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Behavioural Intention of Using E-Learning System: A Bibliometric Perspective

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Abstract

The Unified Theory of Acceptance and Use of Technology (UTAUT) has evolved to be a very important theory in the acceptance and usage of learning technologies. This paper does a bibliometric study on UTAUT concerning learning environments based on the Scopus database from 2004 to 2025. By the use of sophisticated bibliometric instruments, procedures, and methods such as citation analysis, co-authorship mapping, and keyword co-occurrence visualization, this paper presents an extensive analysis of UTAUT in learning.he analysis seeks to determine the trends and the contributors and shifts in the research focus in the last twenty years. It draws attention to such a factor as the practical application of UTAUT in learning studies and its critical importance in understanding the use of educational technologies. UTAUT continues to advance as more usage of its concept is illustrated in learning environments with newer ideas that address recent developments such as mobile learning and digital literacy being integrated.In addition, through this method, the paper maps out the chronological development of UTAUT within the scope of learning and suggests several potential directions for future studies after identifying existing challenges. The results substantiate the importance of UTAUT in the conduct of technology diffusion issues, with an emphasis on educational change and the development of pedagogical ideas in the custody of new technologies.

Keywords: *UTAUT Framework, E-Learning, Bibliometric Analysis, Technology Adoption, Educational Technology.*

Introduction

At the core of understanding technology utilization in various realms, the Unified Theory of Acceptance and Use of Technology (UTAUT) has become a vital conceptual pillar. Since the seminal work by Venkatesh et al. (2003), it has woven through diverse scholarly terrains, advancing perception in fields from education to public administration. This paper's bibliometric evaluation examines how learning theories have changed over time and how they have changed in relation to UTAUT. It does this by identifying the subtleties and trends that have helped us better understand how people accept technology and how education is progressing. Delving into a wealth of scholarly material and diverse citation trails, this study seeks to sketch the research trajectory and catalog the dialogue between the UTAUT and various pedagogic theories. The expansion of technology and its assimilation into academia necessitate a critical examination of how traditional learning theories coalesce with models of technological acceptability. Many studies have used the four main ideas of UTAUT as building blocks to examine the complex web of factors that influence people's decisions to use technology. These are performance expectations, effort expectations, social influence, and facilitating conditions.

We meticulously carried out database searches spanning two decades of literature before embarking on this bibliometric analysis. Bibliometric analyses, in conjunction with close reading, processing publication momentum, keyword patterns, authorship maps, and citation matrices, assist in uncovering crucial information and illuminating the academic currents influencing the application of UTAUT in learning theories. The evolution of UTAUT itself, morphing into refined forms such as UTAUT2, broadened its vista to embrace factors including hedonic motivation and habituation (Venkatesh, Thong, & Xu, 2012).

The convergence of learning theories with the UTAUT construct marks a rich integration of educational psychology and technology studies. Rooted in the past, we see behaviorism, cognitivism, and constructivism

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as seminal frameworks for decoding the mechanics of learning and instruction. With technological frontiers broadening, the infusion of these pedagogical paradigms within UTAUT reveals deep insights into technology's role in mediating education. For instance, effort expectancy echoes through the lens of cognitive load theory, aligning a user's interaction complexity with effective technological integration (Paas, Renkl, & Sweller, 2003).

The amalgamation of UTAUT and learning theories has yielded fresh perspectives that not only pilot empirical ventures but also shape instructional design practices. This bibliometric portrait is meant to both highlight important studies and point out important directions for future research, which could change UTAUT's concepts or include new learning theories in them.

A story-based analysis of real-world data brings together the main ideas of learning theories with UTAUT's framework. This is important for understanding how these ideas will affect education in the future and how people will use technology. This paper goes into great detail about the bibliometric results, which not only show how scholarship has changed over time but also show how well-thought out theories and strong empirical evidence are driving the current use of technology in education. A carefully chosen reference collection is also in support of this bibliometric analysis. It includes groundbreaking studies and scholars who have shaped the area where educational theories and technology acceptance meet.

The UTAUT literature landscape unfolds, revealing an intricate tapestry of interdisciplinary inquiry. Additionally, UTAUT has integrated elements from previous models to provide a comprehensive explanation. It proposes four main ideas for the foundation of technology use intent (Venkatesh et al., 2003). Pavlov (1927) and Skinner (1938) wrote in great detail about behaviorism, which gave way to cognitivism and constructivism, leading to the cognitive revolution and a greater focus on the learner's role (Piaget, 1952; Vygotsky, 1978). This is similar to how technology acceptance models have changed over time.

Educational technology, where the axes of UTAUT's constructs meet with teaching methods to reveal useful results, demonstrates the real-world effects of these theoretical connections (Tarhini, Hone, & Liu, 2014). Al-Gahtani (2016) tailors the application of UTAUT to educational environments, integrating novel constructs that resonate with the learning milieu that educators and students navigate.

Newer studies use bibliometric methods to narrow down the UTAUT framework's influence and thematic reach, revealing important research paths and thematic frontiers (Williams, Rana, & Dwivedi, 2015). The blending of learning theories within UTAUT reflects a broader interpretation of technology's engrained role in contemporary education, a mosaic of variables that educational strategists and technological designers must carefully consider. Moreover, the dialogue between evolving educational theories and their inscribed role within UTAUT-oriented research elucidates a dynamic flux. This interaction underscores a practical essence influencing the design and deployment of educational technology, which in turn loops back to affect learning outcomes (Teo, 2011).

The significance that emerges from this scholarly examination positions UTAUT as an inherently dynamic and continually enriching model, increasingly intertwined with a range of learning theories. The insights offered by this bibliometric dissection demonstrate the profound adaptability of the UTAUT model in explaining and predicting technology engagement within educational settings. Furthermore, it establishes a solid foundation for future pedagogical strategies and technological advancements. Therefore, the bibliometric investigation of the integration between learning theories and the UTAUT framework highlights its crucial role in educational technology research, as demonstrated by the following inquiries:

Q1. In the academic literature, what are the publication trends related to UTAUT? How has the volume of research evolved over time, and are there any noticeable patterns or shifts in publication frequency?

Q2. Who are the prolific authors contributing to UTAUT-related research? Are there specific authors or research groups dominating the field, and how has authorship evolved over different periods?

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Q3. What types of documents contribute to UTAUT's understanding? Is there a concentration of UTAUT-related research in popular sources like journals, conferences, or books?

Q4. Which work within the UTAUT framework has garnered the most citations? Are there seminal papers or influential studies that have had a significant impact on subsequent research in this domain?

Q5. What are the prevalent keywords, and how have they evolved over time? Are there emerging themes or changes in terminology that reflect the evolution of UTAUT concepts?

Q6. How prevalent is collaboration among authors in UTAUT-related research? Are there dominant collaborations or networks between researchers or institutions, and how has this collaboration evolved?

Q7. What is the geographical distribution of contributions to UTAUT-related research? Are there specific regions or countries that are more active in producing research on UTAUT?

Q8. How has the application of the UTAUT framework extended beyond traditional technology and education fields? What interdisciplinary connections or intersections exist in UTAUT-related research?

Materials and Methods

The term "research methodology" refers to the organized approaches and methods used in the pursuit of scientific study. It comprises the complete planning, strategies, and data-gathering processes used. Bibliometrics, grounded in the venue of library and information science, operates as a quantitative analysis technique to scrutinize scholarly texts such as books and academic articles (Bellis, 2009; Connaway & Radford, 2021). Designed to chart and evaluate the articulations of scientists, bibliometric studies adapt to the fluid research contours shaped by the evolution of journal publication indices. This methodology also serves to assess the import and relevance of academic fields as communicated via scholarly texts (Campbell et al., 2010). Citation metrics often infer the prestige of academic publications, with high-frequency citations suggesting noteworthy impact. Furthermore, bibliometric research unravels key details such as prevalent themes, notable contributors, and the primary discussion points of the literature (Agbo et al., 2021; Shome et al., 2023).

In this light, the current study has started a bibliometric investigation by looking at work from well-known journals in the huge Scopus database. Its main focus is on how the UTAUT framework fits into learning environments. Scopus enjoys a global reputation as a repository for scientific outputs, offering detailed records applicable to a plethora of scientific fields. Recognizing the unique ability to tailor searches on various benchmarks ranging from subject matter to publishing country, Scopus stands as a pivotal reference point for bibliometric research data compilation.

The bedrock of our study was qualitative research methodology, specifically a literature review, which scrutinized some 1600 publications related to the UTAUT framework in educational settings. Qualitative research stands out for its exploratory nature and delves into descriptive analyses to understand findings narratively rather than testing hypotheses (Eyisi, 2016; Rusdiana, Sukmana, & Laila, 2021). Data collection from scientific journals involved triangulation, followed by processing using VOSviewer. This software facilitated a qualitative breakdown of the thematics inherent in VOSviewer's output, shedding light on central themes within the UTAUT framework in learning environments. According to criteria that complemented the study's objectives, selective non-probability sampling was the method of choice. The data collection journey for this bibliometric study unfolded across four stages, with methodologies refreshed by subsequent scholars (Sukmana, 2020; Narayan & Phan, 2017; Kholidah et al., 2022).

Thus, the exploration focused on literature at the nexus of health care and those with disabilities within learning environments chronicled in Scopus-indexed journals. In these learning contexts, the goal was to sieve through and analyze texts relevant to the UTAUT framework. A keyword-specific search, centered on "UTAUT FRAMEWORK IN LEARNING ENVIRONMENTS," targeted the heart of the subject. This strategy, meticulous in its deployment across titles, abstracts, and author affiliations, ensured a honed

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concentration on the desired topic. We limited our consideration to articles published in 2004, coinciding with the launch of the UTAUT framework in Scopus.

McAllister et al. (2022) specifically tailored VOSviewer to visualize the patterns and connections within bibliometric studies, thereby depicting these amassed works. The VOSviewer's bibliometric mapping, which employs the VOS, or similarity visualization, gathers visual literature data in the form of maps, assisting researchers in identifying trends relevant to their research (Van Eck et al., 2010; Borrett, 2014). The from prior research by Ezugwu (2021) and Costas et al. (2010), the outlined study methodically chartered four defined research phases. Establishing a clear analysis focus, framing research goals, and defining the academic groundwork for prospective outcomes remained paramount throughout.

Bibliometric Data

The domain of "UTAUT IN ELEARNING" is broad-based and incorporates several areas of science, giving rise to a number of research works that can be found in the Scopus database." This is why great care ought to be taken in selecting appropriate keywords to fit the studies. Such research cut-across different fields leading to the availability of many studies.

This study implemented a systematic review based on the Preferred Reporting Items for bibliometric reviews. The first step was specifying the exclusion criteria for the review. Following this, relevant information sources were identified.A coherent search strategy was then devised, supplemented by a strict selection process. The last stage was devoted to the presentation of techniques that would be used to extract data from the selected academic research. Furthermore, for the exclusion criteria, the review was limited to English studies. Other criteria, applied during the literature screening phase, are detailed in Table 1 (Appendix).

In order to achieve the acknowledgement of such high-quality literature, the research was limited to documents found in the Scopus database. Concerning the search strategy, there has been a use of the directory of educated terms, which coordinated the words "UTAUT and learning." This strategy used our logical expression as the search terms linking terms to form a search string: TITLE-ABS-KEY (utaut AND learning) AND (LIMIT-TO (EXACTKEYWORD , "UTAUT" OR "E-learning" OR "The Unified Theory Of Acceptance And Use Of Technology (UTAUT)" OR "Education Computing" OR "Higher Education" OR "Technology Acceptance" OR "Learning Systems" OR "Unified Theory Of Acceptance And Use Of Technology" OR "Mobile Learning" OR "Education" OR "Online Learning" OR "UTAUT Model" OR "Technology Adoption" OR "Unified Theory Of Acceptance And Use Of Technology (UTAUT)") OR LIMIT-TO (EXACTKEYWORD , "Structural Equation Modeling" OR "Computer Aided Instruction" OR "Learning" OR "Technology Acceptance Model" OR "Learning Management System" OR "M-learning" OR "TAM" OR "Technology" OR "Adoption" OR "Educational Technology" OR "Behavioral Research" OR "Acceptance" OR "Least Squares Approximations" OR "Information Systems" OR "Performance Expectancy" OR "E-Learning" OR "M-Learning") OR LIMIT-TO (EXACTKEYWORD , "Curricula") OR LIMIT-TO (EXACTKEYWORD , "E - Learning") OR "High Educations" OR "Social Networking (online)" OR "Blended Learning" OR "Behavioural Intentions" OR "Computation Theory" OR "PLS-SEM" OR "SEM") OR "Information Use" OR "Structural Equation Modelling" OR "UTAUT2" OR "Utaut Models" OR "Machine Learning" OR "Teaching And Learning" OR "Mobile Technology" OR "Distance Learning" OR "ICT") OR "Learning Management Systems" OR "Perception" OR "Acceptance Tests" OR "Cloud Computing" OR "Distance Education" OR "Unified Theory Of Acceptance And Use Of Technology Model" OR "Innovation" OR "MOOC") , terms defined by Marı´n-Marı´n et al. (2021) and Oliveira Dos Santos et al. (2018). The search, conducted on October 2nd, 2024, yielded 1088 records. In the selection process, records were screened based on the exclusion criteria, resulting in 940 papers for in-depth analysis. The specific screening process is illustrated in Figure 1.

Using the keywords "UTAUT IN ELEARNING" in the title section, a search in the Scopus database produced 940 research, which included 617 articles, 292 conference paper, 10 book chapters, 25 review,

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and 6 others. The figure below illustrates the accumulation of these studies over a 20-year period, from 2004 to 2025.

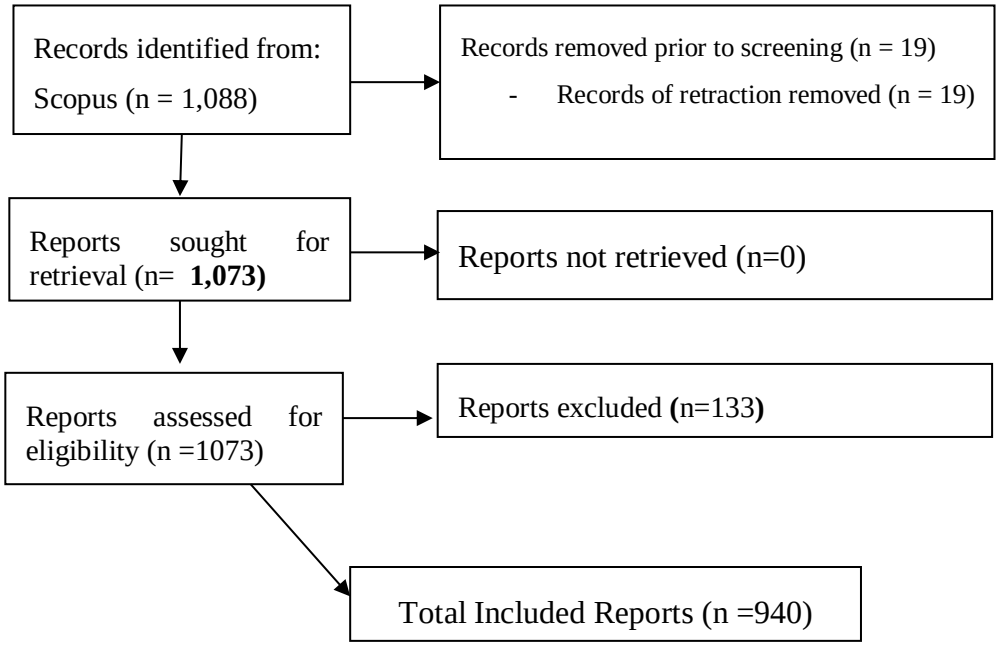

Figure 1. Flowchart of article selection

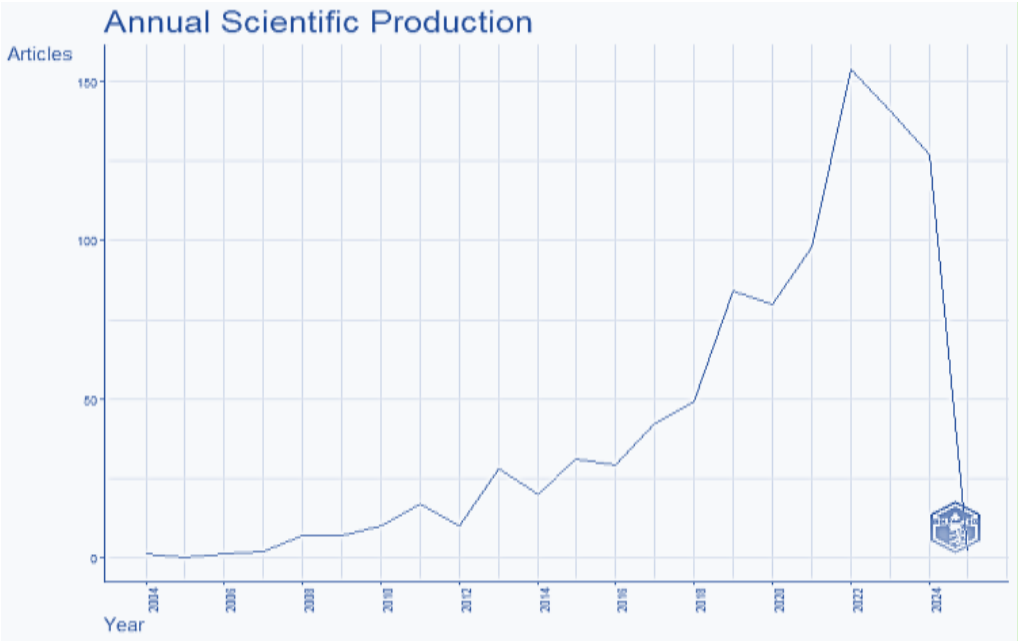

Figure 2. Timeline of Publication.

Figure 2 illustrates the annual scientific production from 2004 onwards, showing the number of articles published each year. The figure reveals trends in research output over time, highlighting significant fluctuations in the number of publications. For instance, early years such as 2005 experienced minimal or no publications, while later years, particularly post-2008, demonstrate a marked increase in scientific activity. This upward trend may suggest a growing interest or investment in research within the field, reflecting

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broader developments or initiatives that have fostered a more robust academic environment over time. The data underscores the evolving nature of scholarly contributions.

Bibliometric Analysis Methods

The study used a variety of bibliometric techniques, such as co-occurrence, citations, co-citations, co-authorship, and bibliographic coupling analysis, to build and break down the complex web of scholarly communications in learning environments that are part of the UTAUT framework. Employing these methods facilitated the mapping of key scholarly networks as well as the identification of prominent entities, including leading authors, seminal works, influential institutions, and contributing countries, as distilled from the Scopus database. In their thorough review of bibliometric methods, Zupic and Čater (43) highlighted Biblioshiny within Rstudio, VOSviewer, and KnowledgeMatrix as tools that were particularly useful for the execution of these analyses.

Results

- *Keywords' Analysis Results*

Figure 3 showcases the most frequently recurring words in a range of studies and investigations pertaining to UTAUT in eLearning.

Figure 3 (Appendix) shows the most frequently occurring words in the dataset, with "e-learning" being the most prominent, followed by "students" and "the unified theory of acceptance and use of technology." This figure emphasizes key themes and topics that dominate the research landscape, reflecting the primary areas of focus and interest within the scholarly community. The prominence of terms related to education and technology suggests a significant concentration of research in these areas, indicating trends or emerging topics within the field. This visualization effectively highlights the central themes driving the academic discourse.

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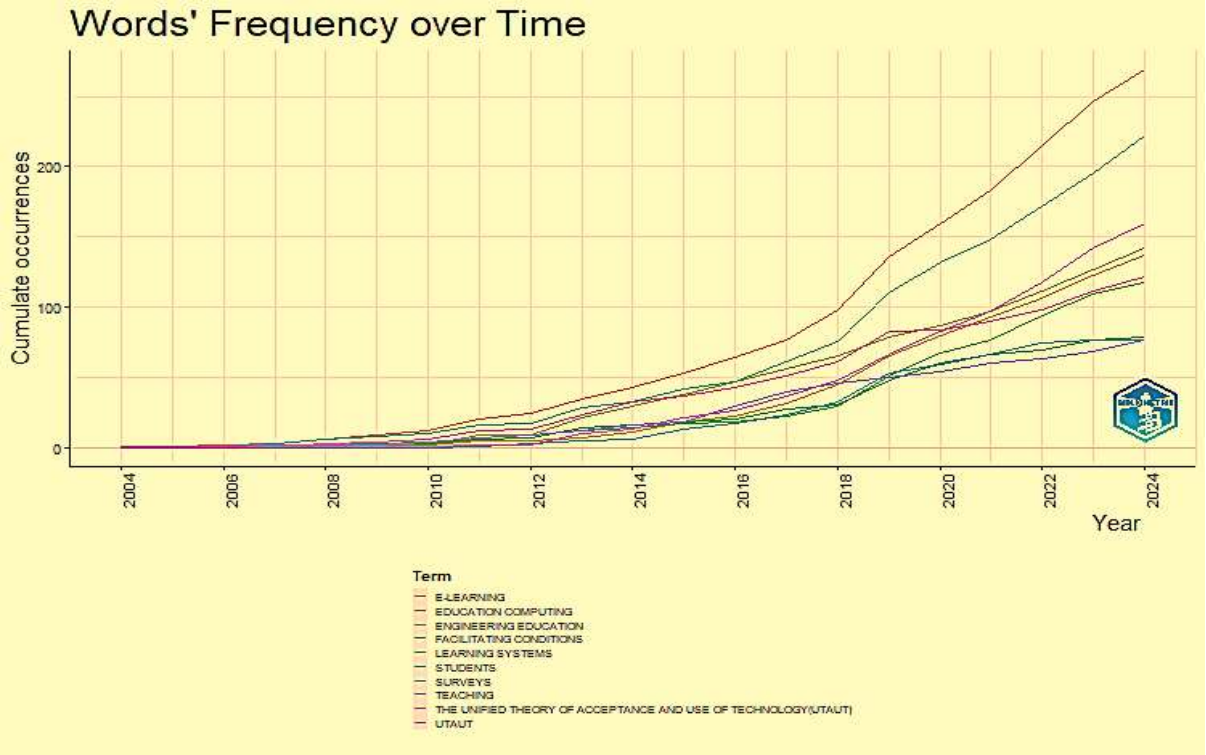

Figure 4. Words Frequency Over Time

Figure 4 (Table 2. Appendix) illustrates the evolving frequency of key terms associated with UTAUT in eLearning over time, highlighting the increasing focus on this theoretical framework in educational research. Terms such as "UTAUT," "eLearning," "behavioral intention," and "perceived usefulness" have shown a marked rise in usage, especially in recent years, indicating a growing interest in applying UTAUT to understand and enhance the adoption of eLearning technologies. This trend underscores the framework's importance in shaping discussions on technology acceptance and optimizing eLearning environments, reflecting its critical role in guiding research within the academic community.

Figure 5 demonstrates The research landscape's trending topics capture how certain themes have gained prominence over time. For instance, Figure 4 shows "technology" and "social networking (online)" as dominant topics, particularly from 2013 to 2018, indicating a surge in scholarly attention during those years. Other topics like "virtual learning environments" and "research models" also feature prominently, reflecting ongoing academic interest. The figure provides a visual representation of how research focus has shifted, with some topics maintaining consistent relevance while others emerge more recently, signaling evolving priorities and emerging fields within the academic community.

The trend of applying the Unified Theory of Acceptance and Use of Technology (UTAUT) within eLearning contexts has seen significant growth over the past few years, as illustrated in Figure 4. Users are increasingly using this model to understand and predict their acceptance and use of eLearning technologies. The data suggest that UTAUT-related research in eLearning has surged, particularly in the context of understanding factors such as perceived usefulness, behavioral intention, and facilitating conditions. This trend underscores the importance of UTAUT as a framework for evaluating the success and adoption of eLearning platforms, reflecting its ongoing relevance in educational technology research.

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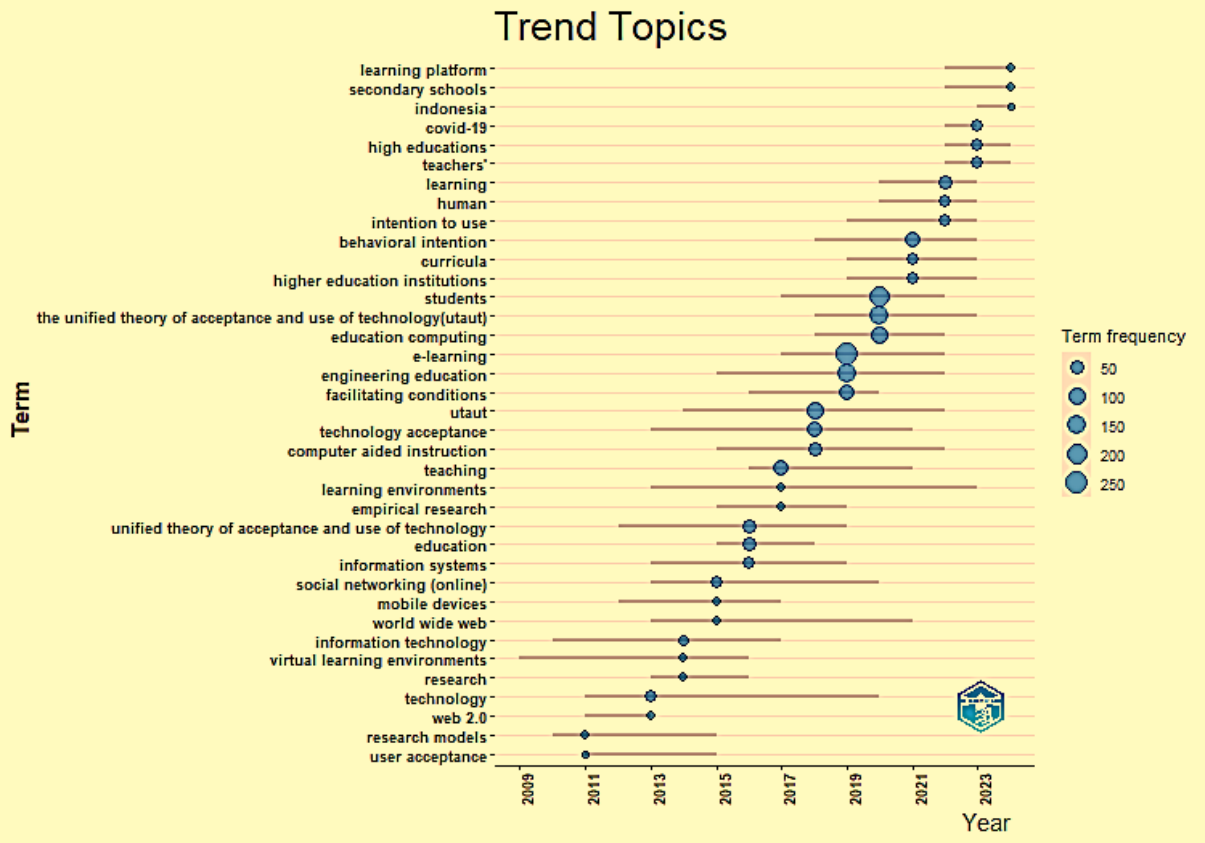

Figure 5. Trend Topics

Authors' Analysis Results

Figure 6 depicts the influential scholars in research pertaining to the Unified Theory of Acceptance and Use of Technology (UTAUT) in the context of learning environments. CHAVEESUK S, NISTOR N, are well-known in advancing UTAUT studies, and in the other works they appear relatively often for their empirical insights, which can be supported by almost all the authors of the papers, as shown in Figure 6 (Chaveesuk & Nistor, 2014). Also, unclear patterns in leadership with respect to conducting articles did not allow them to characterize their research interests. Statistically unproven reasons for this inadequacy have also reported the participation of few authors, even AL-RAHMI WM and coworkers in publication, implying that there is communication all the time.

They each have five articles and co-authors' interactions regarding this, which some of the authors, including AL-RAHMI WM, CHAIYASOONTHORN W, and KHECHINE H, should encourage. Normal practices in one discipline reveal the occurrence of potential coeyo authors' networks, in this case, technology acceptance research, since such patterns appear to occur consistently within disciplinary groups.

However, some other authors, such as ALMAIAH MA and AL-ADWAN AS, who had fewer published papers (4), had huge citation rates of their works, signifying the quality of the single pieces of work done by them. These cross-referenced insights provide a clearer understanding of the key contributors who shape the trends of UTAUT research in educational technology.

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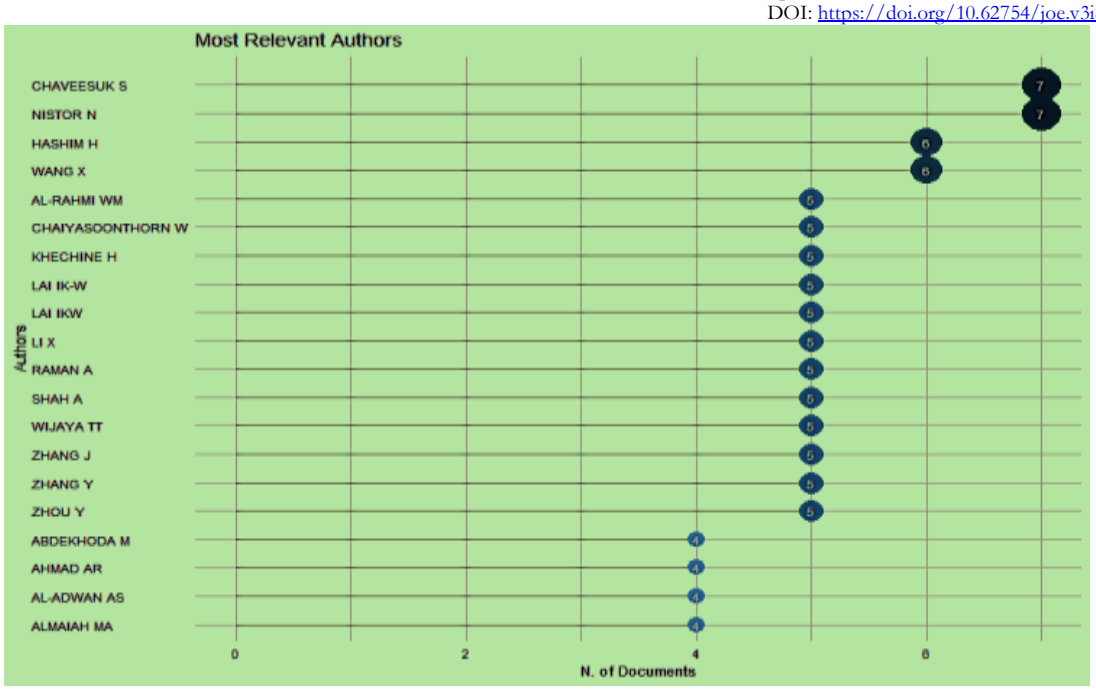

Figure 6. Most Relevant Authors

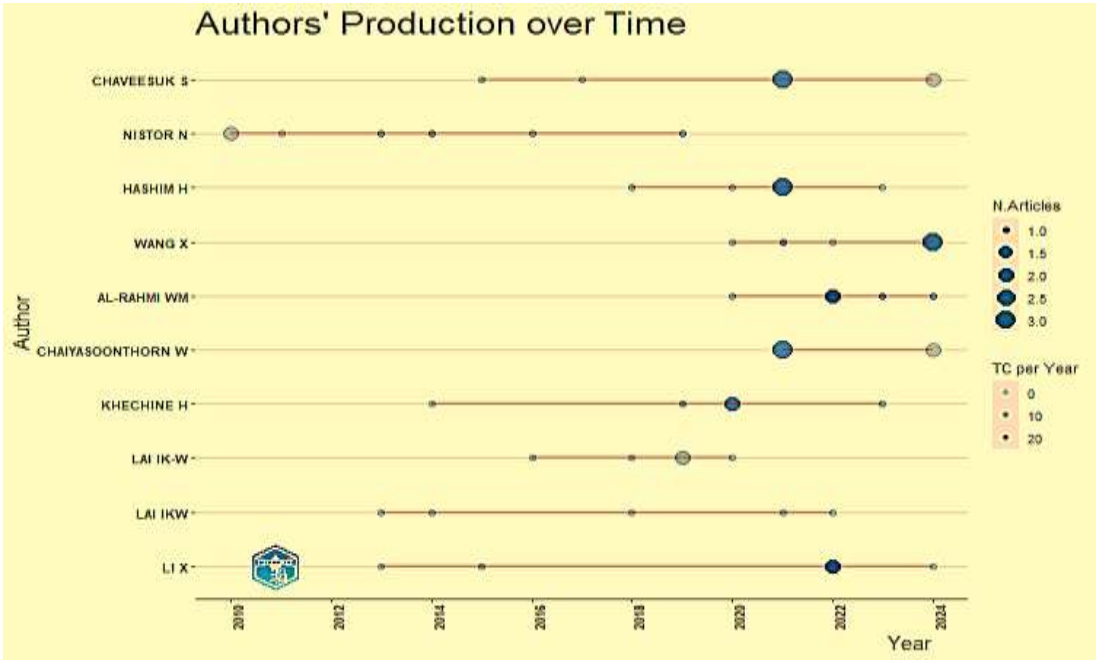

Figure 7. Authors' Production Over Time

Figure 7 shows how the volumes of the research output of the top authors have changed over time, indicating contributions to the application of UTAUT in such approaches as learning. CHAVEESUK S has been quite busy working on this theme, and a relatively large number of works were published between 2015 and 2024, including Factors Influencing Behavioural Intention to Use MOOCs (31 citations) and MOOC Adoption in Higher Education: A Management Perspective (38 citations). In addition, NISTOR N also has a long publication record with high-profile publications such as Towards the Integration of Culture into the UTAUT (83 citations) and Educational Technology Acceptance Across National and Professional Cultures (73 citations), revealing his substantial productivity in cultural approaches to technology acceptance research.

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WANG X's recent works have mostly centered around education structures and AI-enabled health care systems, with Factors Affecting College Students' Continuous Intention to Use Online Course Platforms (39 citations) standing out. Thus, HASHIM H has a smaller number of recently published articles; however, Factors Affecting TESL Students' Behavioural Intention During COVID-19 (45 citations) and others had notable research impact. This study accentuates the changing trend and transdisciplinary orientation of these authors in UTAUT research.

Sources and Documents Analysis Results

There is a wealth of references and sources available on the UTAUT IN Learning, but the most relevant ones are highlighted below.

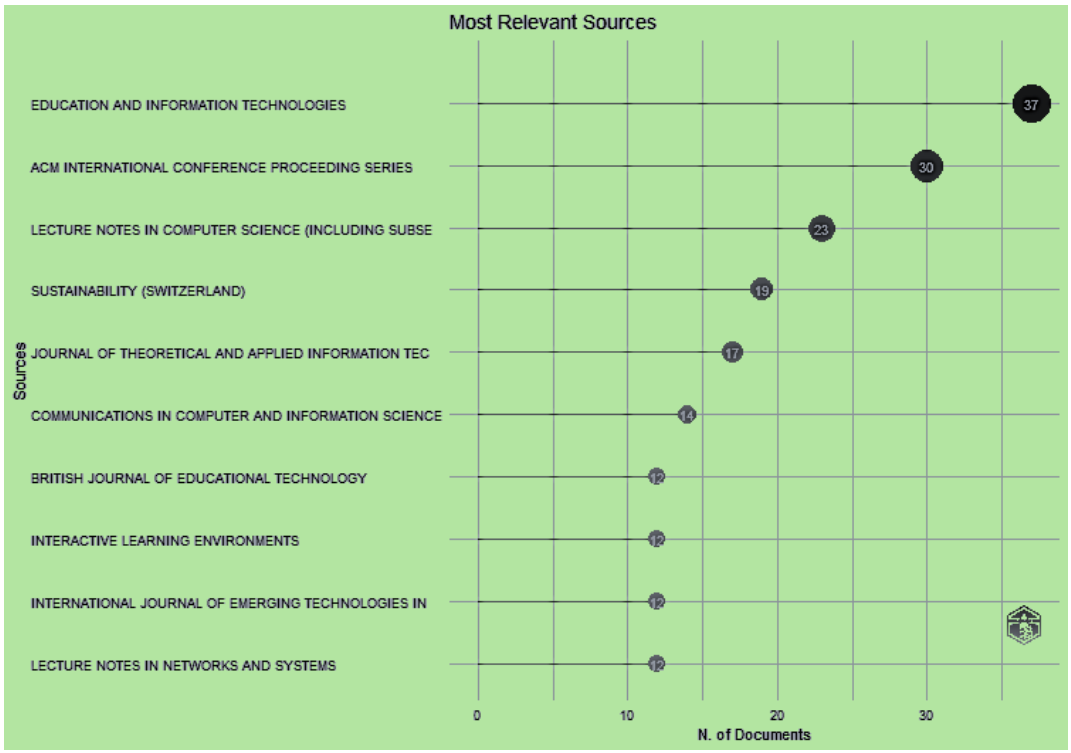

Figure 8. Most Relevant Sources

In Figure 8, it is apparent that there exist dedicated primary channels of disseminating UTAUT-based research in educational contexts, and this is a contribution from 12. Education and Information Technologies happens to be the leading publication that contributed a total of 37 articles. The importance of this journal shows that it is a major avenue for sharing research about acceptance of technology and innovations in learning. Equally, the ACM International Conference Proceeding Series, which has published 30 articles, is an outlet for emerging research, especially in the coherence of UTAUT applications and conference-based studies in digital learning technologies.

The 23 volumes led by UTAUT in the S Wing encompass 23 influences for learning the tower block issues of UTAUT across different computational and/or educational contexts. Of the journals within that range, twelve international grieve journals include Children and Youth Services Review (12 articles). Their comprehensive includes a Children's Hearings Review. Sustainability Switzerland retains the fourth position and hence increases in the use of technology to support the learning process.

Also, there are content-related journals like the British Journal of Educational Technology (12 articles) and Interactive Learning Environments (12 articles), which personally consider the technology in education

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aspects of every study. By cross-citing these sources, a cost-effect analysis of the research can be carried out, demonstrating the effective venues for UTAUT studies.

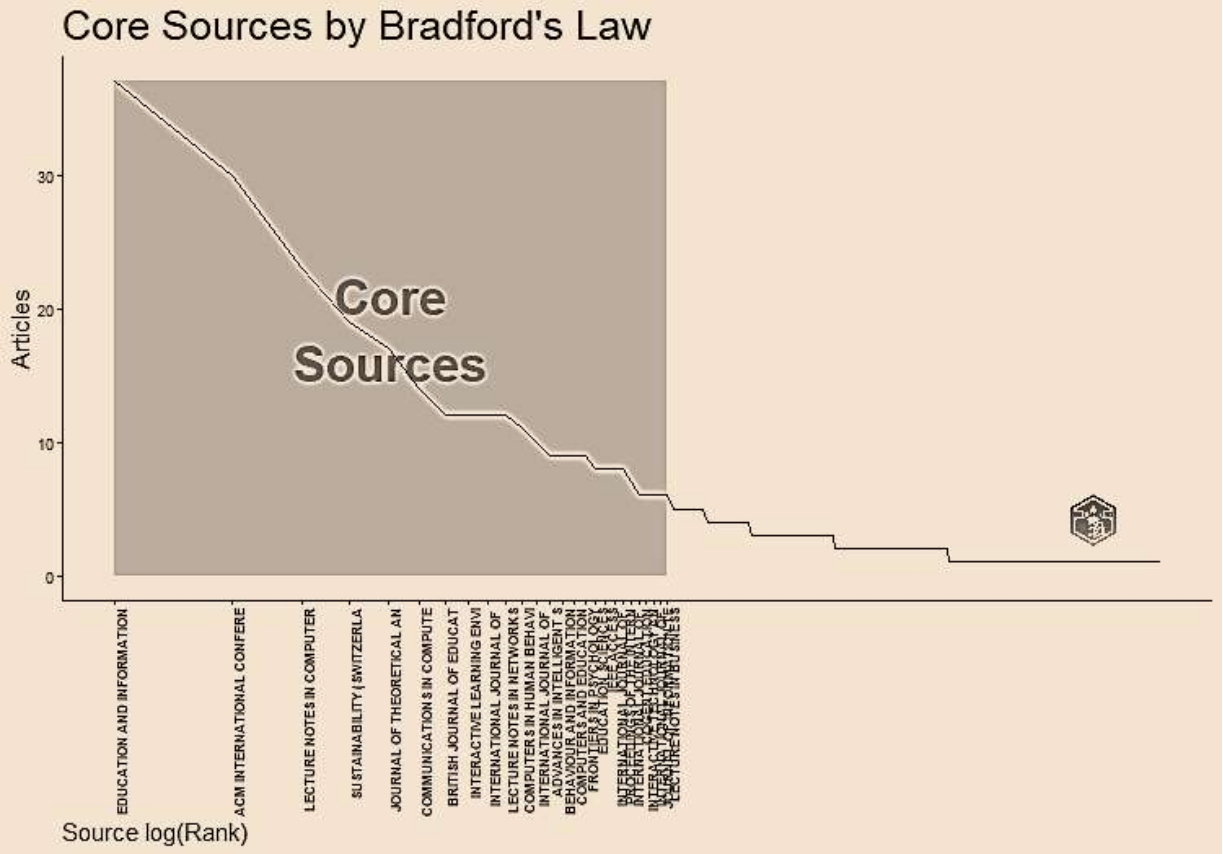

Figure 9. Core Sources by Bradford's Law

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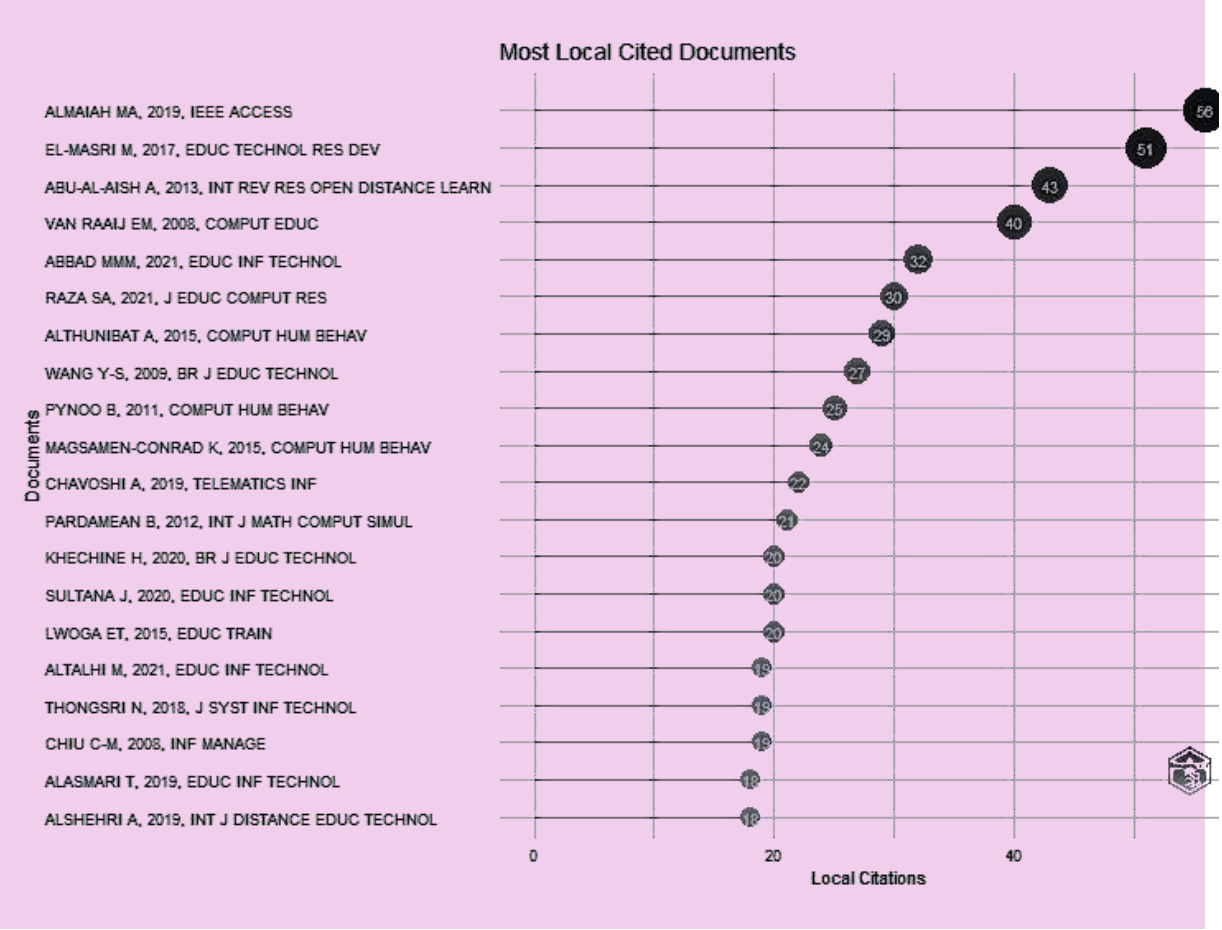

Figure 10. Most Local Cited Documents

Figure 9 summarizes the main areas constituting the foundational UTAUT in learning environments and connects them to journals in pursuit of Bradford's Law. Education and Information Technologies occupies the first place on such a list and underlines why it has been most effective in helping to propagate the studies of technology acceptance and its integration in educational domains. Ranging just below this in submission is the ACM International Conference Proceeding Series, which ranks second, stating its relevance for revealing new research in the fields of technology adoption models and their actual application.

The Lecture Notes in Computer Science, ranked third, publishes various papers, but they primarily focus on education technology and computing. It is noteworthy that Sustainability Switzerland comes first here as well but shows a new interest in appropriate use of technology and thus relates UTAUT studies with sustainability endeavors.

Journals such as Computers and Education, ranked 15, and Behavior and Information Technology, ranked 14, also appear, suggesting their roles in influencing the research trends on educational technology interface and interaction. Additionally, these sources, through cross-referencing them with citation norms, can help in spotting core hubs that promote active UTAUT research in education.

While Figure 10 presents the list of articles that have received extensive global coverage in the UTAUT research domain, thus highlighting great works of scholarship. Wang (2009) is the author who contributes the highest number of international citations (821) in the British Journal of Educational Technology and is still relevant in current technology integration and teaching outcomes. Equally so, Van Raaij and Schepers (2008) concentrated on the topic and have been cited 650 times, published a major study in Computers &

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Education journal with regard to technology where social and cognitive aspects have been integrated in its use.

Other notable highlights are El-Masri and Tarhini (2017) Educational Technology Research and Development (309) that dealt with e-learning acceptance through varying cultures. This is progressive to the work of Abu-Al-Aish and Love (2013) on mobile learning acceptance (259 articles) which demonstrates the usability of UTAUT across different educational environments.

More coming into the friction and yet more recent publications include those of Abbad (2021) in Education and Information Technologies (203) and Raza et al. in 2021 Journal of Educational Computing Research has also scored well with 265 citations which suggests a scenario that these technology adoption current issues are still yawning problems. As such, chasing these articles in correlation with its local citations will help identify the global trends and active authors in the scholarly work of UTAUT and education.

Countries Results

Countries that are most frequently partnered with Malaysia are Sri Lanka and Singapore. Culturally diverse Malaysia assists Saudi Arabia in 8 studies and Australia, China, Indonesia, and the UAE in 5 studies. This puts forth the case of Malaysia being connected to other countries for research purposes, particularly in education and technology spheres (Figure 11).

China and the USA, who are also ranked sixth in terms of the number of collaborative efforts, moderate six collaborative studies and awe a certain level of connection in terms of research areas that cuts across technology acceptance and digital learning environments. It is also worth noting that Jordan was able to collaborate with the UAE (6 times) and Saudi Arabia on collaboration efforts with Jordan and the UK (4 each) and focuses instead on technology dissemination in the Middle East and technology use in Western academic institutions.

Apart from that, Germany and Romania, as well as Portugal and Brazil (by 4 and 3 collaborations, respectively), demonstrate that they are rather active participants in such research initiatives that take place in Europe and Latin America. Linking all of these trends together, it can be understood that the nations having a well-settled education technology ecosystem are more likely to collaborate with their partners. The collaboration efforts make it possible to diversify the concept of UTAUT models in the globalization context and also to further develop the concept in the scope of various educational systems, introducing additional context-specific changes into the theory.

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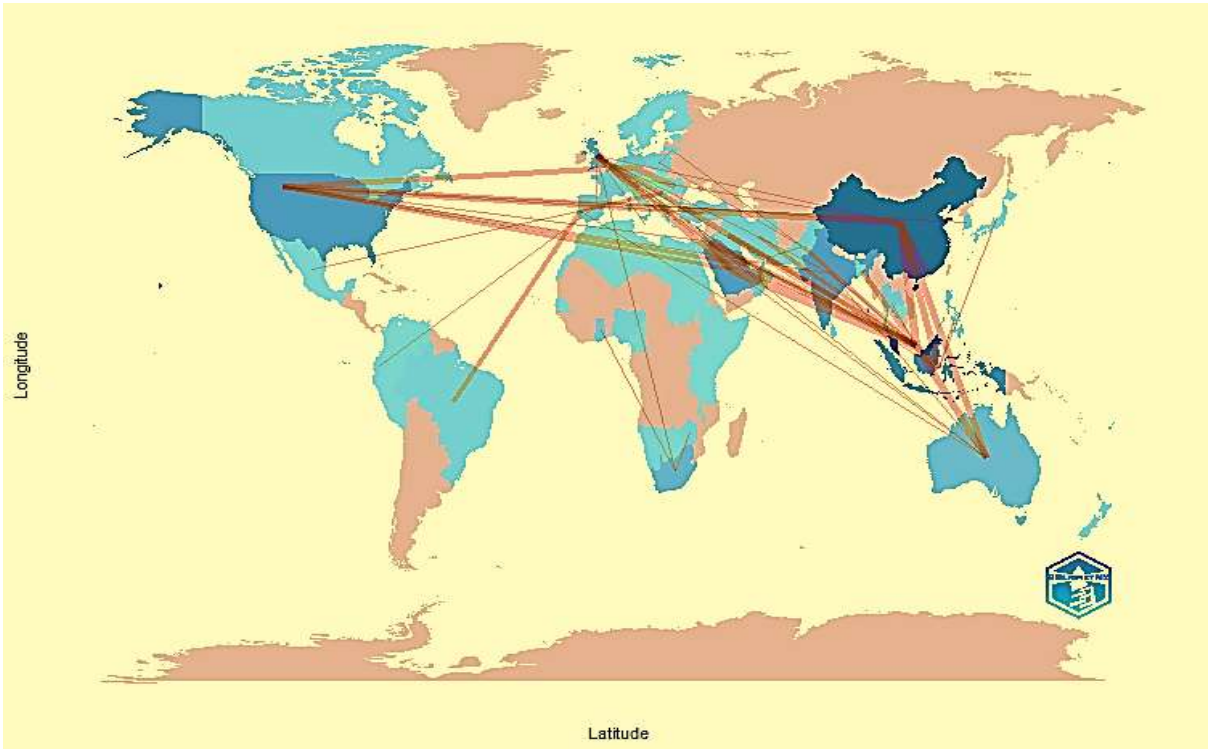

Figure 11. Countries' Collaboration World Map

- *Thematic Network*

Figure 12 (Figure 13. Appendix) highlights the most productive studies in the UTAUT literature based on the subject of the studies within e-learning and education as well as other domains. Wang et al. (2009), with 821 citations, stand out basing their research on the issues of age and gender in mobile learning acceptance (British Journal of Educational Technology), a pioneering study regarding demographic issues in technology. Similarly, Van Raaij and Schepers (2008) did research on China's virtual learning environment acceptance and have been cited 650 times about the focus on culture (Computers & Education) (van Raaij & Schepers, 2008).

Information & Management published an influential 620 citations, which Chiu and Wang (2008) aimed at the web-based learning continuance intention by integrating subjective task value. This is, therefore, a crucial work required in the comprehension of consumer post fulfillment in the domain of digital learning environments (Chiu & Wang, 2008). Mohammadyari and Singh (2015) evaluated the impact of digital literacy on the e-learning performance, demonstrating its importance in the proper use of technology. (Computers & Education, 269 citations) (Mohammadyari & Singh, 2015).

McEwan et al. (2017) proposed updates to some models, including UTAUT568, related to the acceptance of virtual and augmented reality in education. Again, these recent academic works, including Almaiah et al. (2019), seem to take UTAUT to the engagement of mobile learning in higher education as a progressive approach to this development. (from IEEE access, 197 citations) (Almaiah et al., 2019). Comparing these studies under this framework provides a more complete understanding of UTAUT application on the one hand: there are cultural contexts, there are mobile learning systems, and there are the effects of digital literacy on the offline systems.

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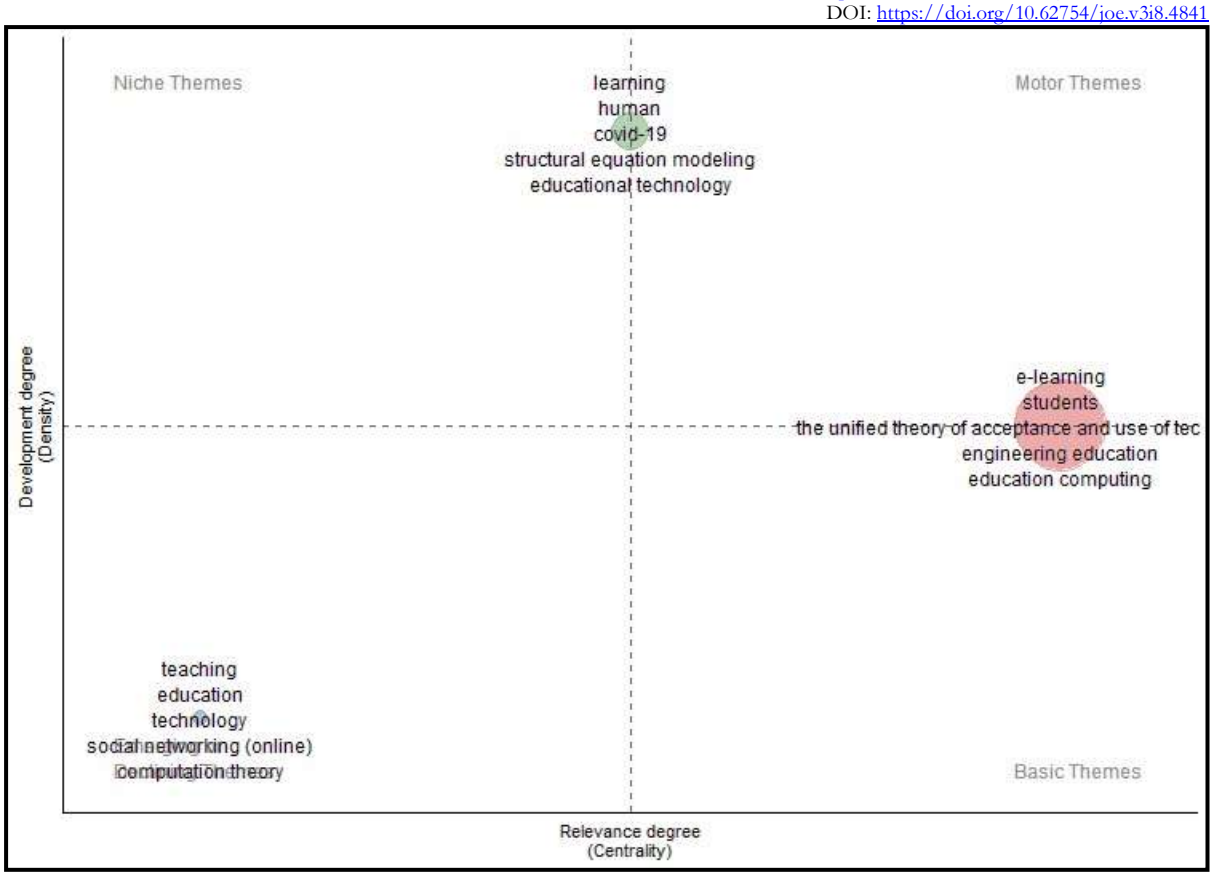

Figure 12. Thematic Evolution

Discussion

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), is one of the most prominent theoretical frameworks for understanding user intentions to accept and utilize technology. Originally formulated to consolidate previous technology acceptance models (e.g., TAM, TPB, and IDT), UTAUT has emerged as a cornerstone for analyzing technology adoption in various domains, including education, healthcare, and business. In educational settings, UTAUT provides a structured lens through which researchers can examine the integration and adoption of emerging technologies, making it particularly valuable in understanding digital transformation in learning environments.

The core constructs of UTAUT—performance expectancy, effort expectancy, social influence, and facilitating conditions—are highly applicable to educational contexts. Performance expectancy, which refers to the perceived usefulness of a technology in enhancing performance, is critical in education, where technology is expected to facilitate improved learning outcomes and instructional efficiency. For example, students may adopt e-learning platforms or digital tools if they believe these technologies will help them achieve better academic results or gain a deeper understanding of the subject matter (Venkatesh et al., 2003). Similarly, educators may integrate technology into their teaching practices if it is perceived to support pedagogical goals, such as fostering student engagement or enabling more personalized learning experiences.

Effort expectancy, which relates to the perceived ease of use, also plays a pivotal role in the adoption of educational technologies. If an LMS (Learning Management System) or digital learning tool is perceived as intuitive and easy to navigate, students and educators are more likely to use it regularly. This construct is particularly important when introducing new technologies to less tech-savvy users, where perceived complexity can act as a significant barrier to adoption (Teo, 2011).

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Social influence, or the degree to which individuals perceive that important others believe they should use the technology, is also impactful in educational settings. Instructors' attitudes and recommendations often shape students' willingness to engage with digital tools, while institutional policies and peer behaviors can influence educators' adoption of new instructional technologies. Facilitating conditions, the fourth core construct, encompass the technical and organizational support available to users, which is crucial in educational contexts where the availability of training, technical support, and resources can determine the success or failure of technology adoption (Venkatesh et al., 2003).

Venkatesh, Thong, and Xu (2012) extended the UTAUT framework to UTAUT2 by adding constructs such as hedonic motivation, price value, and habit. These additions are especially relevant in modern educational environments, where the integration of mobile devices, gaming elements, and personalized learning pathways has transformed the landscape. Hedonic motivation, which refers to the pleasure or enjoyment derived from using technology, is becoming increasingly significant in educational contexts, where gamified learning, interactive simulations, and multimedia resources are used to engage students. The inclusion of hedonic motivation helps explain why some technologies are adopted not only for their functional benefits but also for the enjoyment and engagement they provide (Venkatesh, Thong, & Xu, 2012).

Price value, another addition to UTAUT2, reflects the cost-benefit considerations of adopting technology. In educational settings, where funding and budget constraints are common, the perceived value of an educational technology relative to its cost can influence decisions at both the individual and institutional levels. Finally, habit, defined as the extent to which individuals tend to perform behaviors automatically, is particularly relevant for understanding the continued use of technology in educational environments. For instance, once students and educators become accustomed to using a particular platform or tool, the habit can sustain usage even if the initial motivations for adoption change (Venkatesh, Thong, & Xu, 2012).

The bibliometric analysis conducted in this study reveals a significant increase in research applying UTAUT to educational contexts over the past two decades. The temporal analysis (Figure 2) shows that the number of publications on UTAUT-related research has grown steadily since 2003, with notable spikes from 2008 onwards. This trend coincides with the rapid development and integration of digital technologies in educational settings, including the widespread adoption of learning management systems, e-learning platforms, and mobile learning tools.

Keyword analysis (Figure 4) indicates that terms such as "e-learning," "behavioral intention," and "perceived usefulness" have become central to UTAUT research in education. The prominence of these terms reflects the focus on understanding the determinants of technology acceptance and how digital tools can support or hinder learning outcomes. The steady rise in publications related to "e-learning" and "mobile learning" is particularly noteworthy, suggesting a growing interest in exploring how these technologies can be used to enhance both formal and informal learning experiences.

The analysis also reveals that the COVID-19 pandemic has had a significant impact on the research landscape. The sudden shift to remote and hybrid learning models in 2020 and 2021 led to a surge in studies examining the factors influencing the acceptance and use of digital learning tools. As a result, keywords such as "remote learning," "digital transformation," and "online education" have gained prominence in recent years, reflecting the evolving challenges and opportunities in educational technology adoption.

The analysis identifies several influential authors who have made significant contributions to UTAUT-related research in educational contexts. Wang (2009) is one of the most frequently cited authors, with his study on the determinants of mobile learning acceptance highlighting the role of demographic variables such as age and gender in shaping technology adoption (Wang, 2009). This study, published in the British Journal of Educational Technology, has been a foundational work in understanding the factors that influence students' and educators' willingness to engage with mobile learning platforms.

Similarly, Van Raaij and Schepers (2008) have made a substantial impact with their research on the acceptance and use of virtual learning environments in China. Their study, which explored the role of

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cultural factors in shaping technology adoption, has been widely cited and remains relevant as educational institutions around the world seek to implement digital tools in diverse cultural contexts (Van Raaij & Schepers, 2008).

More recently, Almaiah et al. (2019) have extended the application of UTAUT to mobile learning systems, providing valuable insights into the factors that influence students' acceptance of these technologies in higher education. Their study, published in IEEE Access, emphasizes the importance of understanding how constructs such as perceived usefulness, perceived ease of use, and social influence interact to shape technology adoption in modern educational environments (Almaiah, Alamri, & Al-Rahmi, 2019).

The thematic analysis presented in Figure 12 shows a gradual shift in research focus from basic technology adoption to more nuanced studies involving mobile learning systems, digital literacy, and the role of virtual learning environments. Early research primarily focused on identifying the determinants of technology acceptance, with an emphasis on constructs such as performance expectancy and effort expectancy. However, as digital technologies have become more embedded in educational practices, researchers have increasingly turned their attention to understanding how these technologies can be used to enhance learning outcomes and support new pedagogical approaches.

Recent studies have expanded UTAUT's application into mobile and ubiquitous learning contexts, reflecting the growing importance of mobile technology in education. For example, Almaiah et al. (2019) explored the factors influencing students' acceptance of mobile learning systems, highlighting the role of hedonic motivation, perceived usefulness, and facilitating conditions in driving adoption. This shift in focus reflects a broader trend toward understanding not only the initial adoption of educational technologies but also the conditions that support sustained use and engagement over time.

Moreover, studies that integrate UTAUT with other theoretical frameworks, such as TAM or the diffusion of innovations theory, are becoming more prevalent. For instance, Williams, Rana, and Dwivedi (2015) found that combining UTAUT with TAM provided a more comprehensive understanding of the factors influencing technology adoption in higher education settings. This trend toward integrating multiple theoretical perspectives reflects a broader recognition of the complexity of technology adoption in educational contexts, where factors such as institutional support, pedagogical strategies, and individual learner characteristics interact in complex ways.

The collaboration patterns identified in Figure 11 highlight the global nature of UTAUT research in education. Countries such as Malaysia, Saudi Arabia, China, and the USA have emerged as key players in advancing UTAUT's application to educational technologies. Malaysia, in particular, has been a hub for UTAUT-related research, with a strong focus on understanding technology adoption in higher education. Collaborative efforts between Malaysian researchers and their counterparts in other countries, such as Saudi Arabia and the UAE, have contributed to a rich body of research exploring the factors influencing technology adoption in diverse cultural contexts.

The analysis also reveals that collaboration between Western and Asian countries has been particularly fruitful, resulting in studies that examine the role of cultural factors in shaping technology acceptance. For example, Teo (2011) explored the influence of cultural values on teachers' acceptance of educational technologies in Singapore, highlighting the need to consider context-specific factors when applying UTAUT in different regions. Similarly, studies conducted in Middle Eastern contexts have emphasized the importance of social influence and facilitating conditions in driving technology adoption, reflecting the unique social and cultural dynamics of these regions.

Despite its widespread application, the UTAUT model has several limitations when applied to educational contexts. One of the primary criticisms is that UTAUT focuses primarily on intention and usage behavior, potentially overlooking other important factors that influence technology adoption, such as institutional support, curriculum design, and pedagogical innovation. For example, while UTAUT can explain why students may be willing to adopt a new learning technology, it may not capture the broader contextual

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factors that influence whether the technology is effectively integrated into teaching and learning practices (Tarhini, Hone, & Liu, 2014).

Future research could address these limitations by integrating UTAUT with other educational theories, such as constructivism or self-determination theory, to provide a more holistic understanding of technology adoption in learning environments. Constructivist approaches, which emphasize the active role of learners in constructing knowledge, could complement UTAUT's focus on intention and usage behavior by highlighting the pedagogical strategies that support effective technology use. Similarly, self-determination theory, which focuses on the role of intrinsic and extrinsic motivation in shaping behavior, could provide valuable insights into the factors that influence long-term engagement with educational technologies.

Additionally, as digital literacy and online learning environments evolve, the UTAUT model may need to be refined further to address emerging challenges, such as data privacy, digital equity, and the effectiveness of AI-based learning platforms. For instance, the increasing use of AI and machine learning in educational technologies raises new questions about the factors that influence users' trust and acceptance of these tools. Future research could explore how constructs such as perceived transparency, trustworthiness, and algorithmic fairness interact with traditional UTAUT constructs to shape technology adoption in educational settings.

Conclusion and Implications

The findings of this bibliometric analysis provide a comprehensive overview of the research landscape surrounding the Unified Theory of Acceptance and Use of Technology (UTAUT) in educational contexts. The results highlight the consistent growth in UTAUT-related publications over the past two decades, reflecting the framework's widespread adoption for understanding technology use in learning environments. This trend aligns with prior studies, such as those by Williams, Rana, and Dwivedi (2015), which similarly reported increasing interest in applying UTAUT to diverse educational settings. Our study's identification of "e-learning," "behavioral intention," and "perceived usefulness" as dominant research themes is also consistent with earlier findings that emphasize these factors as central to understanding technology acceptance and usage behavior in education. However, the growing focus on mobile learning and digital literacy as emerging themes represents a more recent shift that our study uniquely captures, indicating that UTAUT's application is evolving to keep pace with technological advancements.

Furthermore, the analysis reveals that influential works by authors such as Wang (2009) and Van Raaij and Schepers (2008) remain foundational in the UTAUT literature, confirming the lasting impact of early research that explored demographic and cultural factors in technology acceptance. These seminal studies have been widely cited and continue to inform current research, highlighting their alignment with our study's results. In contrast, our bibliometric analysis also identifies Almaiah et al. (2019) as an emerging influence, with their focus on mobile learning adoption in higher education environments. This contrasts with previous research trends that predominantly focused on traditional e-learning platforms and virtual learning environments. The prominence of Almaiah's work suggests that mobile and ubiquitous learning contexts are becoming a key area of interest for UTAUT researchers, marking a departure from the more static models of technology use explored in earlier studies.

Another notable finding is the prominence of specific countries, such as Malaysia, Saudi Arabia, and China, in advancing UTAUT research. Our study's emphasis on these countries' contributions is consistent with Teo's (2011) observations that UTAUT is particularly relevant in Asian educational contexts, where social and cultural dynamics play a crucial role in shaping technology adoption. However, our study also highlights the emergence of collaborative networks between Western and Middle Eastern countries, such as the USA and the UAE, which were not as prominently featured in previous bibliometric reviews. This points to a broadening of UTAUT's geographical research base and suggests a growing interest in cross-cultural comparisons and collaborations, which may provide more nuanced insights into how regional and cultural contexts influence technology acceptance.

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The results also underscore the increasing integration of UTAUT with other theoretical frameworks, such as the Technology Acceptance Model (TAM) and the Diffusion of Innovations Theory. This finding is consistent with previous literature that calls for a more interdisciplinary approach to understanding technology adoption in complex educational environments (Williams et al., 2015). However, our analysis reveals a novel trend of combining UTAUT with theories of digital literacy and self-determination, which are not traditionally associated with technology acceptance research. This trend suggests that researchers are seeking to address some of the limitations of UTAUT by incorporating constructs that better capture the evolving nature of digital learning environments and the diverse motivations of users in these settings.

In summary, while the core findings of our study are largely consistent with previous bibliometric reviews, such as the increasing focus on behavioral intention and perceived usefulness, our analysis also uncovers new directions in UTAUT research. The growing emphasis on mobile learning, the emergence of new collaborative networks, and the integration of UTAUT with novel theoretical frameworks all point to a dynamic and evolving research landscape. These insights suggest that UTAUT's applicability in educational contexts is expanding, offering fresh perspectives on how technology acceptance and use are understood in contemporary learning environments. As UTAUT research continues to evolve, future studies should further explore these emerging trends to ensure that the framework remains relevant and robust in the face of ongoing digital transformation in education.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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Appendix

Table 1. Words Frequency Over Time

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2004:2025
Sources (Journals, Books, etc)	477
Documents	940
Annual Growth Rate %	3.36
Document Average Age	4.1
Average citations per doc	21.08
References	39201
DOCUMENT CONTENTS	
Keywords Plus (ID)	2466
Author's Keywords (DE)	2042
AUTHORS	
Authors	2429
Authors of single-authored docs	93
AUTHORS COLLABORATION	
Single-authored docs	105
Co-Authors per Doc	3.14
International co-authorships %	21.6
DOCUMENT TYPES	
Article	617
book chapter	10
conference paper	292
data paper	2
Letter	1
Note	2
Retracted	1
Review	15

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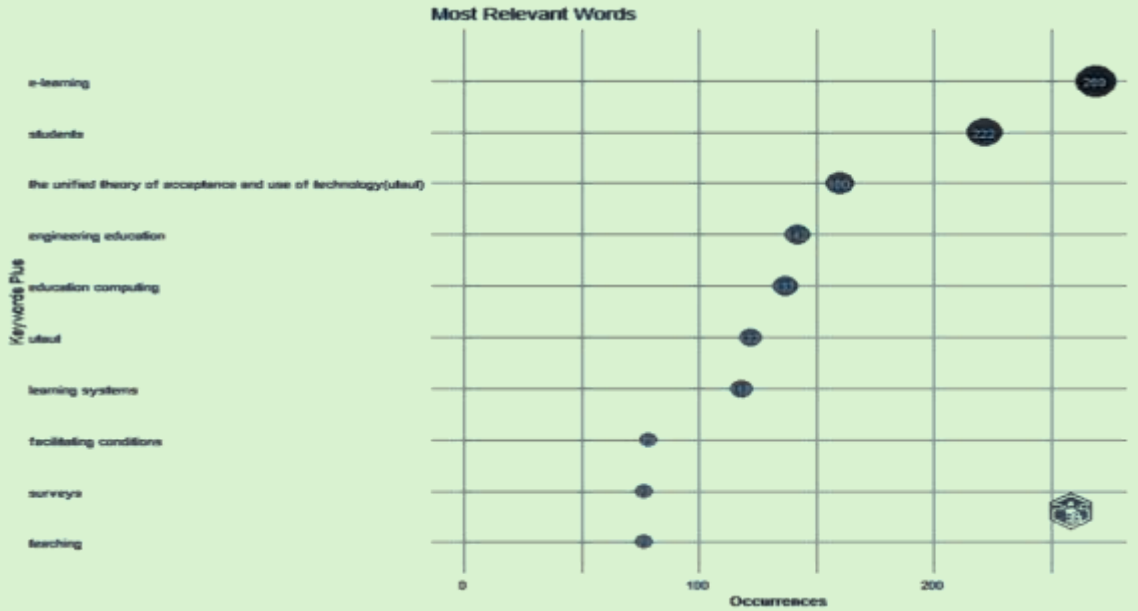

Figure 3. Most Relevant Words

Table 2: Words Frequency Over Time

Year	E-Learning	Students	The Unified Theory Of Acceptance And Use Of Technology (Utaut)	Engineering Education	Education Computing	Utaut	Learning Systems	Facilitating Conditions	Surveys	Teaching
2004	1	1	1	0	0	0	0	0	0	1
2005	1	1	1	0	0	0	0	0	0	1
2006	2	1	1	0	0	0	0	0	0	1
2007	3	3	1	1	1	1	0	0	0	2
2008	6	6	1	1	1	3	2	2	0	2
2009	9	8	1	2	1	4	3	3	0	2
2010	12	10	1	2	2	6	4	3	0	4
2011	20	16	2	9	5	12	7	6	1	7
2012	24	17	2	9	5	13	9	7	3	9
2013	35	28	10	21	7	23	12	14	5	12
2014	43	33	13	29	11	33	14	16	6	16
2015	53	42	21	38	18	37	17	18	13	18
2016	64	47	26	47	22	43	18	20	17	30
2017	77	61	37	56	32	51	22	27	23	40
2018	98	76	48	65	45	61	30	31	33	46
2019	136	110	66	79	65	83	51	48	53	50
2020	160	132	83	87	80	84	67	60	59	54
2021	183	148	97	97	93	90	77	66	66	60
2022	215	172	118	111	106	98	94	69	75	63
2023	247	195	142	127	123	111	109	77	77	68
2024	269	222	160	142	137	122	118	79	77	77

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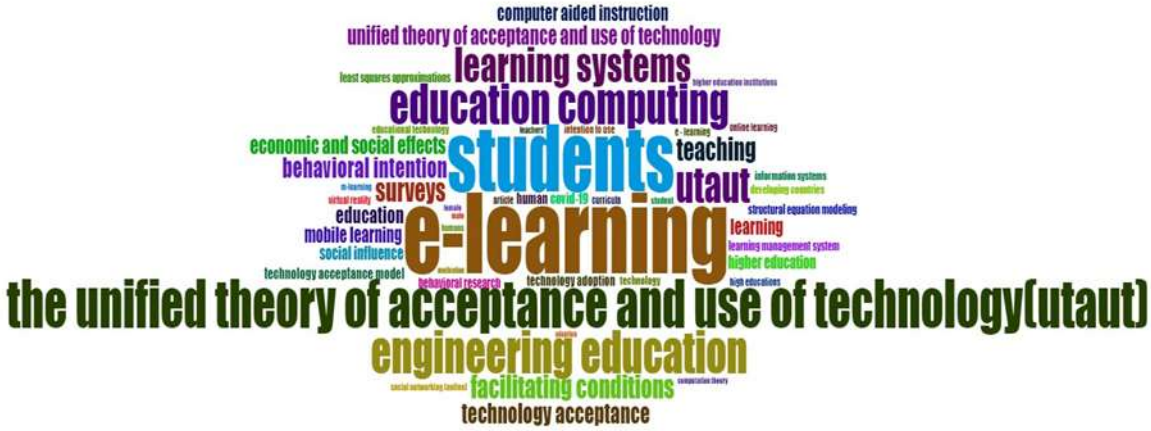

Figure 13. Wordcloud