RevistaEconomică
Journal of economic-financial theory and practice
Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

CHALLENGES AND SOLUTIONS IN THE EDUCATIONAL SYSTEM DURING THE DIGITAL ERA: A LITERATURE REVIEW

Elena-Georgiana ZAMFIROIU[1], Mircea GEORGESCU [2]

[1]*Alexandru Ioan Cuza University of Iași, 0009-0004-2998-1495*
[2]*Alexandru Ioan Cuza University of Iași, 0000-0002-7022-3715*

Abstract:
The speed at which information is shared in the digital age is astounding. In a relatively short period, we've gone from carrying around numerous heavy textbooks to having all the information we need at our fingertips through a simple tap on a screen. Today, information is readily available to anyone and is easier than ever to find and examine. The access to information has brought about numerous benefits for both students and the education system, but it has also presented some challenges that need to be addressed to effectively incorporate communication and information technologies into education.
This article acts as a precursor to a more extensive study. It involves a bibliometric analysis using the VOSviewer Software and aims to explore how communication and information technologies can be integrated into the pre-university academic environment. It also intends to review a wide range of studies resulted from said bibliometric analysis from around the world on this subject and analyze their findings in detail.

Keywords: *Communication and Information Technologies, Education, New Generations, Challenges, Students*

JEL classification: I21

1. Introduction

If we want to go back in time, we can reference [3]the authors Leavitt and Whisler, who state, «The new technology does not yet have a well-established name; we will call it "information technology " » (Harvard Business Review*, 1958).*

For many years, technology integration in education has been a major topic of study and discussion. Since the first computer system was deployed in the 1960s, numerous methods and programs have been developed to promote the integration of Information and Communications Technology (ICT) in all educational sectors. (Loh,2023)

The rapid development of Information, Communication, and Technology (ICT) has resulted in significant changes in the twenty-first century, as well as an impact on the expectations of modern communities. ICT is becoming more significant in our daily lives as well as in our educational system. As a result, there is a growing desire for educational institutions to employ ICT to teach students the skills and information they will need in the twenty-first century. Recognizing the impact of ICT on the business and daily life, educational institutions are attempting to reform their educational curricula and classroom facilities in order to bridge the existing technological gap in teaching and learning. (Buabeng-Andoh, 2012)

The transition of the education system to the digital age is a vital transition to a learning paradigm that incorporates technology and innovation in the educational process. This transformation brings with it a slew of new opportunities and problems that necessitate strategic thinking and agility in order to fulfill the demands of a rapidly changing world.

ICT stands for Information and Communication Technology, and it is a subject that students take in the pre-university system. These ICT courses have been implemented in schools since the ability to

[1]*georgiana_zamfiroiu@yahoo.com*
[2]*mirceag@uaic.ro*

Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

operate a computer is no longer optional in today's world because we are surrounded by technology, and kids need these abilities to prepare for the post-high school or college labor market.

An essential component is the benefits of ICT in the educational support of kids with Special Educational Needs, whether they have learning challenges, behavioral issues, or other impairments. For example, when we had a student with significant vision impairments in class, we were able to readily create functioning documents with the characters and proportions to ensure a good response.

2. Literature Review

In recent years, the educational landscape has undergone a transformative shift fueled by rapid advancements in online learning platforms and widespread integration of cutting-edge technology. High-speed internet access and the affordability of digital devices have driven a paradigm change, offering unprecedented flexibility for diverse learners, including working professionals and those with busy schedules, breaking free from traditional institutional constraints.

Online education not only enhances accessibility but also provides transformative opportunities for individuals with disabilities. Integration of assistive technologies and adaptable digital content fosters inclusive learning, catering to diverse styles and accessibility needs.

The boundary-breaking nature of online education has dismantled geographical barriers, enabling a global exchange of knowledge. Students can now enroll in courses offered by renowned institutions worldwide, fostering a cosmopolitan approach to learning.

Powered by adaptive learning algorithms, online education embraces a personalized learning paradigm, allowing students to chart their educational paths at their own pace. Immediate feedback mechanisms enhance comprehension, nurture critical thinking, and promote active engagement, making online education a transformative force redefining conventional learning boundaries.

While the discourse gained traction during the Sars-Cov2 pandemic, research on this subject dates back to the early 2000s. Qualitative and quantitative analysis methods, including bibliometric analysis, were employed to understand concerns. These initiatives enhance comprehension and pinpoint effective intervention strategies in various domains like healthcare, environment, and education.

By examining keyword co-occurrence, researchers uncover correlations, facilitating hypotheses formulation and a comprehensive understanding of research themes. The integration of keyword co-occurrence proves invaluable in fostering interdisciplinary studies and broadening knowledge horizons in emerging or less-explored fields.

ICT enables teachers to convey their lessons in an appealing manner while also providing students with opportunity to develop and use 21st-century skills. It gives in-depth understanding of how people learn and what it takes to build effective and interesting learning environments, as well as the ICT skills required for content-related teachers, pedagogy, technical issues, social concerns, cooperation, and networks. Also included are case studies that demonstrate the various ways that may be used in integrating ICT into teacher training, as well as recommendations for building a high-quality technology strategic plan. (Ratheeswari, 2018)

Alemany-Bordera, J said that Online education has advantages such as flexibility, cost and time savings, personalized learning, and accessibility. However, it lacks social interaction, direct supervision, real-time feedback, and can lead to technology dependence. Traditional education provides direct human interaction, structure, access to facilities, but it may lack flexibility and be costly and less accessible. (Alemany-Bordera,et. al 2020).

Gamification can be seen as a solution to the lack of interaction between students, however the same author found limitations with this solution: short-term effects of gamification on user privacy and engagement, difficulty measuring appropriate privacy policies, potential knowledge loss over time, and the need to consider diverse user types and other factors like usage duration and reward design (Alemany-Bordera, et. al. 2020).

In the context of educational systems, teachers' empathy towards disengaged students is a crucial component in addressing the academic success of each student. However, despite this empathy, there are

Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

sometimes difficulties in implementing effective interventions to support and motivate disinterested students to actively engage in the learning process. Bergdahl discovered that teachers empathize with disengaged students but lack effective intervention knowledge. Describing engagement was easier for teachers than describing disengagement. The study emphasized understanding teachers' perceptions of student engagement and the need for digital pedagogy development. (Bergdahl, 2022)

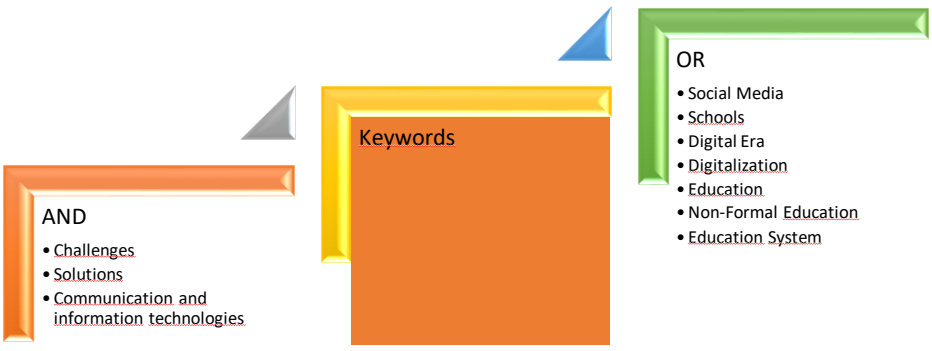
As online and hybrid education continue to shape modern learning landscapes, Bram Bruggeman's insights shed light on the multifaceted challenges inherent in these modes of education. Identifying several key issues, Bruggeman highlights the complexities that educators and students face in navigating the evolving dynamics of digital learning environments. These challenges encompass various aspects, from maintaining a balance between education and research to ensuring effective comprehension and engagement among learners. Understanding these obstacles is crucial for implementing strategies that enhance the efficacy and quality of online and hybrid education. He identified several challenges associated with online or hybrid education. These include difficulties in balancing education and research due to the increased time and effort required for online communication, as well as challenges for students in distinguishing key information from secondary content in online learning materials. Moreover, there is a notable time pressure for both teachers and students in preparing and implementing online education. The lack of personalized technical support for teachers and students, combined with the absence of a unified vision for online education, further compounds the issues. Additionally, maintaining students' focus and attention in online learning materials proves to be a significant obstacle (Bruggeman, et al, 2021).

A study conducted by Alberto A.P. Cattaneo identified that vocational education teachers in Switzerland have a moderate level of digital competence, with significant variations among different sub-domains of digital skills. Personal and contextual factors such as attitudes towards technology, access to digital resources, and support for professional development were found to significantly influence teachers' levels of digital competence. Furthermore, the study revealed that teachers with broader professional training and more experience in using technology are more digitally competent than those with narrower domain-specific preparation. Additionally, teachers in media and communication-related fields demonstrated higher digital competence compared to those in other domains. Overall, the study underscored the importance of professional development support and access to digital resources in enhancing the digital skills of vocational education teachers (Cattaneo, 2022).

3. Methodology

In conducting the research for this article, the team extensively accessed and analyzed the rich repository of scholarly articles within the acclaimed Clarivate Web of Science database. Notably recognized for its expansive collection of peer-reviewed publications, this database served as the primary source for gathering relevant data. Employing a meticulously designed search strategy, as outlined in Figure 1, the initial exploration yielded an impressive compilation of 454,019 articles.

Figure. 1 The string of keywords used



Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

In the preliminary phase, a careful selection process focused on papers published between 2020 and 2023, resulting in 168,891 articles for analysis. A meticulous exclusion process refined the dataset to 146,147 articles, ensuring study specificity. Further filtration, specifically addressing the integration of social networks and web 2.0 technology in education, yielded a focused set of 508 articles aligned with research objectives.

All identified articles were in English, maintaining scholarly integrity. Geographical filtering included studies from Europe, America, Central and East Asia, and Australia, reducing the pool to 317 articles. Emphasizing open access, the refined corpus comprised 153 freely accessible articles, addressing challenges posed by inaccessible literature.

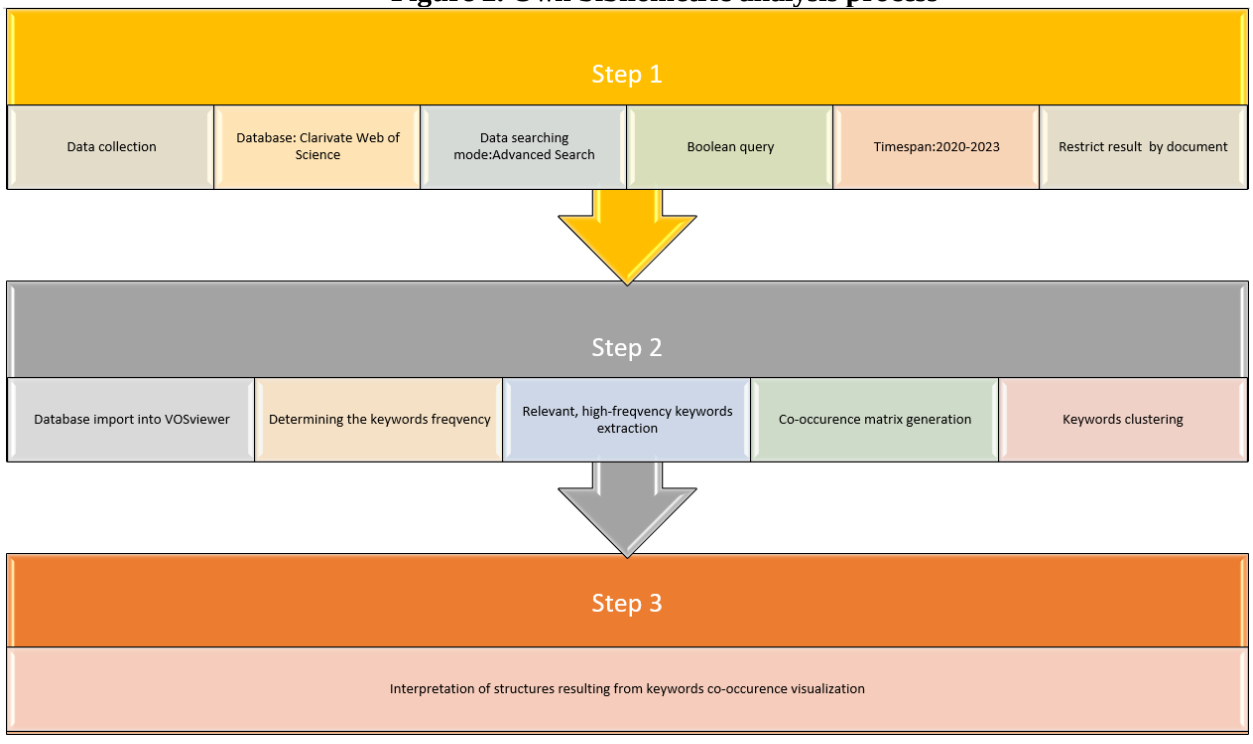
The limitation of non-open-source articles in the Clarivate Web of Science database hampers comprehensive research. Advocacy for open access has gained prominence, emphasizing unrestricted access for collaborative endeavors. A final filtration step using Zotero resulted in a curated selection of 89 articles for comprehensive study.

Figure 2 visually represents the nuanced stages of bibliometric analysis, depicting the methodology from data selection to geographical filtering, open-access exclusions, and final dataset curation. The diagram underscores the meticulous approach for accurate and reliable research outcomes.

The substantial volume of generated papers underscores the robust interest in this field. No filtering was applied to the publications gathered for the research query, allowing for a comprehensive analysis using VOSviewer. Network graphs were developed, revealing intricate relationships between keywords, authors, and institutions.

The analysis focused on identifying key trends and collaborative associations among authors and institutions, revealing a surge in research, especially in artificial intelligence and machine learning. The bibliometric study involved a meticulous keyword selection process, considering a minimum occurrence threshold of 10. This resulted in 174 carefully chosen keywords, further refined to 254 through a relevance score mechanism, ensuring a comprehensive and pertinent representation of the literature.

Figure 2. Own bibliometric analysis process



The significance of this keyword selection lies in its role in providing an accurate depiction of the research domain. Anchoring data analysis and insights on these keywords ensures a thorough exploration of the subject matter.

Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

4. Results and discussions based on the bibliometric analysis

Bibliometric research, a systematic quantitative approach, analyzes academic literature by examining the network of bibliographic references. The frequency and extent of citations are considered empirical indicators of a work's influence. This methodology is applied across diverse domains, offering a comprehensive evaluation of scholarly impact by authors, publications, and institutions. It provides insights into the evolving landscape of knowledge dissemination and discovery.

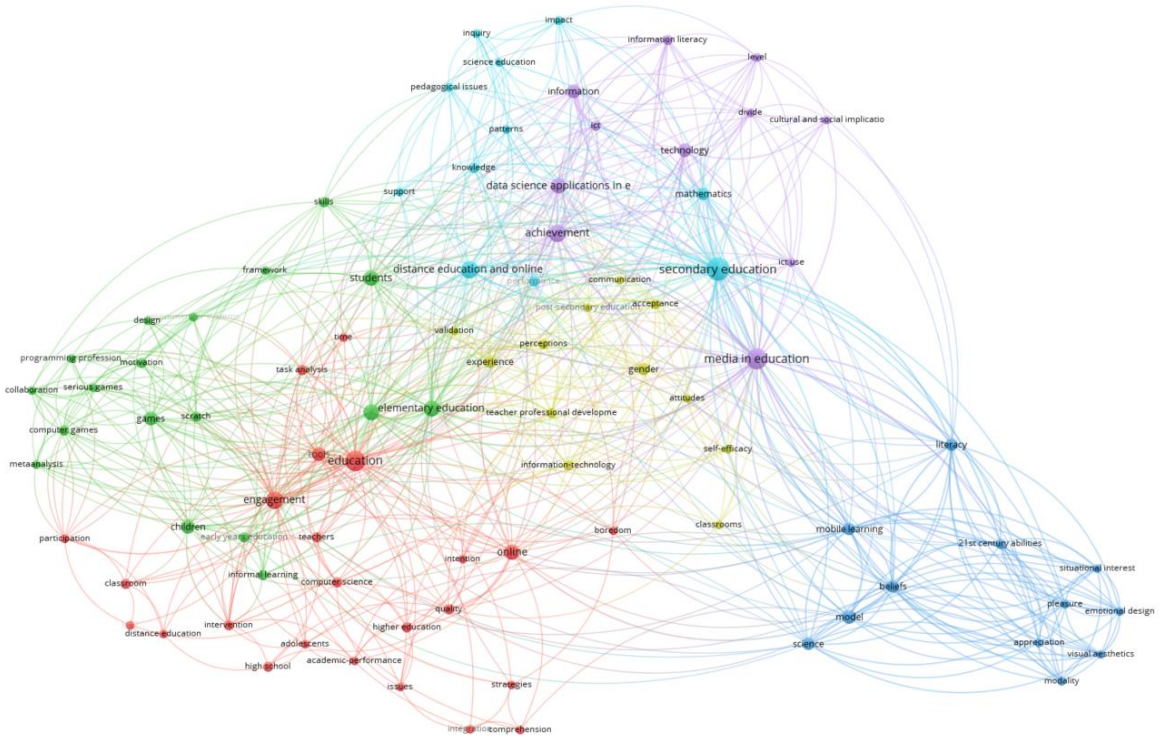
Cluster analysis enhances data interpretation by identifying latent patterns and thematic clusters within the scholarly network. Clusters reveal interconnectedness between researchers, institutions, and contributions to scholarly discourse. This synergy between bibliometric analysis and cluster investigation enriches research impact assessment, uncovering emerging paradigms and interdisciplinary intersections.

In Figure 3 an associated terms map, generated from Web of Science data, visually represents keywords as pivotal nodes. Their strategic positioning and proportional scaling denote significance and prevalence in the scholarly corpus. This map offers a nuanced depiction of conceptual relationships, illustrating the intensity of interconnections and thematic coherence in contemporary scholarly discourse.

Figure 3's co-occurrence matrix highlights the significance of media in education, encompassing a diverse range of multimedia resources and interactive technologies. This pedagogical strategy aims to enrich learning, promote engagement, and cater to diverse learning preferences. Integrating media fosters a comprehensive and interactive environment, nurturing critical thinking and problem-solving skills. It encourages active engagement, collaborative learning, and the exploration of diverse perspectives, fostering 21st-century skills.

"Distance education and online" represent approaches transcending geographical barriers, employing communication tools and online platforms. Distance education uses various technologies for remote learning, while online learning leverages internet-based tools for flexibility and accessibility. Advancements in information and communication technologies enhance these modalities, offering personalized learning experiences.

Figure 3. Map of recurring words



Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

Another cluster, "information literacy," is crucial in the digital age, involving the ability to access, evaluate, and ethically use information. It empowers learners to navigate the information landscape, critically assess credibility, and make informed judgments. Information literacy enhances critical thinking, research capabilities, and contributes to a well-informed society.

Table 1 depicts primary research interests, highlighting the top 5 correlated keywords based on frequency and interconnections. This analysis, following VOSviewer principles, provides a nuanced understanding of thematic interdependencies and research trajectories, revealing overarching themes shaping scholarly discourse in the field (Waltman, 2013).

Table 1. Top 10 terms used to describe the theme

No.	Term	Number of occurrences	Total link strength
1	**Secondary education**	14	104
2	**Media in education**	12	86
3	**Education**	11	57
4	**Distance education and online**	8	44
5	**Engagement**	8	41

Beyond the initial 5 keywords, the analysis uncovered nuanced interrelations between search terms and relevant concepts, identifying 6 distinct thematic clusters presented in table 2. Each cluster, represented by an assigned color code, forms a coherent grouping of closely interconnected keywords defining thematic contours within the research domain.

Table 2. The 6 clusters and defining keywords extracted from VOSviewer

Cluster	The first two main keywords, based on their occurrence	The other keywords in relation to their occurrence
Cluster 1	Education Engagement	Academic performance Adolescents Boredom Classroom Comprehension Computer Science Distance Education Integration Issues
Cluster 2	Games Motivation	Collaboration Computer Games Framework Improving classroom teaching Skills Students
Cluster 3	Mobile Learning Literacy	21’st century abilities Science Situational Interest Beliefs Emotional Design
Cluster 4	Information Technology Communication	Teacher Professional Development Experience Self- Efficacy Validation

Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

		Classrooms
Cluster 5	Information Technology	Information literacy
		Divide
		Data science application in education
		Cultural and social implication
Cluster 6	Distance Education and Online Science Education	Performance
		Secondary Education
		Knowledge
		Performance

Cluster 2 highlights the integration of video games in education, leveraging gaming technologies to enhance the learning experience. Innovative pedagogy blends educational material seamlessly with interactive gaming formats, creating a learning experience that goes beyond traditional methods. Video games become immersive educational tools, inspiring curiosity, fostering teamwork, and honing problem-solving abilities. Rooted in active learning principles, this approach not only engages students but also cultivates essential 21st-century skills, digital literacy, and technological prowess.

While the bibliometric analysis provides valuable insights, it has inherent constraints. Relying on a single database may limit inclusivity, potentially excluding pertinent works from other platforms. A more expansive approach, encompassing multiple databases and interdisciplinary sources, ensures a comprehensive understanding of the research landscape.

Careful consideration and rigorous evaluation are essential, as the analysis might omit relevant contributions. A nuanced examination of identified works is crucial for deciphering theoretical underpinnings, methodological approaches, and empirical contributions, revealing potential gaps in knowledge.

The outcomes of this bibliometric analysis serve as preliminary groundwork, prompting further in-depth investigation and scholarly inquiry. Augmenting the analysis with complementary research methodologies, interdisciplinary perspectives, and an expansive literature review can provide more comprehensive insights, refining the comprehension of trends and dynamics shaping the academic discourse.

5. Conclusions

In the current digital age, the realm of education has encountered a myriad of challenges, necessitating a comprehensive reassessment of traditional pedagogical methods. From the persisting issue of the digital divide to the imperative need for teacher preparedness and the art of content curation, educators and policymakers are confronted with a dynamic landscape that demands innovative solutions and a holistic approach to learning.

The stark reality of the digital divide highlights the urgent necessity for bridging the gap in technological access, particularly in underserved communities. Robust infrastructure development, affordable internet access, and the provision of devices play a pivotal role in ensuring equitable educational opportunities for all. Here, the synergy between public-private partnerships and governmental support becomes crucial in fostering a digitally inclusive educational environment.

In the midst the transformational shift toward digital learning, the role of educators takes center stage in navigating this evolving terrain. Ongoing professional development, specialized training in digital tools, and a nuanced understanding of pedagogical strategies are instrumental in empowering teachers to effectively engage students in the digital sphere.

The curation of online content emerges as an art, demanding a discerning eye for source credibility, a diverse array of content types, and an emphasis on quality over quantity. By fostering interactive and engaging learning experiences, educators can effectively curate a digital learning environment that inspires intellectual curiosity and critical thinking among students.

Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

Emphasizing the crucial role of social interaction, educators are tasked with fostering a sense of community and collaboration in the digital classroom. Facilitating peer-to-peer engagement, virtual networking, and emotional support systems are integral to nurturing a holistic educational experience that extends beyond the confines of traditional learning.

Furthermore, the holistic well-being of students remains a paramount concern, calling for an integrated approach that prioritizes mental health support, stress management techniques, and a healthy balance between screen time and social interaction. In recognizing the potential challenges posed by prolonged screen exposure and virtual isolation, educators play a critical role in cultivating an inclusive and supportive digital learning environment that promotes student resilience and emotional well-being.

Through the implementation of these progressive solutions, the educational system can adapt and flourish in the ever-evolving digital era, fostering an inclusive, engaging, and enriching learning environment that caters to the diverse needs of students across various socioeconomic backgrounds and communities.

References

- Buabeng-Andoh, C. (2012). Factors influencing teachers adoption and integration of information and communication technology into teaching: A review of the literature. International Journal of Education and Development using Information and Communication Technology, 8(1), 136-155. https://www.uwi.edu/ijedict/article/view/3024
- Loh, Y. L., Mohd Haniff M. T., & Lim, C. C. (2023). Bibliometric Visualization of Literature on Information and Communications Technology (ICT) in Education. Jurnal Komunikasi: Malaysian Journal of Communication, 39, 490-513. DOI: 10.17576/JKMJC-2023-3901-28
- Ratheeswari, K. (2018). Information Communication Technology in Education. Journal of Applied and Advanced Research, 2018, 3(Suppl. 1), S45-S47. https://dx.doi.org/10.21839/jaar.2018.v3S1.169
- Alemany, J., Val, E. D., & Garcia-Fornes, A. (2020). Assessing the Effectiveness of a Gamified Social Network for Applying Privacy Concepts: An Empirical Study With Teens. IEEE Transactions on Learning Technologies, 13(4), 777–789. https://doi.org/10.1109/TLT.2020.3026584
- Bergdahl, N. (2022). Engagement and disengagement in online learning. Computers & Education, 188, 104561. https://doi.org/10.1016/j.compedu.2022.104561
- Bruggeman, B., Garone, A., Struyven, K., Pynoo, B., & Tondeur, J. (2022). Exploring university teachers' online education during COVID-19: Tensions between enthusiasm and stress. Computers and Education Open, 3, 100095. https://doi.org/10.1016/j.caeo.2022.100095
- Cattaneo, A. A. P., Antonietti, C., & Rauseo, M. (2022). How digitalized are vocational teachers? Assessing digital competence in vocational education and looking at its underlying factors. Computers & Education, 176, 104358. https://doi.org/10.1016/j.compedu.2021.104358
- Al-Huneini, H., Walker, S. A., & Badger, R. (2020). Introducing tablet computers to a rural primary school: An Activity Theory case study. Computers & Education, 143, 103648. https://doi.org/10.1016/j.compedu.2019.103648
- Araiza-Alba, P., Keane, T., Chen, W. S., & Kaufman, J. (2021). Immersive virtual reality as a tool to learn problem-solving skills. Computers & Education, 164, 104121. https://doi.org/10.1016/j.compedu.2020.104121
- Araiza-Alba, P., Keane, T., Matthews, B., Simpson, K., Strugnell, G., Chen, W. S., & Kaufman, J. (2021). The potential of 360-degree virtual reality videos to teach water-safety skills to children. Computers & Education, 163, 104096. https://doi.org/10.1016/j.compedu.2020.104096
- Asiri, Y. A., Millard, D. E., & Weal, M. J. (2021). Assessing the Impact of Engagement and Real-Time Feedback in a Mobile Behavior Change Intervention for Supporting Critical Thinking

Vol. 76, issue 1, Year 2024
DOI: 10.56043/reveco-2024-0010

in Engineering Research Projects. IEEE Transactions on Learning Technologies, 14(4), 445–459. https://doi.org/10.1109/TLT.2021.3104817

- Banerjee, S. (2021). To capture the research landscape of lecture capture in university education. Computers & Education, 160, 104032. https://doi.org/10.1016/j.compedu.2020.104032
- Bergdahl, N. (2022). Engagement and disengagement in online learning. Computers & Education, 188, 104561. https://doi.org/10.1016/j.compedu.2022.104561
- Blum-Smith, S., Yurkofsky, M. M., & Brennan, K. (2021). Stepping back and stepping in: Facilitating learner-centered experiences in MOOCs. Computers & Education, 160, 104042. https://doi.org/10.1016/j.compedu.2020.104042
- Bonneton-Botte, N., Fleury, S., Girard, N., Le Magadou, M., Cherbonnier, A., Renault, M., Anquetil, E., & Jamet, E. (2020). Can tablet apps support the learning of handwriting? An investigation of learning outcomes in kindergarten classroom. Computers & Education, 151, 103831. https://doi.org/10.1016/j.compedu.2020.103831
- Bosch, N. (2021). Identifying supportive student factors for mindset interventions: A two-model machine learning approach. Computers & Education, 167, 104190. https://doi.org/10.1016/j.compedu.2021.104190