



RESEARCH ARTICLE

A Student-centric Approach to Higher Education in an Era of Technology-assisted Learning – How Far Active Learning is Possible?

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ABSTRACT

The landscape of higher education is undergoing a transformative shift, driven by the integration of technology-assisted learning. This study explores the potential of a student-centric approach in this evolving educational environment, focusing on the implementation and efficacy of active learning methodologies. Active learning, characterized by its emphasis on student engagement and participation, is evaluated through various technology-enabled platforms and tools. The research investigates the challenges and opportunities associated with fostering active learning in digital and hybrid classrooms. By examining case studies, empirical data, and theoretical frameworks, the study provides insights into the extent to which active learning can be realized and optimized in technology-assisted settings. The findings highlight best practices, technological affordances, and pedagogical strategies that enhance student involvement, critical thinking, and collaborative learning. The paper concludes with recommendations for educators and institutions aiming to effectively incorporate active learning principles in their curricula, ensuring a holistic and adaptive educational experience for students in the digital age.

Keywords: Higher education, Active learning, Hybrid learning, Student engagement

INTRODUCTION

By and large, in the 21st century, we see a student-centered approach as the sine qua non of the educational process. It stresses collaboration, student autonomy, engaging with students to create a learning environment that supports, challenges, and aligns with students' needs and goals. A flurry of research has been done. Khoury (2022) argues in his paper that this student-centric approach motivates students, engages them well, producing learning outcomes, particularly in online and distance learning settings. Stone and O'Shea (2019) opined that students who were more vulnerable and so needed additional support were more likely to enroll online. They included mature-age and first-in-family students, those with low socioeconomic status (SES) or disability, and those coming from regional or remote areas.

Active learning is the watchword in education now where students become the center of the

educational process and hone their skills and competencies (Katawazai, 2021). Various problems ensue though, including lack of infrastructure and scarce resources. Despite this lacuna, the use of modern information technologies, especially distance learning, provides a beehive of opportunities for interfacing this concept, where the teacher becomes the mentor to help students develop learning motivation and stimulate their active learning activities (Haleem

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et al., 2022; You, 2019). In the realm of education, there is a body of discourse around the idea of prioritizing students in the learning mechanism, engaging them actively, and tailoring educational experiences to their needs and interests. Numerous studies, including those by Bakar *et al.* (2013), Neumann (2013a, b), and Komatsu *et al.* (2021), veer to diverse facets of this educational approach. These investigations plunge into topics such as crafting learning environments that revolve around the learner and the barriers faced when put into practice.

Student-centered learning (SCL) involves active student participation in the education process and the ability for students to select what, when, where, and how they will learn. In the field of teaching statistics, there has been a rapid expansion in the use of SCL; but still, there is a lack of research that integrates the results in this area, particularly in the context of computer technologies (Judi and Sahari, 2013). Schweisfurth (2015) emphasizes the importance of flexible learning methods, and Oyelana *et al.* (2022) vouch for active participation, individual attention, and motivation. Research by Lahdenperä *et al.* (2022) shows that teacher support and learning control work behoove regulated learning. Asoodeh *et al.* (2012) further posit that a student-centered approach improves academic progress and social skills. However, the successful implementation of this approach demands changes in the organization of the educational process and teacher training, as indicated in the study by Burner *et al.* (2017). At the same time, Tadesse *et al.* (2021); Zhang *et al.* (2022) and Knorn *et al.* (2022) focus on the importance of interactive and constructivist learning, delivering a deeper understanding of the subject.

The socio-cultural view of learning pushes the use of tools and development of artifacts. Teachers are expected to work with student s' phonological awareness in a structured manner, taking as their starting point student s' learning experiences, creativity therein, and interests. There are many

communication techniques, such as unidirectional, contributed, and others, used in teaching. In unidirectional communication, teachers dominate the discussion for knowledge transfer, and students passively receive it. In contributed communication, interactions between teachers and students share the knowledge. Multimedia and mobile media also give rise to differences, giving room for student experiences in online learning. Social media such as Facebook, Twitter, WhatsApp, LinkedIn, YouTube, and others are leveraged for engagement and learning. Researchers have also checked multimedia tools for learning and how media differences give rise to different student experiences (Crook and Schofield 2017). Earlier studies have also gone into digital tools like tablets as a mode of learning, an alternative to traditional writing tools (Wollscheid *et al.*, 2012).

Theoretical e-learning

A student-centered approach to e-learning orients the educational process towards the needs and interests of students. The approach is that students actively pursue their own learning, set their own learning goals, choose a path to achieve the set goals, and independently assess their progress (Kumar & Owston, 2016) - issues that cannot be easily detected. In a student-centered e-learning environment, various tools and technologies are used to help students obtain knowledge through a more interactive and effective format (Santoso *et al.*, 2016; Versteegen *et al.*, 2016; Dolmans 2019; Rodrigues *et al.*, 2019). For exle, chats, forums, web conferences, online quizzes. Research questions, therefore, are:

- What types of technologies can aid active student learning?
- What are the advantages and limitations of technology-enabled learning?
- What recommendations should be followed?

Accessibility and assignments enable students to communicate and collaborate with each other, exchange ideas, and receive feedback from teachers

and fellow students (Serban and Vescan, 2019). Advanced methods, tools, and technologies create an SCL process on electronic platforms. Specifically, machine learning methods and data analysis are used to personalize the educational process according to each student's needs and level of knowledge. Santoso *et al.* (2018) also adduce the development and testing process of a control panel, which demonstrates that its use can improve the quality of learning in a student-centered e-learning environment.

LITERATURE

Kerimbayev *et al.* (2022) explored the implementation of the T-learning platform in the education system and emphasized the advantages of this innovative platform, which contribute to improving the quality of education and facilitating collaboration between teachers and students.

Uskov *et al.* (2014) describe ways and means of e-learning with a focus on students, delving into the creation of an individual electronic educational environment. Various methods and tools, such as adaptive learning, personalization of the education process, the use of online courses, and other electronic tools, are tested. Faisal *et al.* (2019) favor machine learning methods and data analysis to create personalized educational materials and enhance interaction among students.

In the age of the Internet, traditional lectures are becoming less appealing to students, leading to a decline in their motivation for learning and exam performance. However, widespread adoption of student-centered teaching methods aiming to address this issue faces certain barriers, such as: (1) limitations in preparing materials for e-learning, (2) significant additional time required for active online communication with students, (3) resistance from students to take an active role in their education, and (4) inadequate confidence of teachers that a student-centered approach covers all necessary topics.

Debiec (2017) describes a thematic study conducted in an introductory course on digital systems using a mix of student-oriented strategies to overcome the aforementioned barriers and improve students' performance. Specific measures addressed include: (1) improving student-teacher relationships, (2) using inductive and counterintuitive ways to introduce new concepts, (3) the use of puzzle-based quizzes integrated with peer learning, (4) the use of the audience response system, (5) substituting lectures with educational programs, (6) reducing the course duration, and (7) using a graphic tablet. Student-centered e-learning thus means the use of technologies that allow teachers and students to personalize learning, such as data analysis and adaptive learning. Courses are developed according to the interests and needs of students, which can enhance their motivation and learning efficiency. Student-centered e-learning also covers assignments, cases, group discussions, and presentations, which enable students to actively participate in the learning process (Hermans *et al.*, 2013). Student-centered e-learning secures a high level of individualization in education and boosts learning effectiveness. As a result, students can receive quality education that meets their needs and helps them achieve their learning goals. It has been proved that online courses necessitate the application of more effective learner-centered teaching methods. This approach allows students to choose assignments they prefer, including both traditional projects and more active actions such as demonstrations or skill mastery. To determine the length of these changes and their contribution to active learning, course data analysis was conducted. Students successfully did assignments, palpably demonstrating proficiency in various skills, and positively evaluated the flexible learning approach. Hanewicz *et al.* (2017) confirmed that using student-centered methods that consider their preferences is an effective approach for online courses. Institutional overtones of online learning are crucial for strategic budgeting, policy making, and fertile for future directions of educational services.

Online learning

The impact of a student-centered approach to online learning on student satisfaction, particularly for those with little experience in online education, has been studied. Structural equation modeling is used to test hypotheses regarding the influence of five key elements of SCL in online courses: learner relevance, active learning, true learning, student autonomy, and computer competency on students' perception of satisfaction with online courses and distance learning (Ke and Kwak, 2013; Ribeiro-Silva *et al.*, 2022). The results were that all five SCL structures significantly influenced student satisfaction with online courses and distance online learning.

To develop effective online courses, it is important to utilize research-backed principles and practices that are student-centered. It should be theoretically justified and explained based on empirical data. It is crucial to identify evidence-based practices that have proven effective in attracting and retaining students in online courses (McCombs, 2015). A personalized approach to online learning in higher education considers the individual cognitive and motivational differences of each student, allowing for more student motivation, self-esteem, self-efficacy, intrinsic values, and improving the quality of education and preparation for professional activities. However, the personalized approach may not perceptibly impact students' course-related performance and task value. Data analysis can provide more detailed information about students' learning behavior and help create a variety of intervention strategies to enhance the quality of education (Smit *et al.*, 2014), as measured by their enjoyment and effort. When autonomy is granted within a nurturing context, a learner-focused approach can calcify student motivation.

Related work with distance learning

Chui *et al.* (2020) point to the use of machine learning in virtual learning environments, specifically the creation of personalized learning plans for students.

Machine learning algorithms can be used to analyze student data like test scores and system activity, and based on that, create individualized learning plans taking into account each student's unique needs and abilities.

Kerimbayev *et al.* (2020) explored the use of the learning management system (LMS) Moodle as a virtual educational environment to enhance interactive communication in education. The authors discuss the advantages of this approach in facilitating collaboration among students and instructors and thus improving overall education quality.

Practical approaches to virtual learning environments in the context of distance learning and online education have been researched. Almarzooq *et al.* (2020) discuss the advantages and disadvantages of virtual learning compared to traditional classroom-based learning, considering virtual learning as an effective tool for educating medical professionals both during the pandemic and in the long term.

Marín-Díaz *et al.* (2022) analyzed how universities transitioned to virtual learning, the technologies they used, and how it impacted the educational process and student engagement. To enhance student self-efficacy in virtual learning through mobile educational applications, Hussain *et al.* (2021) outlined the use of mobile apps and suggested recommendations for their use. They also discussed the impact of mobile educational apps on improving students' confidence in their knowledge, skills, and abilities, as well as boosting their motivation to learn.

The use of artificial intelligence technologies the principles underlying explainable artificial intelligence and the application of machine learning and data analysis methods to enhance student-virtual learning interaction are also examined (Alonso and Casalino, 2019; Laužikas and Miliutė, 2021). This includes online courses, webinars, virtual classrooms, interactive textbooks, which can involve both synchronous (real-time) and asynchronous (non-real-time) learning. Virtual learning can be beneficial for

distance learning in blended learning programs that combine both traditional and virtual teaching methods (Jotsov *et al.*, 2021). Numerous studies focus on the effectiveness of virtual learning and the optimization of teaching processes. Aslan and Duruhan (2021) conducted research on the impact of a virtual learning environment and developed a problem-oriented approach to teaching on students' academic performance and motivation. The results showed that the use of problem-oriented virtual learning environments hikes up students' academic performance, problem-solving skills, and motivation compared to traditional teaching methods. Skalka *et al.* (2019) developed a system for automated assessment of programming skills in virtual learning environments. Their study compared the effectiveness of automated assessment with traditional manual assessment methods in programming education. The results showed that automated assessment using virtual learning environments was more effective than traditional manual assessment methods. This study highlights the potential of virtual learning environments for automated assessment and improving programming education.

It can be seen that the use of e-learning has increased significantly since 2012 and continues to grow (Figure 1). Specifically, in 2023, the highest usage was recorded for "Virtual learning," followed by "Online learning" and "e-learning." Additionally, it is worth noting that the usage of "Virtual learning" reached its peak in 2023, while the usage of "Online learning" and "e-learning" continues to go up. As for scholarly articles, it can be inferred that the number of articles on this topic correlates with the popularity of these learning modalities. The highest number of articles was published in 2023, while the lowest was in 2012.

This Figure 1 provides a description and characteristics of three learning modalities: e-learning, online learning, and virtual course of study. It allows for comparing their differences, advantages, and features. For each learning mode, their main characteristics and distinctive features are given. As an exle, e-learning involves the use of computer programs and can be both a standalone form of learning and a complement to traditional learning. The important elements that should be considered for e-learning are - control of the self-learning process,

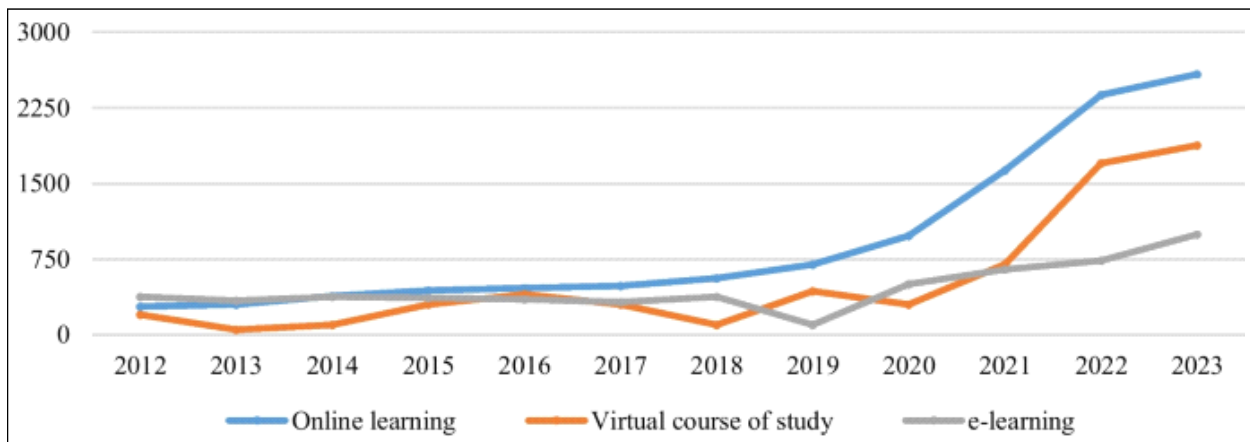


Figure 1: Growth and use of e-learning (Online learning, Virtual course of study, e-learning) from 2012 to 2023

Adopted from [A student-centered approach using modern technologies in distance learning: a systematic review of the literature by Nurassyl Kerimbayev, Zhanat Umirzakova, Rustam Shadiev & Vladimir Jotsov, [Smart Learning Environments]

classification of cultural profiles, learner's feedback, content, and delivery mode of instruction (Kaizer *et al.*, 2020). Through the lenses of technological, pedagogical, and content knowledge, strategies such as clear and consistent design, developing a detailed syllabus, creating a learning community, instructor presence, and prioritizing free educational materials (Mucundanyi, 2021) can be given priority.

RESEARCH GAP AND STUDY OBJECTIVE

Currently, a variety of educational technologies are used to create learning environments that are tuned to students' needs and interests. However, there has been no integrative or holistic research done so far. Various constituents have been discovered, but they have not been properly tied up due to limitations, whether they are structural or otherwise. Shehata *et al.* (2023) conducted a systematic review of literature reviews in this regard. Ochoa and Wise (2021) delve into student-centered analytics in support of the digital transformation of education. Zhang *et al.* (2023) examined student-centered learning in the context of the case method and conducted an analysis of online and offline discussions within this teaching method. Khaldi *et al.* (2023) conducted a systematic literature review on gamification in e-learning in higher education. This was a welcome move from students, but coverage was an issue.

A study by Yang *et al.* (2018) evaluates the effectiveness of smart classrooms and highlights the importance of integrating technology into the teaching process. Meanwhile, the study by Peng *et al.* (2019) focuses on a personalized adaptive learning approach implemented using smart learning environments. Both studies are highly relevant for educational technologies on teaching methods and the establishment of more personalized educational scenarios.

Huang *et al.* (2023) explore educators' readiness to implement Online Merge Offline (OMO) learning in the context of digital transformation. At the same

time, Topuz *et al.* (2022) consider current trends in online assessment systems in the context of an emergency transition to distance learning. Kerimbayev *et al.* (2023) delve into online collaborative learning using educational robotics. The results are not so encouraging. Wang *et al.* (2022) examined the temporal aspect of gender differences in online learning behavior and found no significant difference.

Challenges

It is important to consider the limitations and challenges of using modern technologies in a student-centered approach. First, the accessibility and availability of technologies may be uneven, especially for students from less developed regions or social groups. This can create educational inequalities and exclude certain categories of students.

Secondly, the effective use of technologies requires qualified teachers who can appropriately integrate technologies into the learning process and provide support to students.

Additionally, ethical and confidentiality issues related to the use of modern technologies in education should not be disregarded. The collection and storage of student data, particularly in the context of using artificial intelligence, must adhere to high standards of security and confidentiality.

In Figure 2 below, the use of various modern technologies in education is described. Each technology has its own advantages and contributes to the improvement of the learning process. The use of modern technologies in education has a significant impact on the educational process. Interactive e-textbooks offer engaging learning experiences, where students have access to up-to-date information and can instantly assess their knowledge. Web and video conferencing enable students to communicate remotely, participate in discussions, and engage in virtual lectures and seminars. Virtual and augmented reality create engaging and immersive educational environments, visualizing complex concepts and

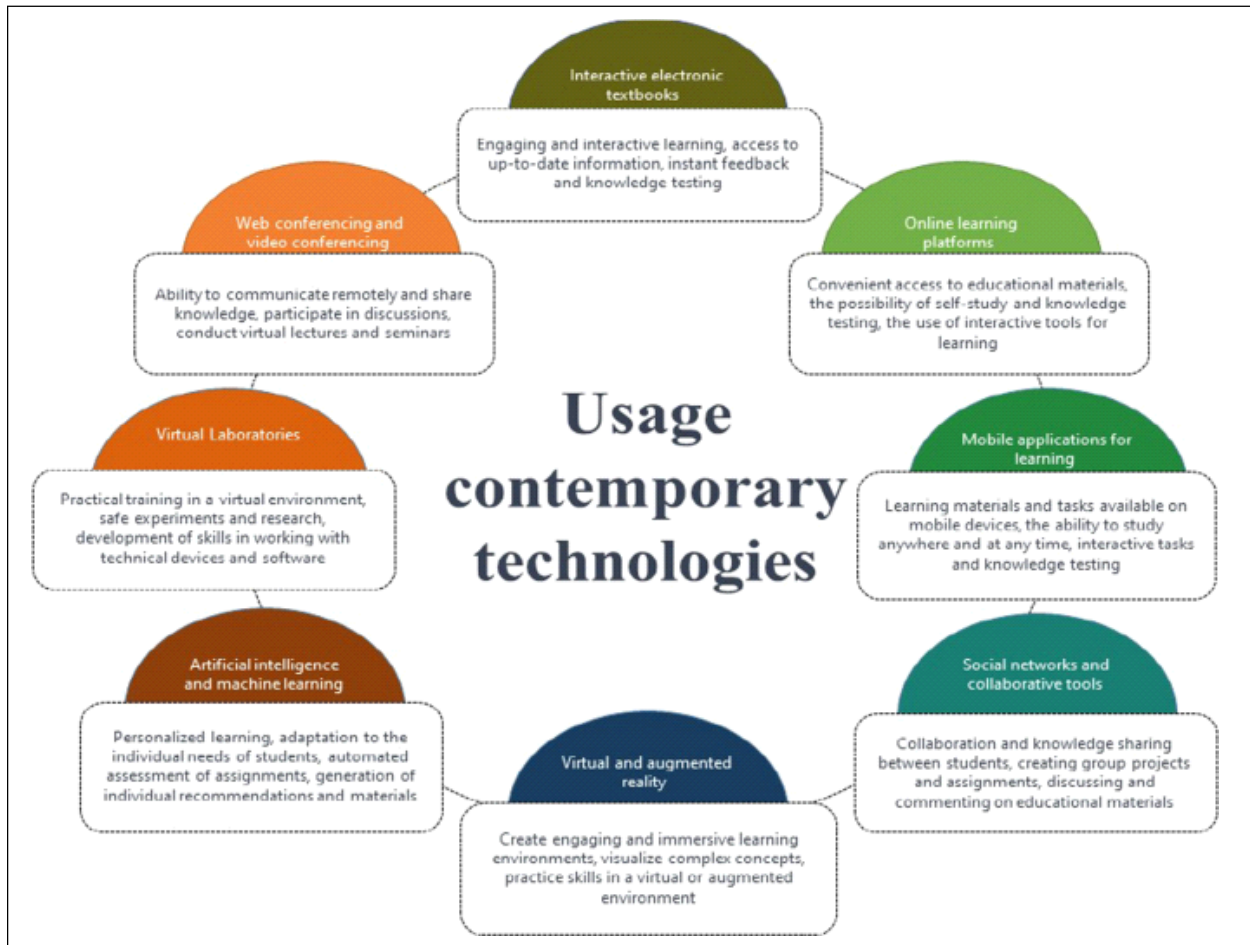


Figure 2: Utilization of modern technologies in education

Adopted from [A student-centered approach using modern technologies in distance learning: a systematic review of the literature by Nurassyl Kerimbayev, Zhanat Umirzakova, Rustam Shadiev & Vladimir Jotsov, [Smart Learning Environments]

enabling the practice of practical skills. The use of social networks fosters collaboration and knowledge sharing among students. All these modern technologies greatly enrich the educational process, making it more engaging, effective, and accessible for learners.

Dunbar and Yadav (2022) analyzed the effects of implementing a summer educational program involving students through service learning on the transition to SCL. The work by Rapanta (2021) explored the potential of integrating a dialogic argumentation method, oriented towards students, in various subject

areas. A study by Muller and Mildemberger (2021) provides a systematic review of blended learning in higher education, aimed at providing flexible learning by replacing some face-to-face time with online environments. Lastly, Bremner *et al.* (2022) present a systematic review of the outcomes of student-centered pedagogy. These works contribute to understanding the effectiveness and benefits of SCL in various educational contexts.

In recent years, virtual learning has significantly expanded its use and overtaken e-learning, becoming

the second most popular form of learning after online learning. This indicates the growing popularity of virtual learning and its importance in the modern educational context. According to the data in Figure 3 below, e-learning was used in 21%, virtual learning in 37%, and online learning in 42%. This diagram provides information about the distribution of different forms of education and helps understand which forms are the most popular and in demand in the educational environment.

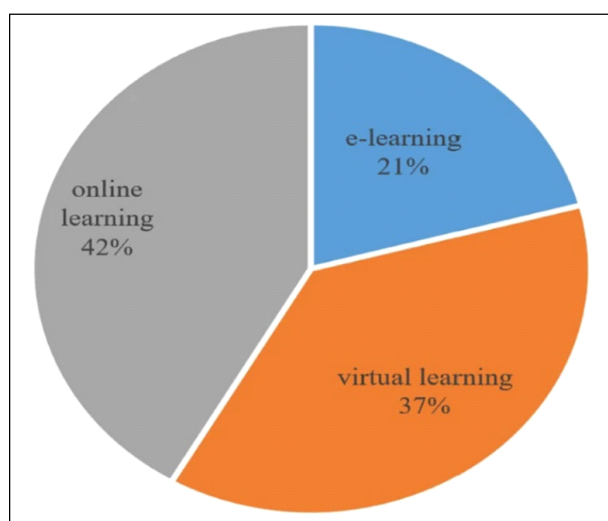


Figure 3

Adopted from 'A student-centered approach using modern technologies in distance learning: a systematic review of the literature' Nurassyl Kerimbayev, Zhanat Umirzakova, Rustam Shadiey & Vladimir Jotsov, *Smart Learning Environments*'

There are also studies addressing artificial intelligence and its application in online education, such as the one conducted by Ouyang *et al.* (2022). Other studies in this list examine online entrepreneurship education, the impact of online learning on students with cognitive impairments, as well as the challenges associated with the online component of blended learning and the issues faced by teachers in the online environment (e.g., works by Rasheed *et al.*, 2020; Martin *et al.*, 2020).

Positives

In general, these studies provide valuable information and recommendations for the development and implementation of student-centered online learning. They also underscore the importance of continuous improvement and the application of new approaches and technologies in this field.

The presented diagram is the result of a synthesis of literature analysis, based on the analysis of a number of studies conducted in the field of online (distance) education, taking into account the use of modern technological solutions (Figure 4). This literature review provides a quantitative assessment of academic work on each of the identified technologies and provides valuable insight into the direction and scope of research in the field.

Negatives

However, research shows that student-centered teaching strategies may have a negative impact on the academic performance of students from different socioeconomic backgrounds. Therefore, when executing student-centered teaching strategies, it is necessary to consider the context of their application and provide the necessary support and resources to students so that they can meet their educational needs and goals effectively. Furthermore, a student-centered approach and modern technologies allow teachers to gain a more accurate understanding of each student's progress and respond to their needs and difficulties in real-time. This contributes to more effective student support and enhances the quality of education.

Limitations

During the process of reviewing and addressing research questions, this study identified several limitations. The vast amount of published articles can lead to the omission of some relevant work, which is a common challenge in literature reviews. Significant effort is required when constructing search queries and determining keywords to ensure the

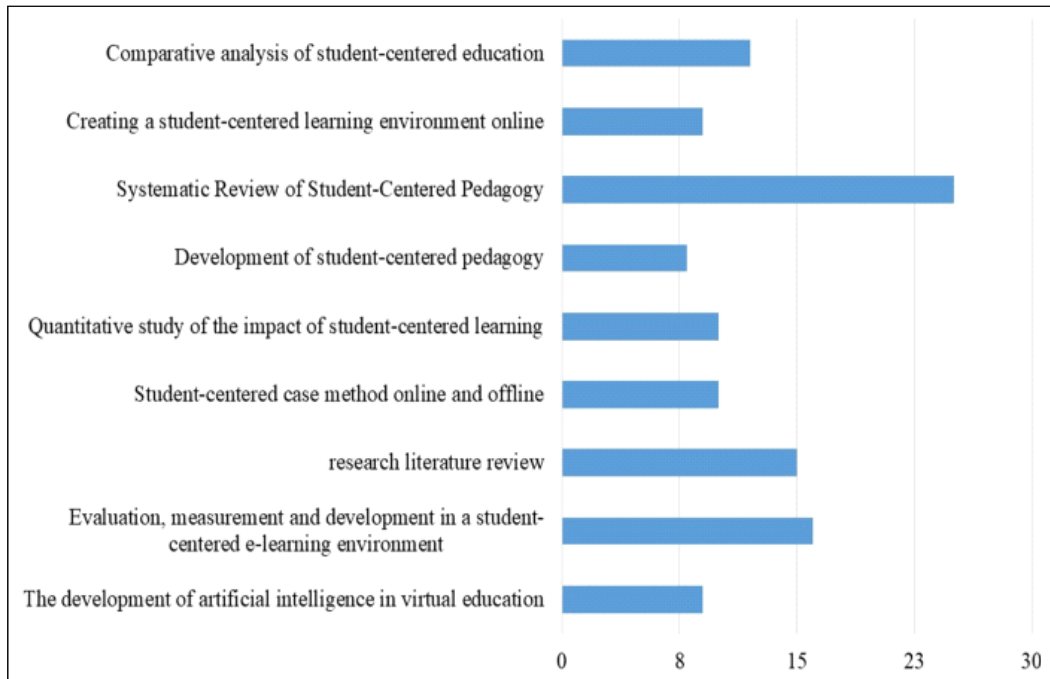


Figure 4

Adopted from ‘*A student-centered approach using modern technologies in distance learning: a systematic review of the literature by Nurassyl Kerimbayev, Zhanat Umirzakova, Rustam Shadiev & Vladimir Jotsov, Smart Learning Environments*’

success of the search process. The method of identifying keywords in this study relied on the “snowballing” process to uncover related reflections and keywords associated with the research topic. However, the limited timeframe may have resulted in the exclusion of certain articles or combinations of keywords, potentially leading to the omission of relevant information.

Furthermore, it should be noted that this study focused only on the analysis of journal articles in the English language. Consequently, works written in other languages or unpublished in journals may have been excluded from consideration.

RECOMMENDATION FOR FURTHER RESEARCH

In the future, research could focus on exploring the components involved in various student-centered

approach systems and modern (distance) learning technologies, and establishing common principles and terminology to create a unified approach and definition. It is important to note that this concept will evolve as our understanding of human psychology and the development of new technologies expand.

Additionally, the emphasis on developing higher-order thinking skills has not received sufficient attention in the existing literature. To address this gap, attention can be given to the development of higher-order thinking skills in the context of a student-centered learning environment. Future research can also focus on implementing these skills using a student-centered approach and modern technologies, including the potential application of virtual reality, while taking care of ethical and confidentiality issues.

Moreover, conducting a detailed investigation to analyze existing platforms and systems of student-

centered approaches and modern technologies in distance learning is necessary to determine which systems work best for different purposes and needs. This will help identify best practices and select the most effective learning systems.

CONCLUSION

A student-centered approach plays a crucial role in the effectiveness of online or distance learning. Considering students' needs and preferences, as well as actively involving them in the learning process, contributes to increased motivation and better outcomes. The use of personalized approaches, adaptive technologies and tools, as well as feedback, results in a learning environment tailored to each student's individual needs.

Overall, the systematic literature review allows for the conclusion that a student-centered approach and modern technologies play a significant role in enhancing the quality of distance learning. They contribute to active student engagement, personalization of the educational process, and the creation of an interactive learning environment. However, successful implementation of this approach requires consideration of the diversity of student needs and overcoming associated limitations. Further research and development in this field will contribute to the continued progress of distance learning and the provision of quality education for students.

However, for the full implementation of the student-centered approach and effective use of modern technologies in distance learning, it is necessary to consider limitations and challenges. This includes ensuring technology accessibility for all students, the quality of educational content, support and training for instructors in technology use, as well as organizational and managerial issues.

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