Hsu, MH; Sun, SY; Lin, TC; Sun, PC	Computers & Education	210 (2)	281 (2)
Learners' acceptance of e-learning in South Korea: Theories and results	Lee, Byoung- Chan; Yoon, Jeong-Ok; Lee, In	Computers & Education	202 (3)	271 (3)
Multi-criteria evaluation of the web-based e-learning system: A methodology based on learner satisfaction and its applications	Shee, Daniel Y.; Wang, Yi- Shun	Computers & Education	168 (4)	219 (4)
A meta-analysis of e-learning technology acceptance: The role of user types and e-learning technology types	Sumak, Bostjan; Hericko, Marjan; Pusnik, Maja	Computers In Human Behaviour	158 (5)	-
An empirical investigation into factors influencing the adoption of an e-learning system	Lee, Ya-Ching	Online Information Review	137 (6)	171 (5)
Adding Innovation Diffusion Theory to the Technology Acceptance Model: Supporting Employees' Intentions to use E-Learning Systems	Lee, Yi- Hsuan; Hsieh, Yi-Chuan; Hsu, Chia- Ning	Educational Technology & Society	127 (7)	179 (6)
The role of perceived user-interface design in continued usage intention of self-paced e-learning tools	Cho, Vincent; Cheng, T. C. Edwin; Lai, W. M. Jennifer	Computers & Education	102 (8)	-
Versatile, Immersive, Creative and Dynamic Virtual 3-D Healthcare Learning Environments: A Review of the Literature	Hansen, Margaret M.	Journal of Medical Internet Research	105 (9)	136 (7)
Numbers Are Not Enough. Why e-Learning Analytics Failed to Inform an Institutional Strategic Plan	Macfadyen, Leah P.; Dawson, Shane	Educational Technology & Society	81 (10)	123 (8)
The role of intrinsic motivation and extrinsic motivation in promoting e-learning in the workplace: a case from South Korea	Yoo, S.J.; Han, S.H.; Huang, W.	Computers in human Behaviour, 28(3)	-	78 (9)
E-learning motivation and educational portal acceptance in developing countries	Maldonado ,U.P.T. Khan, G.F., Moon, J., Rho, J.J.	Online Information Review 35(1)	-	77 (10)
			1,620 (59.23%)	1,934 (51.20%)

3.9 *Research trend on e-learning adoption theory*

Lack of literature on this topic indicates that there is a gap in research focusing on e-learning adoption theory. But this is an area that must be studied further at present to make academics and administrators aware of the issues and challenges relating to existing facilities and usage. Need to popularize e-learning system adoption in the higher education sector of every country, especially developing countries, to provide quality teaching and learning for formal and distant education is firmly acknowledged by various stakeholders. Therefore, more research studies in this area should be encouraged. Search results of Web of Science and SCOPUS database show an exponential growth of productivity in respect of publishing research papers and receiving citations from 2002 onwards. These two results are good signs that the growth trend will continue in future, too. Most of the research papers (94.12%) were published as journal articles, majority of which fall under the broad heading of Education and Educational technology in Web of Science whilst only 47.08% were published as journal articles in SCOPUS, majority of which falls under the broad headings of Computer Sciences. The journal named ‘Computers & Education’ has published the highest number of papers and earned the highest number of citations in both databases.

3.10 *Content Analysis of the 84 papers of WoS and 324 papers of SCOPUS on e-learning adoption theory*

Several theories are employed by global researchers to test technology acceptance/ adoption when introducing technological innovations in the Information and Communication field. E-Learning is also a very innovative and technology based system designed to promote web-based or online learning [17, 18, 19, 20]. Theories employed for e-learning adoption studies are subdivided into two categories as learning theories and innovation adoption theories, as shown in Table 10.

Table 10
Theories used in e-learning adoption studies

Model/ Theory	Number of Occurrences in WoS	Number of Occurrences in SCOPUS
<i>Learning Theories</i>	(n)	(n)
Transactional distance theory	1	1
Expectancy disconfirmation theory	1	1
Theory of multi-criteria decision making	1	2
Connectivism theory	1	1
Theory of change management	1	1
Social Cognitive theory	2	9

Contd...

Expectation Confirmation (Model) Theory	1	5
Institutional theory	1	3
Socio-technical system theory	1	4
Activity Theory	1	14
Social capital theory	1	11
Social influence theory	1	1
Self-determination theory	1	1
Grounded theory	2	15
Gidden’s theory of structuration	1	2
Older-adult friendly theory	1	1
Self-determination Theory	1	4
Occupational Socialization	1	1
<i>Technology/Innovation Adoption and Information System based theories</i>		
Theory of Reasoned Action (TRA)	1	4
Innovation Adoption theory	1	5
Innovation Diffusion theory (IDT)	-	12
Technology Acceptance Model (TAM)	22	44
Unified Theory of Acceptance and Use of Technology (UTAUT)	15	70
Diffusion of Innovation Theory (Roger’s)	8	23
Theory of Planned Behaviour (TPB)	2	11
Information system success model (IS)	11	2
Decomposed Theory of Planned Behaviour (DTPB)	2	5
Information system Maturity Model	-	2
Information system theory	-	3
Information Syatem Continuance model	-	3
Technology, Organization and Environment (TOE)	-	2
Task, Technology Fit (TTF)	-	2

Search results were again refined by adding a few theories. This research is interested specifically on Innovation adoption or technology acceptance theories rather than learning theories or educational theories. With respect to formulating a theoretical framework, which is the main objective of this bibliographic review, the most frequently used model was the technological acceptance model (TAM) by Davis [23]), and its extended versions,

known as TAM2, as per Venkatesh and Davis [24]), and TAM3, as per Venkatesh and Bala [25] in WoS. Unified Theory of Acceptance and Use of Technology (UTAUT) and its extended versions was used as second. UTAUT was the most frequently used model in SCOPUS whilst TAM and its extended versions were the second. The literature reflects the robustness of the TAM as well as UTAUT which could be judged by the numerous replications made and the extension of same in the area of research. This bibliographic review corroborated this in the field of e-learning. In order to explore concepts related to individual's behavior rest of the papers were explored. It was found papers based on the Theory of Reasoned action, Information System Success Model (IS), Innovation Diffusion Theory (IDT), Diffusion of Innovation theory, Technology, Organization and Environment (TOE) model, Information system success model, Task, Technology Fit model, Theory of planned behavior and Decomposed Theory of Planned behaviour . Combinations of several other models were also used in a few studies. Decomposed Theory of Planned Behaviour (DTPB) was used in only two studies in WoS and five studies in SCOPUS respectively. E-learning adoption studies have rarely been carried out by using Decomposed Theory of Planned Behaviour (DTPB), which is more flexible and includes all variables of TRA, TAM, and important variables of DOI theory and IS model as decomposed factors. Comparative study of TAM, TPB & DTPB by Taylor & Todd [26] has proven the robustness and explanatory power of DTPB. Their study concluded that even though all three models are fit to study behavior, DTPB increases the understanding of behavioural intention deeper than the other theories. "DTPB provides a fuller understanding of behavioural intention by focusing on the factors that are likely to influence systems use through the application of both design and implementation strategies" [26]. This theory has proven as more predictive model than original TPB and TRA models, [11, 13, 26, 27, 28]. This is emphasized as "DTPB is a robust model that perfectly fit the e-learning context" [9]. Therefore, to the best of our knowledge based on the reviewed literature, DTPB has been rarely applied to the study of online teaching in higher education.

Factors related to Attitude, Subjective Norm and Behavioural Control have been decomposed into several sub-variables and multiple dimensions in DTPB. This model has flexibility to input various attributes of other theories that suitable for a specific study. Therefore, to examine the be-learning adoption of individuals, DTPB has been identified as the most suitable theory.

Other than technology acceptance theories, there are 19 other theories have been applied in both databases, which are tabulated in Table 10.

Furthermore, WoS database has one paper in each of the following theories; Expectancy value theory, Self-efficacy theory, Uses and gratification theory, Content layer analysis and sense making theory, Media richness theory, Modern learning theories, Construal level theory, Cognitive load theory, Concept functionality model, Bourdieu's theory and Social support theory.

On the other hand, research papers of SCOPUS data has applied some more theories such as Constructivist Learning Theory, Complexity theory, Actor Network theory have been applied in three papers in each. Two papers have utilized Social Cultural theory. One

on each of the following theories were also there; Domestication theory, Inquiry based learning theory, Synergistic Learning theory, Computation theory, ecological system theory, Digitalization framework, Evolutionary game theory, Uses and delight theory, Education technology gap theory, Belief, desire, Intention Model (BDIM), Innovation Translation Theory, Vygotsky’s Theory, Structuration Theory, Universal Design for learning, Experimental Learning theory, Power electronic theory, Learning style theory, Means-end chain theory, Community of practice theory, Theory for knowledge transfer, Herzberg’s two factor theory, Digital Theory, Kolb’s experimental learning theory, Theory of practice, Online community of practice theory, Marxian Alienation theory, Schwartz’s theory of human value, FLOW Theory, Configuration Theory, Attention, Relevance, Confidence and Satisfaction (ARCS) model, Trialogic Learning Theory, Social Learning Theory, Risk Aversion theory and Theory of practical reasoning. In addition to that, some kind of algorithms and Ontology based user modelling have also been applied in two papers in each. As this research study focuses mainly on innovation adoption theory, the other theories were not explored.

Conclusions

This study recorded a total of 84 papers that were published on e-learning from 1989 to 2019 in WoS and 324 in SCOPUS. These papers have received 2735 citations in WoS and 3,777 citation in SCOPUS. The main language of these publications is English. Maximum growth was found in 2019 but there was no definite growth pattern. Altogether 34 countries have contributed to e-learning research with the topmost contributor being Taiwan, with 19 papers (22.24%) in WoS. Similarly 70 countries have contributed to SCOPUS with 39 papers were from USA. Among the most productive Institutions, China Agricultural University held the lead in WoS and Universiti Teknologi Malaysia was the lead in SCOPUS. The most prominent authors were Tarhini Ali in WoS and Giannakos, M.N., and Pappas, I.O. in SCOPUS who have published five papers on e-learning, which have earned 124 citations, 47 citations and 22 citations at the rate of 28.8, 9.4 and 4.4 respectively. Considering the prominence in terms of research impact, Tarhini Ali is at top in both databases who has earned 124 citations for his five papers in WoS and 118 citations for his four papers in SCOPUS. The Top journal was ‘Computers & Education’ as it has published the highest number of papers totaling 13 (16.05%) in WoS and 14 (4.32%) in SCOPUS. Together the top ten journals have contributed 45 papers, which account for 55.56% of the total research output in WoS whilst the top ten sources have contributed 76 papers, which account for 23.46% of the total research output in SCOPUS. The most frequently cited paper (330 citations in WoS and 399 in SCOPUS) was “The acceptance and use of a virtual learning environment in China” authored by van Raaij, Erik M., and Schepers, Jeroen J. L., published in ‘Computers & Education’ journal. This study concluded that across the world, 70 countries have engaged in e-learning adoption theory researches; TAM and UTAUT were used in majority of the papers. Some research papers have used a combination of two or three theories to formulate their research framework. The researcher identified DTPB as the best

model [9, 26, 28] for future studies as it can accommodate most of the requirements and is flexible enough to deal with inputs from any other decomposing factors that a researcher finds crucial.

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