

REVIEW

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# A student-centered approach using modern technologies in distance learning: a systematic review of the literature

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## Abstract

A literature review was conducted to develop a clear understanding of the student-centered approach using modern technologies in distance learning. The study aimed to address four research questions: What research experience already exists in the field of the student-centered approach in distance learning? What modern technologies are used in distance learning, and how are they related to the student-centered approach? What are the advantages and limitations of implementing the student-centered approach and modern technologies in distance learning? What recommendations can be derived from existing research for the effective implementation of the student-centered approach and modern technologies in distance learning? The purpose of writing this review article is to provide a comprehensive overview of the student-centered approach using modern technologies in distance learning and its advantages. To conduct this review, a Web of Science and Scopus database was searched using the keywords “student-centered approach,” “modern technologies,” and “distance learning.” The search was limited to articles published between 2012 and 2023. A total of 688 articles were found, which were selected based on their relevance to the topic. After the verification and selection process, 43 articles were included in this review. The main results of the review revealed that the student-centered approach to learning took various forms or was defined individually, and there were significant differences in the main research findings. The review results provide a comprehensive overview of existing studies, advantages and limitations of the student-centered approach using modern technologies in distance learning as well as examples of successful implementation in various educational institutions. The article also discusses the challenges that online and distance learning may pose to the student-centered approach, the modern technologies that support the student-centered approach, and suggests ways to overcome these challenges. The role of technology in facilitating the student-centered approach in online and distance learning is analyzed in the article, along with recommendations and best practices for its implementation. The student-centered approach is gaining increasing attention and popularity as a means to address these issues and improve the quality of online and distance learning.

**Keywords:** Student-centered approach, Distance learning, Online learning, E-learning, Virtual learning

## Introduction

The student-centered approach is a teaching and learning method that places the needs and interests of students at the center of the educational process. It emphasizes engagement, collaboration, and student autonomy, aiming to create a learning environment that supports, challenges, and aligns with students' needs and goals. In his research, Khoury (2022) argues that this approach has a positive impact on student motivation, active engagement and improved learning outcomes, especially in online and distance learning settings.

Modern education strives for active learning, where students become the center of the educational process and develop their skills and competencies (Katawazai, 2021). However, the implementation of this concept is difficult due to various problems, including lack of infrastructure and limited resources. Despite this, the use of modern information technologies, especially distance learning, provides enormous opportunities for the application of this concept, where the teacher plays the role of a mentor, helping students develop learning motivation and stimulating their independent learning activities (Hal-eem et al., 2022; You, 2019). In the realm of education, there is a significant discourse surrounding the idea of prioritizing students in the learning process, involving 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), explore diverse facets of this educational approach. These investigations delve into topics such as crafting learning environments that revolve around the learner and the hurdles faced when translating this concept into practical implementation.

Student-centered learning (SCL) involves active student participation in the educational process and the ability for students to choose 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. However, despite this, there is a lack of research that synthesizes the results in this area, particularly in the context of computer technologies (Judi & Sahari, 2013). Schweisfurth (2015) emphasizes the importance of flexible learning methods, and (Oyelana et al., 2022) highlight active participation, individual attention and motivation. Research Lahdenperä et al. (2022) shows that teacher support and control of learning tasks promote regulated learning. Asoodeh et al. (2012) further confirm that a student-centered approach improves academic achievement and social skills. However, the successful implementation of this approach requires 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) emphasize the importance of interactive and constructivist learning, providing a deeper understanding of the material.

## Theoretical framework e-learning

A student-centered approach to e-learning involves orienting the educational process towards the needs and interests of students. This approach assumes that students actively participate in their own learning, define their learning goals, choose ways to achieve these goals, and independently assess their progress (Kumar & Owston, 2016). In the context of the accessibility of e-learning, a student-centered approach can be used

to identify accessibility issues that cannot be automatically detected. In a student-centered e-learning environment, various tools and technologies are used to help students acquire knowledge in a more interactive and effective format (Santoso et al., 2016; Versteegen et al., 2016; Dolmans 2019; Rodrigues et al., 2019). For example, chats, forums, web conferences, online quizzes, and assignments allow students to communicate and collaborate with each other, exchange ideas, and receive feedback from teachers and fellow students (Serban & Vescan, 2019). Advanced methods, tools, and technologies are applied to create a SCL process on electronic platforms. Special attention is given to the use of machine learning methods and data analysis to personalize the educational process according to each student's needs and level of knowledge. Santoso et al. (2018) also provide a description of 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.

Kerimbayev et al. (2022) investigated the implementation of the I-learning platform in the education system and emphasized the advantages of this innovative platform, which contributes to improving the quality of education and facilitating collaboration between teachers and students. The article also highlights the importance of integrating technology into education to enhance the quality of education and prepare students for modern employment requirements.

Methods and technologies of e-learning with a focus on a student-centered approach are described by Uskov et al. (2014), who discuss the creation of an individual electronic educational environment that can be tailored to the needs and knowledge level of each learner. The application of intelligent technologies to enhance student learning is emphasized. Various methods and approaches, such as adaptive learning, personalization of the educational process, the use of online courses, and other electronic tools, are employed. Faisal et al. (2019) propose the use of machine learning methods and data analysis to create personalized educational materials and improve interaction among students.

In the age of the Internet, traditional lectures are becoming less appealing to students, leading to a decrease in their motivation for learning and exam performance. However, widespread adoption of student-centered teaching methods aimed at addressing this issue faces certain obstacles, such as: (1) difficulties related to preparing materials for e-learning; (2) significant additional time required for active online communication with students; (3) resistance from students towards taking an active role in their education; (4) insufficient confidence of teachers that a student-centered approach covers all necessary topics. Dębiec (2017) describes a thematic study conducted in an introductory course on digital systems using a combination of student-oriented strategies to overcome the mentioned obstacles and improve students' performance. Specific measures included: (1) improving student-teacher relationships; (2) using inductive and counter-intuitive approaches to introduce new concepts; (3) the use of puzzle-based quizzes integrated with peer learning; (4) use of the audience response system; (5) replacing some lectures with educational programs; (6) reducing the course duration; and (7) utilizing a graphic tablet.

Student-centered e-learning involves the use of technologies that allow teachers and students to personalize learning, such as data analysis and adaptive learning. Courses

are developed considering the interests and needs of students, which can enhance their motivation and learning efficiency. Student-centered e-learning also involves the use of interactive teaching methods such as assignments, cases, group discussions, and presentations, which enable students to actively participate in the learning process (Hermans et al., 2013). Student-centered e-learning helps ensure a high level of individualization in education and enhances learning effectiveness. As a result, students can receive quality education that meets their needs and helps them achieve their learning goals. It has been established that online courses require the application of more effective learner-centered teaching methods. This approach allowed students to choose assignments they prefer, including both traditional projects and more active actions such as demonstrations or skill mastery. To determine the extent to which these changes contributed to active learning, course data analysis was conducted. Students successfully completed assignments, 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.

#### **Background: online learning**

The impact of a student-centered approach to online learning on student satisfaction, particularly for those with limited experience in online education, has been studied. Researchers focus on constructs such as teacher-student interaction, active student participation in discussions and assignments, personalized learning, and others. Structural equation modeling was employed to test hypotheses regarding the influence of five key elements of SCL in online courses: learner relevance, active learning, authentic learning, student autonomy, and computer competency on students' perception of satisfaction with online courses and distance learning (Ke & Kwak, 2013; Ribeiro-Silva et al., 2022). The results demonstrated 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 and can 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). Student-centered online environments serve as important tools for education in the modern world, providing students with access to educational materials anytime and anywhere, as well as offering a convenient and flexible learning format (Rayens & Ellis, 2018). Such an approach can improve the quality of learning and enhance student motivation, ultimately leading to more effective and successful education.

A personalized approach to online learning in higher education takes into account the individual cognitive and motivational characteristics of each student, unlike universal approaches that do not consider these differences. This allows for more effective enhancement of student motivation, self-esteem, self-efficacy, intrinsic values, and improves the quality of education and preparation for professional activities. However, the personalized approach may not have a significant impact on students' course-related performance and task value. Data analysis can also provide more detailed information about students' learning behavior and help develop further intervention strategies to improve the quality of education (Smit et al., 2014).

Smit et al. (2014; Figueiró & Raufflet, 2015) investigated the application of self-determination theory in establishing an educational setting centered around students. Their multilevel analysis revealed that students in this environment exhibited elevated levels of perceived autonomy, competence, relatedness, and motivation, gauged by their enjoyment and effort. When autonomy is granted within a nurturing context, a learner-focused approach can enhance student motivation.

Some higher education institutions are transitioning from a traditional teacher-led model to a student-centered model. However, this process is happening slowly due to the lack of clear instructions and trust in teachers. Yap (2016) investigated the challenges schools face in this process and the influence of a student-centered model. Various student-centered teaching methods have been examined, but insufficient attention has been given to what teachers themselves can do to achieve this model. Different technologies, such as online learning and multimedia, have been presented as supportive tools for this model. The study also presents a SCL model that includes key strategies and clear recommendations for teachers. The traditional teaching model was compared to multimedia and online learning in terms of their impact on student understanding and motivation, using pre-tests, post-tests, surveys, and student feedback (Bonnici et al., 2016) to inform how the modality and style of online learning can be improved and adapted to student needs.

#### **Related work with distance learning**

Currently, as virtual learning becomes increasingly popular and widely used in various fields, including education, it becomes important to ensure effective interaction between learners and technologies in virtual learning environments. To achieve this goal, a student-centered approach is necessary, which allows for individualizing the learning process, taking into account the needs and interests of each learner.

The interaction between learners and technologies in virtual learning environments is an important topic in the field of e-learning. It encompasses various aspects such as interfaces and usability, accessibility of materials, feedback and support, collaborative work and communication, as well as the ability to personalize and customize learning (Borba et al., 2018). Technologies used in virtual learning environments can impact the effectiveness of learning and stimulate active student engagement in the learning process. For example, modern technologies such as online forums, video conferences, and mobile applications can provide a more flexible and convenient environment for communication and collaboration among students and instructors. Chui et al. (2020) discuss 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, such as test scores and system activity, and based on that, create individualized learning plans that take into account each student's unique needs and abilities.

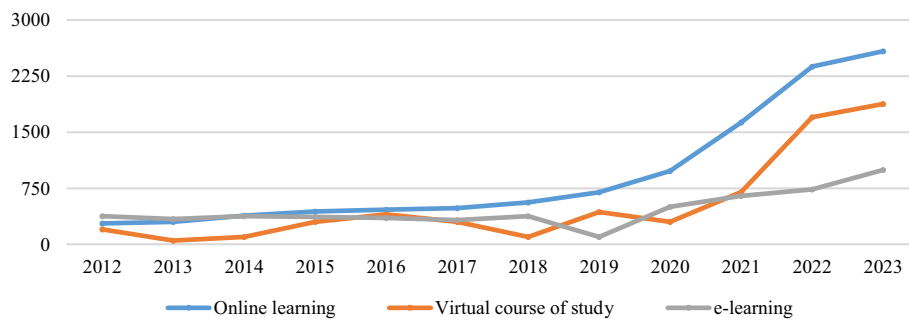
Kerimbayev et al. (2020) discussed the use of the learning management system (LMS) Moodle as a virtual educational environment to enhance interactive communication in education. The authors discussed the advantages of this approach in facilitating collaboration among students and instructors and improving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

The study demonstrated the effectiveness of LMS Moodle in creating an interactive and engaging learning environment.

Practical approaches to virtual learning environments in the context of distance learning and online education have been explored. Various aspects of virtual learning environments, including their definition, history, and evolution, the technologies used, learning models and methods, as well as research related to the effectiveness of virtual learning environments, have been discussed (Flavin & Bhandari, 2021). Different aspects of virtual learning, such as its effectiveness, accessibility, usability, and technological challenges, have been examined. Almarzooq et al. (2020) also 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 used, and how it impacted the educational process and student engagement. They also examined both the positive and negative aspects of virtual learning and discussed future development possibilities for virtual learning environments. To enhance student self-efficacy in virtual learning through mobile educational applications, Hussain et al. (2021) described key approaches to improving student self-efficacy in virtual learning using mobile apps and provided 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 increasing their motivation to learn.

The use of artificial intelligence technologies that explain decision-making in virtual learning environments to make learning more student-centered is also discussed. The principles underlying explainable artificial intelligence and the application of machine learning and data analysis methods to enhance student-virtual learning environment interaction (Alonso & Casalino, 2019; Laužikas & Miliūtė 2021). The role of explainable AI in improving assessment and providing feedback to students in virtual learning environments is also explored. This includes online courses, webinars, virtual classrooms, interactive textbooks, etc., 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 in virtual environments. Aslan and Duruhan (2021) conducted research on the impact of a virtual learning environment developed based on a problem-oriented approach to teaching on students' academic performance, problem-solving skills, and motivation. The results showed that the use of problem-oriented virtual learning environments improved students' academic performance, problem-solving skills, and motivation compared to traditional teaching approaches. Skalka et al. (2019) developed a system for automated assessment of programming skills using 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.



**Fig. 1** Growth and use of e-learning (Online learning, Virtual course of study, e-learning) from 2012 to 2023

**Table 1** Comparison of learning modalities: online learning, virtual course of study, and e-learning

Learning modality	Characteristics	Differences
e-learning	The use of computer programs and electronic resources for learning, including interactive textbooks, tests, and simulations	<ul style="list-style-type: none"> <li>Can be used as a standalone form of learning or as a supplement to traditional classroom instruction</li> <li>Typically requires the use of a computer or laptop to access learning materials</li> <li>Can be organized in self-paced or instructor-led formats</li> </ul>
Online learning	Education that takes place entirely online, without the need for physical presence in educational institutions	<ul style="list-style-type: none"> <li>Usually conducted on dedicated online platforms</li> <li>Enables education to be accessed from anywhere in the world</li> <li>May include the opportunity to communicate with instructors and fellow students through chats and video conferences</li> </ul>
Virtual course of study	Online learning utilizing virtual classrooms, where instructors and students can interact in real-time	<ul style="list-style-type: none"> <li>Typically includes lectures, discussions, and group assignments</li> <li>Allows learners to gain a unique experience of communication and interaction in a virtual environment, which can be valuable in the real world</li> <li>Requires participation at designated times</li> </ul>

It can be seen that the use of e-learning has increased significantly since 2012 and continues to grow (Fig. 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 rise. Regarding 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 2013.

This Table 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 modality, their main characteristics and distinctive features are provided. For example, e-learning involves the use of computer programs and can be both a standalone form of learning and a complement to tradition

### Research gap and study objective

Currently, despite extensive scientific discussion, research issues related to the concept of a student-centered approach and the successful integration of student-centered educational tools when using various educational technologies in the context of e-learning remain the subject of active discussion and research. Several systematic reviews and meta-analyses have attempted to evaluate the effectiveness of a variety of educational technologies in creating learning environments that are tailored to students' needs and interests. Shehata et al. (2023) conducted a systematic review of literature reviews to assess the current state of student-centered learning facilitated using educational technology. Ochôa and Wise (2021) discuss the role of student-centered analytics in supporting the digital transformation of education. Zhang et al. (2023) examine student-centered learning in the context of the case method and conduct an analysis of online and offline discussions within this teaching method. Shemshack and Spector (2020) conducted a systematic review of terminology associated with personalized learning. Yang et al. (2023) focused on student engagement in the context of emergency distance learning. Khaldi et al. (2023) conducted a systematic literature review on gamification in e-learning in higher education.

A study by Yang et al. (2018) evaluates the effectiveness of smart classrooms and highlights the importance of integrating technology into the teaching process. While the study by Peng et al. (2019) focuses on a personalized adaptive learning approach implemented using smart learning environments. Both of these studies are highly relevant for better understanding the impact of modern educational technologies on teaching methods and contribute to the creation of more personalized educational scenarios.

Conducted research Mustafa et al. (2023) examines the impact of gamification on students' online learning behavior and academic performance, taking into account the perspective of learning analytics. Huang et al. (2023) work explores educators' readiness to implement Online Merge Offline (OMO) learning in the context of digital transformation. At the same time, Topuz et al. (2022) considered current trends in online assessment systems in the context of an emergency transition to distance learning. Kerimbayev et al. (2023), is engaged in the development of computational thinking in online collaborative learning using educational robotics. Wang et al. (2022) examined the temporal aspect of gender differences in online learning behavior. These studies make important contributions to the understanding of various aspects of modern educational technologies and their impact on learning and teaching.

**Research Objective:** The aim of this study is to conduct a systematic literature review on the topic of "Student-Centered Approach and Modern Technologies in Distance Learning." The main objective is to analyze and summarize existing knowledge and research on this topic to identify key trends, advantages, limitations, and recommendations regarding the student-centered approach and the use of modern technologies in distance learning.

**Research Questions:**

To achieve the stated research objective, the following questions are formulated:

- What research experience already exists in the field of the student-centered approach in distance learning?



- What modern technologies are used in distance learning, and how are they related to the student-centered approach?
- What are the advantages and limitations of implementing the student-centered approach and modern technologies in distance learning?
- What recommendations can be derived from existing research for the effective implementation of the student-centered approach and modern technologies in distance learning?

The study will focus on seeking answers to these questions and providing a comprehensive literature review that will assist researchers, educators, and practitioners in the field of education to develop strategies and methods for the effective implementation of the student-centered approach and modern technologies in distance learning.

## **Methodology**

### **Use of modern technologies**

The use of modern technologies in a student-centered approach in education is an important and promising area of research. Modern technologies, such as artificial intelligence, virtual reality, adaptive systems, and chatbots, can significantly enhance the educational process, making it more personalized, interactive, and effective.

One of the main advantages of using modern technologies in a student-centered approach is the ability to individualize learning. Adaptive learning technologies allow for the adaptation of educational materials and teaching methods to individual needs and preferences of each student. This facilitates more effective comprehension of the material, increases student motivation, and fosters interest in learning.

Furthermore, the use of modern technologies promotes active student engagement and the development of collaborative work. Virtual environments and tools enable students to collaborate, exchange ideas, solve problems together, and develop communication skills. This is particularly important in the context of collaborative learning, where students may be located in different places and interact virtually.

However, it is important to consider the limitations and challenges associated with the use of modern technologies in a student-centered approach. Firstly, 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.

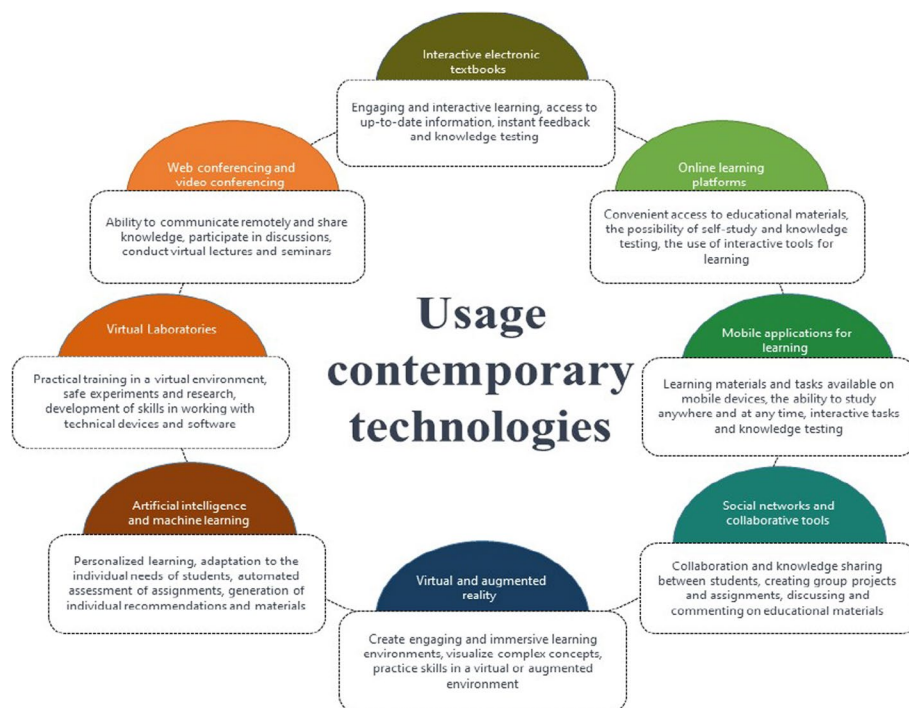
Secondly, effective use of technologies requires qualified educators who can appropriately integrate technologies into the learning process and provide support to students. A shortage of trained teachers may hinder the successful implementation of the student-centered approach.

Additionally, ethical and confidentiality issues related to the use of modern technologies in education should be taken into account. Collection and storage of student data, particularly in the context of using artificial intelligence, must adhere to high standards of security and confidentiality.

Several studies in the field of education and information technology have explored various aspects of technology integration in the educational process. One article examined the role of teachers, the internet, and technology in the education of the younger

generation (Szymkowiak et al., 2021). Another study investigated students’ perceptions of e-learning platforms (Moodle, Microsoft Teams, and Zoom) in the context of the COVID-19 pandemic (Alameri et al., 2020; Gamage et al., 2022). Another research focused on bridging the digital divide and acquiring digital skills among elderly individuals (Blažič & Blažič, 2020). Influencing factors on the acceptance of mobile learning (m-learning) in higher education were explored in another article (Qashou, 2021). A review of digital transformation in education was presented in a study (Bilyalova et al., 2020). The use of artificial intelligence in higher education was investigated using structural equation modeling (Chatterjee & Bhattacharjee, 2020). Augmented and virtual reality technologies in anatomical education underwent a systematic review (Uruthiralingam & Rea, 2020). Overall, these studies reflect different aspects of information technology application in education and highlight the role of teachers, the internet, digital skills, and various technological platforms in student learning.

In Fig. 2 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. Online learning platforms provide convenient access to educational materials and interactive tools, facilitating self-paced learning and knowledge assessment. Virtual laboratories allow for hands-on practical learning in a safe virtual environment, developing skills in working with



**Fig. 2** Utilization of modern technologies in education

technical devices and software. Mobile learning applications offer flexibility and accessibility to educational materials and assignments, allowing students to learn anywhere and anytime. Artificial intelligence and machine learning support personalized learning, automate assignment grading, and offer individual recommendations. Virtual and augmented reality create engaging and immersive educational environments, visualizing complex concepts and enabling 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.

Overall, the use of modern technologies in a student-centered approach opens up significant prospects for enhancing education. However, for successful implementation of this approach, it is necessary to consider limitations and challenges, develop effective implementation strategies, and provide appropriate support and training for the teaching staff. Only then can we fully leverage the potential of modern technologies in education and create more effective and SCL environments.

#### **Research context and data coding**

This article presents two methodological approaches to educational research, enriched by a coding scheme, which is a systematic method for analyzing and classifying data obtained from a study. These methodologies allow researchers to effectively analyze and interpret data to better understand various aspects of educational processes. A critical aspect of such analysis is the number of studies conducted within each of the identified methodological approaches. In quantitative studies that use a coding scheme, data are presented in numerical form and are coded according to predetermined parameters or criteria, including coding for level of education (primary, secondary, high school, college, postgraduate), as indicated in several reviews (e.g. Shehata et al., 2023; Bremner et al., 2022; Khaldi et al., 2023). Qualitative research using a coding scheme focuses on the analysis of qualitative data; researchers use a coding scheme to identify key themes, concepts, and categories in the collected data.

After collecting the sources, the content is analyzed and the information from different sources is synthesized to identify common trends and patterns in the chosen field. The literature review method can also include a critical evaluation of the selected sources to determine their credibility, reliability, and relevance.

In this study, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021) methodology for systematic reviews was adopted to ensure a transparent process of developing the search strategy, defining inclusion criteria, and identifying relevant publications. Then, the AMSTAR 2 (Shea, 2017) critical appraisal strategy was applied to assess the quality of the publications.

**The protocol** for a systematic literature review on student-centered approach and modern distance learning technologies, based on the PRISMA methodology and AMSTAR 2 critical appraisal strategy, includes the following steps:

- Defining the research question and developing a publication search strategy in databases, considering existing systematic reviews and meta-analyses.

- Assessing the quality and relevance of publications based on pre-established inclusion and exclusion criteria.
- Extracting data from selected publications and conducting a qualitative synthesis of the obtained results.
- Evaluating the quality of the data using the AMSTAR 2 critical appraisal strategy and preparing a corresponding quality assessment report.

### **The search strategy**

In our systematic search strategy, we utilized the most relevant terms and synonyms that encompass the key concepts of this study, which were identified based on previous systematic reviews.

We define scientific data as the obtained factual material, generally accepted in the study of distance learning problems and which, due to its data quality, makes it possible to validate them, as well as reproduce research. For study reproducibility, the full search string can be specified. Example of search and substring strings used (search/substring//substring): “student centered approach”/“student centered approach definition”/“student centered approach meaning”; “modern technologies in distance learning”/“latest technology in online learning”/“emerging technologies in distance education”; “online learning”/“online education”/“online teaching”; “virtual learning”/“virtual learning environment”/“virtual education”; “e-learning”/“e-learning platform”/“e-learning in education”, et al.

We conducted an information search on the Internet not only using a short search summary of the document (bibliography), but also the full text. It should be noted that the distinctive feature of such systems is less formalization of the request, simplicity and clarity of the search engine.

Based on their reputation for comprehensive coverage of literature in the field of student-centered approaches to education and feedback research, we chose Web of Science and Scopus as the most relevant databases for our search queries.

### **Inclusion criteria**

During the initial stage of literature review, we applied three main inclusion and exclusion criteria. We included only studies published in English, as the majority of research publications in this field are written in English. We also included publications published from 2012 to 2023. Finally, to ensure the originality, credibility, and quality of the selected publications, we included only peer-reviewed articles published in scientific journals.

During the second stage of screening, we selected only empirical research studies. Conceptual studies were excluded from our analysis.

### **Identification of relevant publications**

During the screening process, a total of 688 articles were identified from the selected databases (Web of Science—187, Scopus—288, other sources—213). After removing 385 duplicates in the first stage of screening, the number of articles was reduced to 303. Subsequently, in the second stage of screening, we analyzed the titles and abstracts

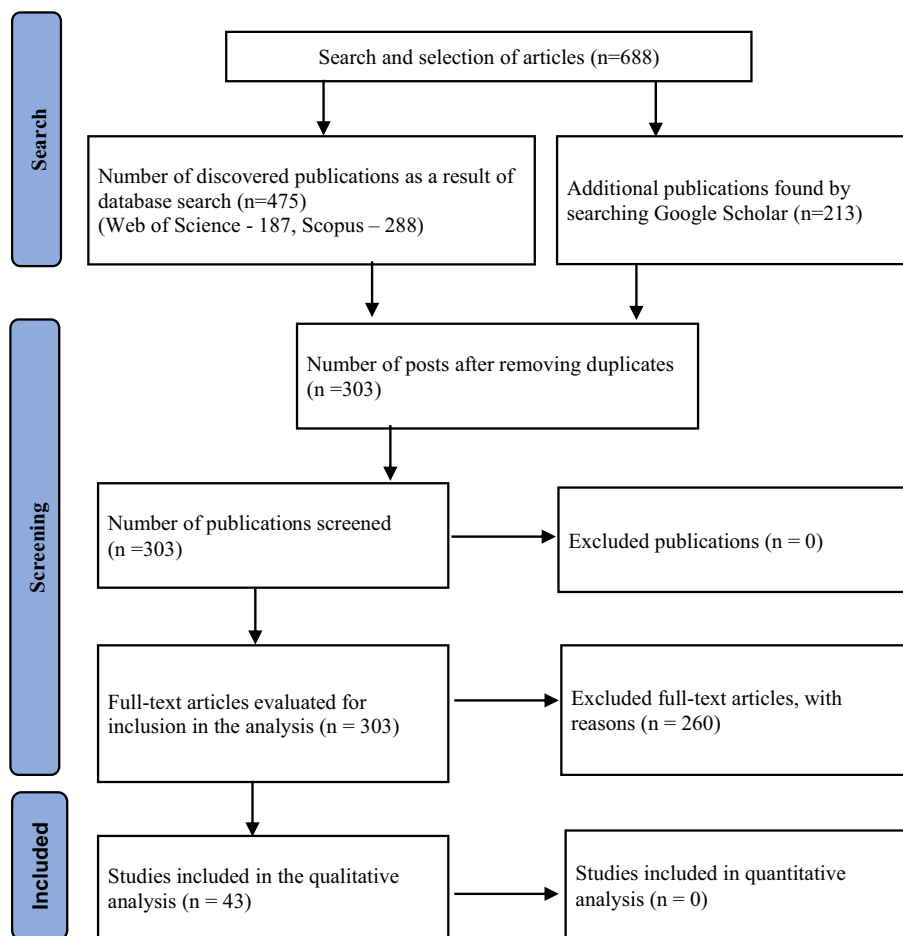
according to our inclusion criteria. Out of these 303 articles, 260 did not meet our criteria and were excluded from further analysis, resulting in a final set of 43 articles. These 43 articles were included in the quality assessment. Figure 3 illustrates the stages of our screening and selection process.

**Quality assessment**

We used the quality assessment criteria proposed by Shea (2017) within the framework of AMSTAR 2. These criteria are based on a study conducted to assess the quality of both quantitative and qualitative research. The quality assessment criteria were evaluated at four levels: high, moderate, low, and critically low.

The results of the quality assessment of the 43 systematic reviews conducted using the AMSTAR tool are provided in Additional file 1: Appendix 1. Among them, 10 were assessed as low quality (AMSTAR score 0–6), 19 as moderate quality (7–11 points), and 10 as high quality (12–16 points). It is worth noting that no conflicts of interest were identified in any of the included studies or the systematic reviews.

The Table 2 presents the main materials and methods used in the student-centered approach to online learning. Each column corresponds to a specific aspect of this



**Fig. 3** Flowchart of the process of identification and selection of studies in accordance with the PRISMA guidelines

**Table 2** Main materials and methods in a student-centered approach to online learning

Materials and methods	Description
Personalized content	Educational materials, including text, videos, and audios, adapted to individual students' needs and learning styles
Interactive lessons	Engaging and interactive lessons offered to students, such as quizzes, simulations, and games
Flexible schedule	Students are provided with the opportunity to learn at their own pace and on their own schedule
Collaborative learning	Students are encouraged to collaborate and communicate with other learners through online forums, discussion boards, and other interactive tools
Continuous assessment	Regular assessments and feedback provided to students to track progress and identify areas for improvement
Adaptive technology	Use of artificial intelligence and machine learning algorithms to personalize the learning process
Gamification	Incorporation of gaming elements into the educational process to enhance motivation and engagement of students
Multimodal learning	Utilization of various formats and delivery methods to cater to different learning styles
Mobile accessibility	Provision of access to educational materials and lessons on mobile devices for convenience and accessibility
Resource access	Provision of access to tutors, consultants, and other resources to support students' learning and success

approach, and the rows represent various methods and materials used to achieve personalized and engaging learning. The table includes the following categories: "Personalized Content," "Interactive Lessons," "Flexible Schedule," "Collaborative Learning," and "Continuous Assessment." This table provides a summary and systematic organization of information about the methods that help create a more effective and individually oriented educational environment for students.

These materials and methods contribute to the creation of online learning that is learner-centered, flexible, engaging, and effective. By employing a student-centered approach, online learning can become a valuable tool for students to acquire new skills and knowledge and fully unleash their potential.

## Results

The systematic literature review revealed that the student-centered approach and modern technologies play a significant role in distance learning. Numerous studies confirm that the student-centered approach promotes active student engagement in the learning process and enhances their motivation to learn. It also contributes to the development of self-regulated learning and critical thinking skills among students.

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. The report by Grammens et al. (2022) presents a systematic review of the roles and competencies of teachers in synchronous online learning using video conferencing technologies. Ashiru et al. (2022) presented a student-centered approach to studying the choice of business education programs at the university level. A study by Muller and Mildemberger (2021) provides a systematic review of blended learning in higher education, aimed at providing flexible

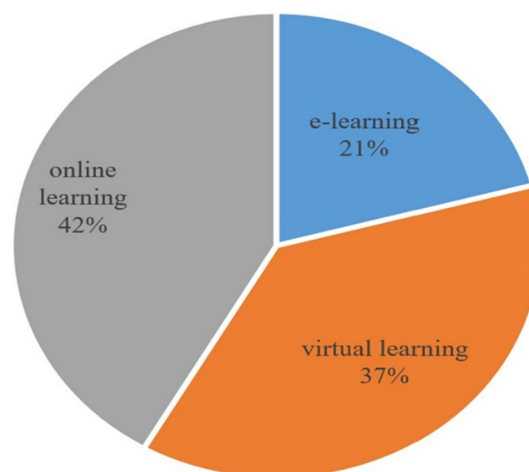
learning by replacing some face-to-face time with online environments. Lastly, Bremner et al. (2022) research presents a systematic review of the outcomes of student-centered pedagogy. These works contribute to understanding the effectiveness and benefits of SCL in various educational contexts.

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 Fig. 4, 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.

In recent years, numerous studies have been conducted on the use of virtual educational tools and technologies. For example, Kerimbayev (2016) research explores the possibilities and implementation of virtual learning, providing insights into its advantages, challenges, and significance in modern education. The study contributes to a better understanding of virtual learning environments and their impact on teaching and learning processes. Radianti et al. (2020) contribute to understanding virtual educational environments and their application in various areas of learning and education. These studies deepen our understanding of virtual educational environments and their influence on teaching and learning processes in different fields of education.

Aull (2020) examines student-centered assessment and feedback on written assignments in the online environment. Cavalcanti et al. (2021) conduct a systematic review of automatic feedback in the online learning environment.

There are also studies addressing artificial intelligence and its application in online education, such as the research 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). The study by Juliantara et al. (2022) focuses on student-related factors in online learning.



**Fig. 4** Frequency of use of various forms of education

Saleem et al. (2022) provides a literature review on the application of gamification in e-learning. Giannakos et al. (2022) conduct a systematic literature review, exploring the potential of e-learning to enhance organizational learning.

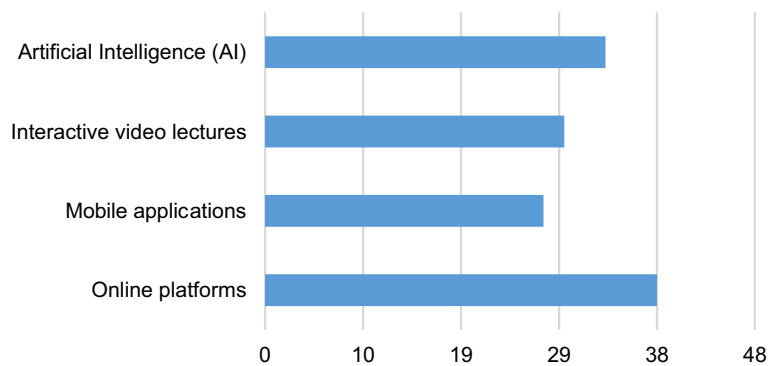
The overall trend in these studies indicates the importance of a student-centered approach, the use of various technologies and tools, as well as the development of students’ skills and competencies in online learning. They also emphasize the significance of feedback, collaboration, and flexibility in the online environment.

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.

In relation to the use of modern technologies in distance learning, research also highlights the importance of developing information and communication skills among students. It has been shown that the use of technologies can contribute to the development of collaborative learning, online processing, and other forms of active interaction among students. Online learning also enables students to receive feedback and support from their teachers and peers.

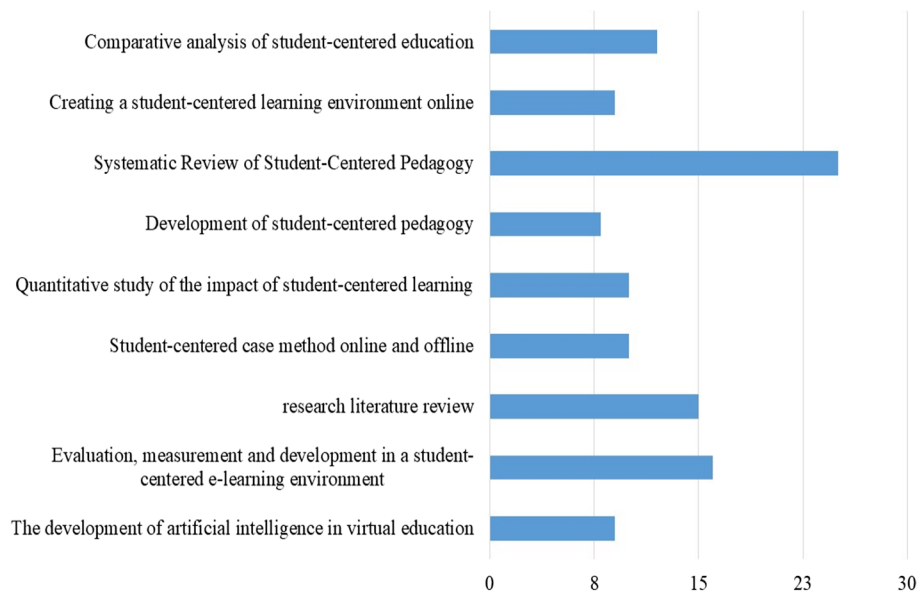
The presented diagram is the result of a synthesis of literature analysis, based on the analysis of a number of studies conducted in the field of distance education, taking into account the use of modern technological solutions (Fig. 5). This literature review provides a quantitative assessment of academic work on each of the identified technologies and provides valuable insight into the direction and scope of research in the field.

The learner-centered approach to education has been investigated by several researchers, and the results of these studies show that such an approach can take various forms and be individually determined. Furthermore, significant differences in the key findings of these studies have been identified. Kang and Keinonen (2018) examine the influence of different learner-centered approaches on students’ interest and achievements in the field of science, emphasizing their positive impact on the learning process. Zhang et al. (2021) explore factors related to the implementation of learner-centered teaching methods, revealing the challenges and difficulties faced by educators. However, overall, the learner-centered approach is considered more effective and appropriate in informal learning settings as it allows students to develop their skills and knowledge, taking into account their individual needs and interests.

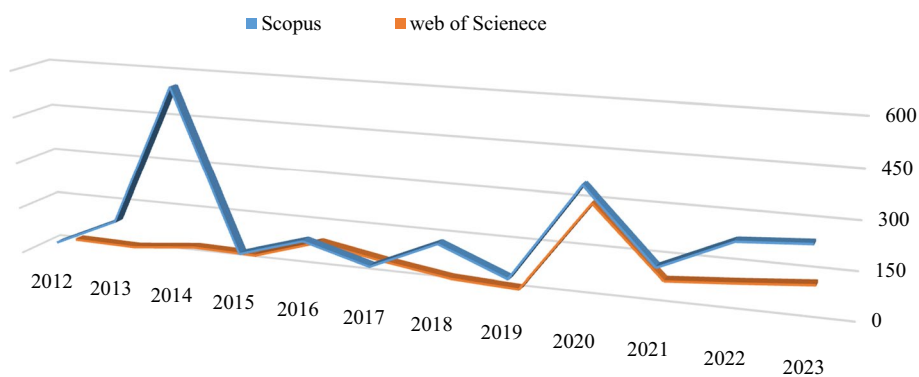


**Fig. 5** Analysis of the number of studies in the field of modern technologies in distance education





**Fig. 6** Methodology and amount of research in education



**Fig. 7** Publications in Scopus and Web of Science by years (2012–2023)

The diagram represents various student-centered methodologies related to education and indicates the number of studies conducted in each of these methodologies (Fig. 6). The types of methodologies include the development of artificial intelligence in virtual education, assessment and development in student-oriented e-learning environments, literature review studies, student-centered case method in online and offline modes, quantitative research on the impact of SCL, development of learner-centered pedagogy, systematic review of student-centered pedagogy, and the creation of a student-centered online learning environment.

From the presented data, it can be observed that the number of publications indexed in the Scopus and Web of Science databases is unevenly distributed across years (Fig. 7). In 2012, Scopus registered more articles than Web of Science. In the subsequent years, the situation changed, and in 2014, Scopus registered significantly more articles than Web of Science. In 2020, the number of publications in both databases was substantial, but Scopus still surpasses Web of Science. Overall, it can be

concluded that the number of publications in Scopus and Web of Science is unstable and can vary from year to year.

However, the systematic literature review also identified some challenges and limitations associated with the implementation of student-centered approaches and modern technologies in distance learning. Some studies highlight the need for more effective training of teachers in technology use and the application of student-centered approaches. It is also noted that individual needs and differences of students should be taken into account when designing and implementing educational programs.

Overall, the systematic literature review confirms the significance of student-centered approaches and modern technologies in distance learning. It emphasizes their positive impact on student engagement, the development of self-regulation and critical thinking skills, as well as the creation of conditions for more flexible and personalized education. However, for the effective implementation of these approaches and technologies, further work is required in terms of teacher training, program adaptation, and providing support to students in the online learning environment.

Thus, the findings of the systematic literature review confirm that student-centered approaches and modern technologies play an important role in distance learning. They contribute to active student participation, educational individualization, and the development of necessary skills. However, further work is needed for the effective implementation of these approaches and technologies in educational practice.

The results of the study confirmed that there is considerable experience in the field of distance learning in applying a student-centered approach. Modern technologies such as interactive platforms, adaptive learning systems and virtual reality are closely related to this approach. The advantages of introducing a student-centered approach and modern technologies are the individualization of learning, improved interaction and accessibility of education. However, limitations include the need for access to technology and the difficulty of adapting traditional models to a remote format. For effective implementation, it is recommended to ensure the availability of technology, integrate a student-centered approach, organize interaction and support for students, and conduct ongoing research on the effectiveness of implementation.

## Discussion

This section discusses the relationship between the student-centered approach and the use of modern technologies in distance learning based on the conducted systematic literature review. It assesses the advantages and challenges associated with implementing such an approach in the context of distance learning and discusses the prospects for its development and recommendations for practice.

In this study, various works related to the topic of student-centered approaches and modern technologies in distance learning were examined. The study by Wang and Zhang (2019) explores the relationship between the student-centered approach, deep learning, and self-assessment of skill improvement among higher education students in China. The work by Xie et al. (2020) and Yin et al. (2021) examines motivation, engagement, and academic achievement of students in the context of an inquiry-based approach. Chen and Tsai (2021) delve into the utilization of mobile technologies in education and teachers' perceptions of this approach. Brouwer et al. (2019) explore interaction and a sense

of belonging within learning environments that prioritize learners. Cheng and Ding (2021) make a comparison between the behavior and motivation of Chinese teachers and students in this educational context. Al-Balushi et al. (2020) examine teachers' and their supervisors' perceptions of student-centered classrooms and the learning process. Overall, these works enrich our understanding of the impact of the student-centered approach and the use of modern technologies in distance learning on student motivation, interaction, and achievement.

In addition to the previous works, the following studies related to the topic of student-centered approaches in education have also been explored. Polly et al. (2015) examine the relationship between teacher professional development, their outcomes, and student achievement using a mathematics program for elementary school teachers as an example. Marioara (2015) discusses the changes in education associated with the implementation of a student-centered approach. The work by Rich (2021) investigates teacher agency when using mathematical instructional programs and their impact on SCL. Haber-Curran and Tillapaugh (2015) examine transformative learning with an emphasis on a student-centered approach in leadership education. Frambach et al. (2014) study student behavior in discussions in student-centered education across different cultures. Baeten et al. (2013) explore student-centered teaching methods and their impact on students' approaches to learning in higher professional education. Adam et al. (2017) conduct a systematic review of self-regulated learning and online learning. Aytac and Kula (2020) perform a meta-analysis of studies on the impact of student-centered approaches on the development of students' creative thinking. Finally, Metsälä and Törnroos (2021) conduct a literature review on the benefits and effectiveness of student-centered strategies in healthcare education. These works provide additional scientific evidence for the significance of the student-centered approach in modern education and its impact on student learning and development.

Baeten et al. (2010) examine the use of SCL environments to stimulate deep approaches to learning. Bower and Hedberg (2010) conduct a quantitative multimodal analysis of teaching and learning discourse in a web-conferencing environment and assess the effectiveness of student-centered learning-based designs. Hew and Cheung (2014) investigate the motivation and issues faced by students and instructors in Massive Open Online Courses (MOOCs). Rabin et al. (2019) conduct an empirical study on the antecedents of achievement of student-centered outcomes in MOOCs. Cela et al. (2015) explore social network analytics in e-learning. Chen et al. (2021) conduct a systematic review of technology adoption in online and blended entrepreneurial education. Cinquin et al. (2019) investigate online learning and cognitive impairments. Garcia et al. (2018) conduct a systematic review of self-regulated learning using electronic tools in computer science education. Wong et al. (2015) describe a model for integrating learning management systems, MOOCs, and flipped classrooms in an integrated Moodle learning system. Harris et al. (2013) provide a literature review confirming the significant impact of student-centered schools on learning. Hernández-Velázquez et al. (2021) conduct a systematic review of literature on the relationship between mobile learning and student-centered design. Margot and Kettler (2019) review teachers' perceptions of integration and education in STEM fields. Marín (2022) critically analyzes SCL in higher education during the COVID-19 pandemic. Mousavinasab et al. (2021) conduct a

systematic review of intelligent learning systems, their characteristics, applications, and assessment methods. O'Donnell et al. (2017) present a systematic review of personalized approaches to studying traumatic events. Rukmini et al. (2018) conduct a meta-analysis and systematic literature review on student-centered learning and its relationship with academic achievement and soft skills. Shah and Kumar (2020) present concepts of student-centered learning.

Student-centered teaching strategies are approaches to education that emphasize the needs and interests of students rather than the requirements of the curriculum or the teacher. These strategies take into account individual differences among students, their cultural and social context, and different learning styles. They help students develop critical thinking, self-esteem, and self-regulation (Andersen & Andersen 2017). However, research shows that student-centered teaching strategies may have a negative impact on the academic performance of students from different socioeconomic backgrounds. Therefore, for the effective implementation of 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 successfully meet their educational needs and goals.

### **Advantages**

The advantages of a student-centered approach and the use of modern technologies in distance learning include:

- **Student motivation:** The student-centered approach and modern technologies allow creating interactive and attractive educational environments that stimulate the interest and motivation of students. This promotes active student participation in the learning process.
- **Individualized learning:** Through the use of modern technologies and a student-centered approach, educators can adapt educational materials and methodologies to meet the individual needs and proficiency levels of each student. This allows us to provide personalized support and ensure optimal conditions for the learning and development of each student.
- **Flexibility in learning:** Distance learning with the use of modern technologies allows students to study at their own time and location, providing flexibility in organizing the learning process. This is particularly important for students who have other commitments, such as work or family.
- **Development of digital literacy skills:** The use of modern technologies in distance learning contributes to the development of digital literacy skills among students. They gain experience working with various digital tools and resources, which is crucial for their future professional endeavors.
- **Feedback and assessment:** Modern technologies enable teachers to provide more frequent and precise feedback to students. Automated assessment systems can also be employed, allowing for more objective evaluation of students' knowledge and skills.

The advantages of a student-centered approach and modern technologies in distance learning contribute to more effective and personalized education, meeting students'

needs, and improving learning outcomes. Students engaged in a student-centered educational environment using modern technologies can develop skills in independent work, critical thinking, collaboration, and communication. This helps them better grasp the learning material and apply it in practical contexts.

Due to the individualization of learning and flexibility in organizing the learning process, students can develop their strengths, overcome challenging moments, and achieve better results. Educational materials and assignments can be adapted to their needs and interests, promoting deeper understanding and retention of the material.

Moreover, 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.

Overall, the advantages of a student-centered approach and modern technologies in distance learning include increased motivation, personalized learning, flexibility, development of digital literacy skills, and improved feedback and assessment. These advantages contribute to higher-quality education and better achievement of students' learning goals.

### **Restrictions**

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 works, which is a common challenge in literature reviews. Significant effort is required when constructing search queries and determining keywords to ensure the 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 has its own limitations related to the selected criteria for inclusion. For example, it 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.

Overall, despite the aforementioned limitations, this study provides important findings in the examined research area. To achieve a more comprehensive understanding of the topic and account for the limitations, it is recommended to consider these factors when planning and conducting future research.

### **Recommendation for further research**

Our research has revealed the absence of a widely accepted conceptual framework for the components to consider when developing a student-centered approach and using modern technologies in distance learning. 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. Al-Ansi's (2022) study examines the strengthening of student-centered learning through social e-learning and assessment. Rotar's (2022) work proposes a framework for implementing student support in the online learning cycle. These studies contribute significantly to understanding the effectiveness and applicability of these approaches and technologies in distance learning, offering new ideas and recommendations for future research.

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 considering ethical and confidentiality issues.

Furthermore, 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

This systematic literature review examined the impact of a student-centered approach and modern technologies on distance learning. The analysis of the presented studies allows for the following conclusions.

Firstly, a student-centered approach plays a crucial role in the effectiveness of 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, helps create a learning environment tailored to each student's individual needs.

Secondly, modern technologies play an important role in the development of distance learning. They provide access to educational resources, create interactive and collaborative environments, and enable the use of gamification and virtual reality in education. Tools such as electronic platforms, online communication, cloud technologies, and data analytics facilitate the effective delivery of materials, interaction between students and instructors, and adaptation of the educational process to changing needs.

Lastly, the student-centered approach and modern technologies in distance learning are interconnected and mutually reinforcing. The combination of these approaches allows for the creation of effective and innovative learning environments that promote active and interactive student engagement. They provide flexibility, accessibility, and personalization of learning, which are particularly relevant in the context of distance learning.

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. Therefore,

further research and development in this field will contribute to the continued advancement of distance learning and the provision of quality education for students.

The student-centered approach includes the active involvement of students in the educational process, taking into account their needs and preferences, as well as the development of self-regulation and autonomy skills. It focuses on individualizing learning and supporting students in their educational journey. Modern technologies, in turn, provide a wide range of tools and resources for creating interactive and adaptive educational environments, ensuring accessibility and convenience in learning.

The use of modern technologies such as electronic platforms, virtual classrooms, multimedia materials, and communication tools enables the creation of an effective and flexible educational environment. They enrich learning by making it more interactive and engaging for students. They also facilitate personalized learning, allowing students to choose their own time and pace of learning.

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 aspects.

#### Abbreviations

SCL	Student-centered learning
MOOCs	Massive Open Online Courses
STEM	Science, technology, engineering and mathematics
COVID-19	Corona Virus Disease 2019
LMS	Learning management system
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
AMSTAR	A measurement tool to assess systematic reviews

#### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40561-023-00280-8>.

**Additional file 1: Appendix 1.**

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#### Author contributions

All authors approved the final manuscript.

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#### Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

#### Declarations

##### Ethical approval and consent to participate

Not applicable, because this research does not contain any studies with human participants or animals performed by any of the authors.

##### Consent for publication

Not applicable.

##### Informed consent

No human participants were involved in the scope of this study.

**Competing interests**

The authors declare no conflict of interest.

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