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Identifying Causal and Contextual Factors Affecting the Efficiency of Distance Education

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ABSTRACT

Objective: The primary aim of the current research endeavor was to discern the determinants influencing the efficacy of distance education

Methods: In this investigation, a qualitative methodological approach was employed. The sampling within the qualitative component was executed intentionally through the expert network methodology, wherein 13 individuals contributed to the interview process. To evaluate the variables pertinent to the research, a semi-structured interview format was utilized to examine the factors influencing the assessment of the efficacy of distance education. The agreement coefficient of 0.78 obtained from the interviews signifies a high level of reliability associated with the research instruments employed. The analysis of qualitative data was conducted utilizing open, selective, and theoretical coding techniques.

Results: The conclusive findings of the study, as derived from the interviews, revealed that the determinants influencing the assessment of the efficacy of distance education include: 1) Causal factors (modern technology; perceived ease of use; suitable educational software; qualified instructors; learner motivation and engagement); 2) Contextual factors (legislative frameworks and regulations, adequate technological infrastructure, support mechanisms for distance learning, proficiency in information technology, and the diversity and applicability of educational content).

Conclusions: Findings support the role of contextual and causal factors in the effectiveness of distance learning.

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Introduction

Distance education, as a contemporary educational modality that has emerged in recent decades, has demonstrated the capacity to furnish diverse learning opportunities for a variety of individuals (Clark, 2020). This educational paradigm has evolved into an essential requisite, particularly in contexts where conventional face-to-face educational interactions are unattainable (for instance, during global emergencies such as the COVID-19 pandemic). Nonetheless, the efficacy of this educational approach is contingent upon a constellation of causal and contextual determinants that may serve to either augment or diminish its efficacy and overall quality. Causal determinants encompass the caliber of the instructional content provided, the proficiency of educators in utilizing educational technologies, and the implementation of suitable pedagogical methodologies. Conversely, contextual determinants, such as the accessibility of technological infrastructure, the socio-economic circumstances of the learners, and the prevailing cultural attitudes toward technology usage within society, also exert considerable influence in this domain (Bozkurt & Sharma, 2020).

Empirical investigations indicate that deficiencies in information and communication technology infrastructure, coupled with the unavailability of high-speed internet access for certain segments of the population, represent a significant impediment to the effective implementation of distance education. For instance, in developing nations, a substantial fraction of students lacks access to the requisite digital tools essential for participation in online educational activities, thereby engendering a digital divide (Czerniewicz et al., 2020). Furthermore, the proficiency of both educators and learners in the utilization of educational technologies is regarded as a pivotal causal factor. In numerous instances, educators are unable to convey course content to students effectively due to inadequate training in online pedagogical tools. This inadequacy culminates in diminished engagement and compromised educational quality. In this context, the absence of standardized educational content tailored to the requirements of distance learning is also recognized as a significant barrier (Hodges et al., 2020).

The effectiveness of distance learning in the modern educational landscape has emerged as a paramount concern within the domain of pedagogy. Distance learning denotes the employment of digital technologies and platforms to facilitate knowledge transfer without necessitating the physical presence of students within the educational setting. This instructional method has

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garnered considerable scholarly attention in recent years, particularly amid the COVID-19 pandemic, and has been posited as a viable alternative to sustain the educational process. However, notwithstanding the proliferation of educational technologies and a variety of platforms, the assessment of the effectiveness of distance education remains a contentious issue (Arkorful & Abaidoo, 2015).

The principal concern in this context pertains to the degree to which distance education influences the learning process, the attainment of educational objectives, and the satisfaction of various stakeholders (including students, educators, parents, and educational administrators). Distance education offers notable advantages such as flexibility in terms of time and location, cost reductions, enhanced access to educational opportunities, and the potential for self-directed learning. Conversely, significant challenges persist, including subpar educational quality, insufficient social interaction, infrastructural inadequacies, inequitable access to technology, and diminished motivation to engage in learning (Rasmitadila et al., 2020).

With the progression of technological innovations and the proliferation of digital instruments within educational frameworks, the significance of distance education as an emergent pedagogical approach has garnered attention. Although the integration of information technology within educational institutions and public sectors is extensively documented, the phenomenon of distance education within the higher education landscape, particularly in Iranian universities, has been relatively underexplored. Detrimental factors such as inadequate infrastructural support, the lack of standardized evaluative measures, and insufficient alignment between technological capabilities and educational requisites are among the elements that have compromised the efficacy of this educational modality. Notably, in nations like Iran, infrastructural deficiencies coupled with socio-economic disparities in access to technological resources exacerbate the challenges confronting the effectiveness of distance education. Learners residing in marginalized areas or those lacking access to suitable digital apparatus are particularly disadvantaged by this educational format. A study published in the Journal of Educational Technology Research and Development indicates that the efficacy of distance education is closely linked to the degree of learner engagement and the caliber of educational content (Kirkwood & Price, 2014).

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The evolution of distance education assessment was instigated as a strategic response to the difficulties associated with providing conventional or face-to-face education to certain demographics. Distance education permeates all educational strata, from primary education to tertiary institutions, encompassing general education, vocational training, and ongoing professional development, with its significance escalating, partially in response to societal demands and partially due to the augmentation of technological (communication) advancements (Wolf, 2009). The origins of the distance education system can be traced to the deficiencies inherent in the traditional educational paradigm, as the regulatory frameworks of the conventional system obstructed numerous capable individuals from gaining admission to universities, thereby depriving them of the opportunity for lifelong learning. A significant proportion of these individuals were either employed, resided in remote locales, or faced physical disabilities that precluded attendance at traditional universities. Furthermore, there existed other learners who, prompted by advancements in scientific knowledge and technology, required participation in updated training programs due to the obsolescence of their prior specializations. These dynamics, in conjunction with the latent political influence of students, the advent of novel communication technologies, and various factors such as technological progression, demographic expansion, economic challenges, and geographical dispersion in certain nations, have spurred a burgeoning demand for enhanced educational opportunities and the aspiration of individuals to engage in self-directed learning and elevate educational quality, culminating in the establishment of a supplementary educational framework alongside traditional face-to-face instruction, designated as distance education (Rahmati et al., 2024). In conjunction with the accelerated advancement of technology, significant transformations have transpired within the higher education system, akin to numerous other sectors. The evolution of computer technologies and the rapid dissemination of information via the Internet have commenced at an unprecedented pace. Pertaining to the contemporary educational framework, it has become evident that a multitude of technologies ought to be employed, and furthermore, these technologies should serve to augment the educational experience. The velocity of knowledge generation and consumption has liberated learning from the constraints of fixed temporal and spatial parameters, thereby facilitating the possibility of learning at any given moment and in any location. With the continual progression of technology, this phenomenon has become increasingly pervasive, and in alignment with emerging exigencies,

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the construct of distance education has materialized, which offers equity for individuals residing in diverse geographical contexts and conditions while affording flexibility regarding space and time (Biçer, 2019).

Distance education denotes the pedagogical process wherein the instructor and the learner are not co-located, with their interaction mediated through communication and information technologies (Bahrami & Rashidi, 2024). This educational modality enables learners to access educational resources and learning materials devoid of spatial and temporal constraints (International Distance Education Association, 2021). Distance education constitutes a pedagogical approach in which learning transpires autonomously and without the physical co-presence of the instructor and the learner within the educational setting. This methodology employs a variety of tools and technologies, including online platforms, videoconferencing, and multimedia resources, to enhance the educational experience (Barani et al., 2024). Distance education embodies a pedagogical paradigm in which the instructor and learner are temporally and spatially distinct, with their interaction predominantly occurring via electronic media such as the Internet and contemporary communication technologies. This form of education is particularly advantageous for individuals lacking the opportunity to engage in face-to-face educational experiences (Ashouri Nalkiashari, 2022). Distance education represents a pedagogical framework wherein students and educators engage through technological and communication modalities, including the Internet, email, videoconferencing, and educational software, thereby eliminating the necessity for their physical presence in a designated educational setting. Gagne (1992) articulates distance education as follow: Distance education is a process wherein educational materials and resources are conveyed to students or learners utilizing various technologies, facilitating learning in a self-directed manner absent the direct presence of an instructor. This educational approach affords the learner increased autonomy and flexibility.

The efficacy of distance education, as delineated in various definitions, underscores the enhancement of learning quality, the utilization of novel technologies, the augmentation of interaction, and the promotion of equitable access. This efficacy is contingent upon multiple factors, including the technological infrastructure, the quality of content, and the digital competencies of individuals. Enhancing these factors can significantly augment the effectiveness of this emergent educational methodology.

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Causal and contextual elements influencing the efficacy of distance education can be examined through the lens of learning theories and educational technology frameworks. According to systems theory and Moore's theory of educational interactions, the efficacy of distance education is contingent upon the robust interaction among the learner, instructor, and educational content (Allen et al., 2004). Causal determinants, including the caliber of educational material, the robustness of information technology infrastructure, as well as the digital competencies of both educators and learners, alongside contextual determinants such as the economic, social, and cultural milieu of the learners, can profoundly impact the distance education experience.

Prior investigations, such as the research conducted by Kudin et al. (2023) established that non-interactive and unidirectional content diminishes learner motivation and engagement. These results unequivocally demonstrate that causal factors, such as enhancing content quality and incorporating interactive technologies, in conjunction with contextual factors, such as augmenting access to infrastructure and prioritizing educational equity, can substantially elevate the efficacy of distance education. In a study conducted by Hassani et al. (2022), the variance in effectiveness between online and face-to-face learning was scrutinized, revealing that under specific circumstances, online learning may yield superior outcomes compared to traditional face-to-face learning modalities. Consequently, it is imperative to meticulously scrutinize and evaluate the efficacy of distance education, discern the advantages and disadvantages of this pedagogical approach, and propose strategies for its enhancement. To fulfill this objective, it is essential to assess the determinants influencing the quality of distance learning to establish an equitable and conducive environment for all learners. In light of the aforementioned considerations, the focal point of this research is: What factors influence the effectiveness of distance education?

Research questions

What are the principal categories of distance education effectiveness?

What causal factors influence the efficacy of distance education?

What foundational conditions impact the efficiency of distance education?

Material and Methods

In this study, a qualitative method was used. The study population pertinent to this investigation encompasses faculty members and subject matter experts possessing a scientific or research-

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oriented background pertinent to distance education. Such backgrounds may entail the execution of research projects, the authorship or translation of scholarly texts, and the dissemination of scientific articles within this domain. The primary criterion for the selection of these individuals rests upon their relevant scientific and practical experience, as well as their expertise in the realm of distance education. It is imperative to acknowledge that the participants were not predetermined; rather, they were discerned throughout the research process. The methodology of theoretical sampling was employed for the selection of samples. This approach facilitates the dynamic selection of samples concurrently with the advancement of the research. Theoretical sampling is conducted in response to the necessity for new information and the completion of the theoretical framework of the investigation, thereby ensuring that the selection of participants aids in elucidating the connections between concepts and fortifying the research theories. In this methodological process, experts possessing direct experience and knowledge in the field of distance education were initially selected, followed by continued sampling aimed at achieving theoretical saturation. The determination of the participant count was grounded in the principle of theoretical saturation. In accordance with this principle, the sampling and data collection process was concluded when subsequent interviews yielded no new information for the research and merely reiterated previously established concepts, ultimately resulting in the selection of 13 individuals as the sample.

Instruments

In this inquiry, semi-structured interviews served as the principal instrument for data collection. Semi-structured interviews comprise a series of predetermined inquiries that afford the requisite flexibility to comprehensively explore the perspectives and experiences of the interviewees. This format of interview enables the researcher to adhere to the overarching framework while, when warranted, posing new and probing questions to procure rich and pertinent data. The amassed data were meticulously analyzed via grounded theory methodology. The data analysis process was delineated into three principal stages: 1. Open coding: During this phase, initial concepts are extracted from the data corpus. 2. Axial coding: The identified concepts are systematically organized into primary and secondary categories, along with the identification of their components. 3. Selective coding: The central category (main phenomenon) is selected, and its interrelations with other categories (causal conditions, contextual factors, intervening conditions,

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strategies, and outcomes) are scrutinized. The aim of data analysis was to achieve a paradigmatic model elucidating the relationships among concepts and categories, ultimately culminating in the articulation of the primary phenomenon of the research, namely the efficacy of distance education. This methodological approach facilitated the construction of a theory grounded in data through a meticulous examination of the interviews and the critical rejection of the researcher's assumptions. The data analysis was executed in accordance with a systematic design of grounded theory. The analytical process comprised three stages of coding: Open coding: Extracting foundational concepts from the raw data. Axial coding: Structuring the identified concepts into primary and secondary categories. Selective coding: Identifying the axial category and examining its associations with other categories (causal conditions, contextual factors). The MAXQDA software was employed to streamline the qualitative data analysis process.

Results

The population of this study included faculty members and experts in the field of distance education efficiency. Of the total participants, 8 were assistant professors, 3 were associate professors, and 2 were professors. In terms of gender distribution, the findings showed that 69.2 percent of the interviewees were male and 30.8 percent were female. Analysis of the data from the interviews at different stages of coding led to the extraction of 147 primary codes and 12 subcategories. These categories provided a basis for explaining the main phenomenon of the study, namely distance education efficiency, and presenting a coherent theoretical model.

Causal factors

Table 1. Codes identified from interviews with experts (causal conditions affecting distance education efficiency)

Interview code	Initial codes identified
I-1	Acceptance of changes; Ability of teachers to work with technology; Ability of teachers to control students; Effective attendance; Motivational factors; Positive evaluation of the distance learning environment; Self-regulation; Collaborative learning opportunities; Goal achievement; Time management; Independence
I-2	Saving energy and time; Net and servers; Providing students with suitable conditions for the virtual classroom
I-3	Previous knowledge of learners about distance learning; Relative familiarity with the subject; Suitable space and location; Current conditions (Corona)
I-4	Problems related to classroom attendance; Corona disease; Internet and servers; No problem with servers; Changes in lifestyle
I-5	Sufficient awareness of this method and educational content; Illness; Physical problems; Remoteness of the location; Sufficient awareness of the tool
I-6	Environment; Technical facilities; Academic level of the instructor; Relevance of the instructor's academic degree; Learner readiness; Ability to work with related software and hardware; Appropriate Internet platform

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I-7	Corona disease; Creating and improving software platforms; Hardware platforms; Availability of sufficient educational resources; Efficient instructors; Developing standardized tests
I-8	Teacher's desire and interest; Motivating learners; Having ideal educational tools; Corona disease
I-9	Creating a suitable electronic platform; High-speed internet; Computer systems; Suitable software; On-time attendance of students
I-10	Preparing educational infrastructure; Availability of servers; Suitable internet; Availability of sufficient facilities for use by teachers and students
I-11	Providing the possibility of continuing education in all parts of the country; Increasing the admission capacity of universities; Training a part of the community's expert forces
I-12	High-speed internet; Suitable servers; Correct and accessible communication platform; User-friendliness; Easy-to-use
I-13	Increasing extensive services; Keeping up with the world's technology; Using equipped applications; Easy-to-use software used

In relation to the first research question, six factors were identified. Therefore, in response to the first research question, using the results of semi-structured interviews during three coding stages and inspired by the theoretical and empirical literature on the subject, the identified codes have been categorized into 6 subcategories. The six categories are: modern technology, perceived ease, appropriate educational software, qualified instructor, motivation and interest of learners, and new living conditions.

Table 2. Classification of identified codes into subcategories (causal factors)

Selective codes	Open codes
Modern technology	Ability of teachers to work with technology; Internet and servers; Net and servers; Creating a suitable electronic platform; High-speed internet; Computer systems; Existence of servers; Suitable internet; High-speed internet; Keeping up with the world's technology
Perceived ease	Previous knowledge of learners about distance learning; Sufficient awareness of this method and educational content; User-friendliness; Easy-to-use; Increasing extensive services
Appropriate educational software	Appropriate software, technical facilities; Creating and improving software platforms; Hardware platforms; Preparing educational infrastructures; Using equipped applications; Easy use of the software used
Qualified teachers	Ability of teachers to control students; Effective attendance and absence of the teacher's academic level; Relevance of the teacher's academic degree; Efficient teachers
Learner motivation and interest	Learner readiness; Teacher's desire and interest; Motivating learners; On-time attendance of students; Motivational factors; Positive evaluation of the distance learning environment; Self-regulation; Cooperative learning opportunities; Goal achievement; Time management; Independence
New living conditions	Acceptance of changes; Providing students with suitable conditions for the virtual classroom; Current conditions (Corona); Corona disease; Changes in the way and way of life; Corona disease; disease; physical problems

Modern technology: Advanced technology is considered one of the most important pillars of distance learning efficiency. Access to modern equipment and technologies such as high-speed internet, online learning systems (LMS), advanced communication tools, and digital devices play a key role in facilitating the learning process. Modern technologies provide the possibility of providing interactive and multimedia content that can improve the quality of learning. Also,

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technological innovations such as virtual reality and artificial intelligence provide opportunities to simulate educational situations and create deeper and more engaging learning. In the absence of appropriate technology, many learners experience problems such as reduced engagement and motivation.

One of the participants in this study stated: "*The emergence and spread of new educational technologies and adaptation to advanced global technologies, along with the provision of extensive and diverse services at different times for all learners, play a key role in improving the quality of distance education. The use of advanced and widely used applications with capabilities that allow learners to access in any situation and situation can effectively increase the effectiveness of this educational method*" (Interview No. 13).

Perceived ease: Learners' perception of the ease of using distance education tools has a direct impact on their participation and productivity. Learners are more likely to use this method when they feel that educational systems are easy to use and do not have technical complexity. Systems that have a user-friendly and simple design can increase user satisfaction. Conversely, technical complexity or the lack of proper guidance may reduce learner interest or confusion and significantly affect the effectiveness of this educational method.

One participant (interviewee number 3) pointed out the importance of communication infrastructure in improving the effectiveness of distance education and stated: "*The presence of appropriate facilities such as high-speed internet, powerful servers, reliable and accessible communication platforms, user-friendly design of educational systems and the ease of use of these tools are key factors affecting the success of this educational method. Also, the individual circumstances of students, including access to technological tools, play a significant role in increasing the effectiveness of distance education.*"

Appropriate educational software: The availability of efficient and quality educational software is another key factor in the effectiveness of distance education. This software should have features such as interactivity, online assessment facilities, multimedia tools, and easy access to content. Appropriate educational software allows teachers to present course content in creative and diverse ways and allows learners to learn at their own pace. Poor or ineffective software disrupts the learning process and may cause distrust in distance education systems.

Another participant (No. 9) emphasized the need to create appropriate infrastructure in critical situations and stated: "*Given conditions such as the pandemic that has doubled the need for distance education, the existence of electronic platforms such as high-speed internet, advanced computer systems,*

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and application software is essential for all users, including teachers and students. Providing this infrastructure will enable a more effective move towards a wider use of this type of education."

Qualified teachers: The teacher's academic competence and digital skills are important factors in the success of distance education. In addition to specialized knowledge, teachers must have the ability to use technology tools and manage virtual classrooms. They must be able to present educational content in an attractive and understandable way and use creative strategies to interact with students. The lack of qualified teachers can lead to a decrease in the quality of education and a decrease in the motivation of learners, since a large part of the success in this type of education depends on the ability to effectively convey concepts.

One of the participants (No. 1) pointed out the need for infrastructure readiness and technological capabilities and stated: "*Given the developments of the last two years and the increasing changes that may affect the conditions of education, it is necessary to make fundamental changes in methods to continue education. These changes require the provision of appropriate infrastructure. Also, teachers should have the ability to use technology in the teaching process, such as controlling students, monitoring real-time attendance, and managing virtual classes. These capabilities significantly affect the effectiveness of distance learning*.

Learner motivation and interest: Intrinsic motivation and interest of learners are among the psychological factors that affect the effectiveness of distance learning. Learners who are sufficiently motivated to participate in the learning process usually show greater commitment to completing assignments and participating in classes. However, the lack of face-to-face interactions and the social environment of traditional classes may reduce motivation and feelings of isolation. Designing engaging content, providing continuous feedback, and creating interactive opportunities can help maintain learner motivation.

Another participant (No. 8) pointed out the importance of motivation and two-way interaction between teachers and students, saying: "*Education will be truly effective when both parties, the teacher and the learner, are willing to play their roles. If the student is not motivated to learn, even the best efforts of the teacher and the use of advanced tools cannot lead to the desired results. In ideal conditions, the right educational tools can create significant efficiency, but these tools are only effective if they are accompanied by motivation and effort from both parties*."

New living conditions: Modern living conditions, including changing lifestyles due to social and economic developments or crises such as the Covid-19 pandemic, have had a profound impact on

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distance learning. These conditions have led many people to turn to virtual learning. The flexibility of time and place of distance learning allows individuals to balance work, family and learning commitments. However, the pressures arising from these conditions, such as limited access to technology or the lack of a suitable learning environment, can negatively affect the quality of education.

One of the participants (No. 4), referring to the role of social conditions and changes caused by crises, stated: "*The developments and conditions that arise in different periods, such as the Corona pandemic, inevitably affect educational methods. These changes require a review of educational approaches and the use of new tools and methods of distance education. Problems such as the inability to hold face-to-face classes prioritize the need to pay attention to flexibility and the use of technology*."

Contextual factors

Table 3. Codes identified from interviews with experts (Contextual conditions affecting the effectiveness of distance education)

Interview code	Initial codes identified
I-1	Employment of the individual; Sufficient time; Organizational structure; University support for distance learning; Administrative assistance; Social interaction with students;
I-2	High costs; Appropriate teaching time; Content; Institutional support
I-3	Sufficient presentation time; Sufficient presentation duration; Sufficient and attractive content; Effective and useful communication with the recipient of knowledge; Sufficient time; Internet speed; Library services; Laboratory; Computer facilities
I-4	Corona disease; Environmental support; Financial support for the distance learning system; Appropriate technological infrastructure; Supporting laws and regulations; Support provided to students; Supporting techniques and media; Providing a reliable source for providing education
I-5	Servers; Appropriate net; Professors' skills in working with computers and the Internet; Students' skills in using computers and the Internet; Developing communication using email; Ability to search for appropriate information on the Internet
I-6	High-speed Internet; Accurate technical follow-up by the university; Availability of necessary facilities for students and professors; Supportive learning environment; Appropriate support strategies; Support provided to students
I-7	Creating learning motivation in learning and teaching; More comfortable conditions for virtual education; Preventing in-person travel and wasting time; 24-hour availability of virtual education
I-8	Corona disease; Access to the necessary software for the development of distance education; Access to the necessary hardware; Access to high-speed internet; Possession of computer systems; Access to Internet service providers; Support of faculty members for distance education; Guidance of students in all situations; Help in solving communication issues
I-9	Organizational structure; laws and regulations; organizational policies; organizational culture; economic, political and social conditions; rewards; creating favorable working conditions
I-10	Internet; multimedia disks; users' awareness of different types of systems; correct selection and proper use of the system; diversity of these systems; messengers; spending a lot of time and effort by instructors
I-11	Illness; problems with employee attendance; availability of educational facilities; increasing needs of society; providing lifelong education
I-12	Students' information and knowledge about using the Internet platform; proper support; availability of educational resources; Internet speed; having a suitable system
I-13	The existence of a suitable administrative system; the existence of legal frameworks; government support; norms; dos and don'ts

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In relation to the second research question, six factors were identified. Therefore, in response to the third research question, using the results of semi-structured interviews during three coding stages and also inspired by the theoretical and empirical literature on the subject, the identified codes were categorized into six subcategories. The six categories are: laws and regulations, appropriate technology infrastructure, support for distance education, ability to work with information technology, time management, and diversity and applicability of content.

Table 4. Classification of identified codes into subcategories (contextual factors)

Selective codes	Open codes
Laws and regulations	Rules and regulations; Organizational rules and policies; Rules and regulations; Overhead rules; Legal factors; Rules and regulations; Rules and regulations; Organizational rules and regulations; Rules and regulations governing the organization
Appropriate technology infrastructure	Internet speed; Servers; Appropriate net; Appropriate technology infrastructure; High-speed Internet; Access to necessary software for the development of distance education; Access to necessary hardware; Access to high-speed Internet; Possession of computer systems; Access to Internet service providers; Internet; Students' information and knowledge about using the Internet platform; Internet speed; Having an appropriate system
Support for distance learning	Environmental support; Detailed technical follow-up by the university; Financial support for the distance education system; Proper support; Government support; University support for distance education; Administrative assistance; Social interaction with students; Institutional support; Support provided to students; Supporting techniques and media; Providing a reliable source for providing education; Supportive learning environment; Appropriate support strategies; Support provided to students; Support from faculty members for distance education; Guiding students in all situations; Library and laboratory services
Ability to work with information technology	Professors' skills in working with computers and the Internet; Students' skills in using computers and the Internet; Computer facilities; Development of communications using email; Ability to search for appropriate information on the Internet; Users' awareness of different types of systems; Correct selection and proper use of the system
Time management	Sufficient time; Appropriateness of teaching time; Sufficient presentation time; Sufficient time; More comfortable conditions for virtual education; Prevention of non-face-to-face traffic and waste of time; 24-hour availability of virtual education; Spending a lot of time and effort by instructors
Variety and applicability of content	Informing learners about the content of distance education; Appropriate definition of distance education; Sufficient presentation time; Sufficient and attractive content; Effective and useful communication with the recipient of knowledge; Availability of necessary facilities for students and professors; Availability of educational resources; Addressing diverse topics in training

Laws and regulations: The existence of clear and comprehensive laws and regulations to facilitate and support distance education is one of the most important factors affecting the efficiency of this system. These laws should clearly and coherently define educational standards, rights and duties of students and professors, evaluation criteria, and the manner of providing educational services. Also, the development of policies to support learners and education providers can help develop distance education. The lack of clear rules or their inconsistency can lead to confusion and reduce users' trust in this educational method.

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According to the participants, issues such as appropriate organizational structure, constructive organizational culture, formulation of precise organizational regulations and policies, and creation of favorable economic, political, social, and working conditions are key factors in increasing the efficiency of distance education. These factors can greatly help facilitate educational processes and improve productivity (Interviewee No. 9).

Appropriate technological infrastructure: Technological infrastructure, including high-speed internet, powerful educational systems, appropriate hardware, and applicable software, play a fundamental role in the success of distance education. Lack of access to adequate infrastructure can lead to inequality in educational opportunities and reduced learner participation. Also, appropriate infrastructure enables effective interaction between professors and students and ensures easy access to educational content. Access to the necessary technologies is considered one of the most important prerequisites for success in distance education. According to the participants, these infrastructures include the following:

• Access to virtual education development software
• Provision of the required hardware
• Access to high-speed Internet
• Availability of appropriate computer systems
• Access to Internet service providers (Interviewee No. 8).

Support for distance education: The existence of a strong support system for users, including students and professors, is another key factor. This support includes guidance in using technology, resolving technical problems, providing consulting services, and educational support. Effective support can improve the user experience and prevent a decline in the quality of education due to technical problems or lack of familiarity with the system.

Continuous support for distance education is an important factor in increasing the quality of this type of education. Providing high-speed Internet, careful technical follow-up by the university, and providing the necessary facilities for students and professors are among these factors. According to the participants, this type of support facilitates learning conditions and brings the education process closer to the desired goals (Interview No. 6).

Ability to work with information technology: Skills in using information technology are essential for learners and teachers. The ability to work with educational software, manage learning

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systems, and use interactive tools form the foundation of distance education. In the absence of these skills, the efficiency of education decreases and educational gaps deepen. Therefore, teaching digital skills to all users of this system should be a priority.

Skills related to information technology play a significant role in the effectiveness of distance education. These capabilities include the ability of teachers and students to use computers and the Internet, mastery of communication tools such as email, and the ability to search for information on the Internet (Interview No. 6).

Time management: Time management is one of the key factors in the success of learners and teachers in distance education. This educational method, due to its time flexibility, requires careful planning for homework, virtual meetings, and educational interactions. Lack of time management skills can lead to reduced productivity and delays in educational activities. Therefore, training in time management techniques is essential for students and professors.

Diverse and Practical Content: Diverse and practical educational content is one of the essential components in the effectiveness of distance education. Content that uses multimedia tools, interactive activities, and practical examples can make learning more effective and engaging. Also, educational content should be designed in a way that responds to the real needs of students and strengthens the skills required by the labor market. Unattractive or irrelevant content can reduce the motivation and participation of learners.

The attractiveness, diversity, and quality of educational content are key factors in the success of distance education. Appropriate content should have the right timing, sufficient internet speed, appropriate duration, and visual and educational appeal. Establishing effective communication with learners is also of great importance. Participants believe that providing these can provide an effective and satisfying learning environment for students.

Discussion

The conclusive findings of the research, derived from interviews, indicated that the causal determinants influencing the assessment of the efficacy of distance education encompass: (modern technology; perceived ease; suitable educational software; proficient instructor; motivation and engagement of learners); A principal element in the endorsement and utilization of virtual education pertains to the perceived ease experienced by users. Perceived ease denotes that

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educational systems are designed to be straightforward and user-centric, thereby mitigating confusion for both students and educators.

Davis et al. (2021), in a study that corroborates the outcomes of this investigation, established that perceived ease constitutes one of the fundamental prerequisites for the adoption of novel technologies within virtual education. The findings are additionally harmonious with those of Gray and DiLoreto (2016), who demonstrated in their research that the integration of new technologies in virtual education enhances learner engagement with content and augments educational performance. The findings are similarly aligned with the research conducted by Qadir et al. (2024), which indicated that educational software endowed with interactive features enhances learner concentration. Graham (2018), who arrived at congruent conclusions in their research, posited that proficient instructors can elevate the quality of learning in virtual environments by fostering dynamic interactions.

Advanced technology serves as the foundation for distance learning, with tools such as high-speed internet, interactive software, and sophisticated educational platforms facilitating this process. Contemporary technologies, including artificial intelligence and virtual reality, possess the potential to render learning more captivating and foster an enhanced interactive experience for students. For instance, intelligent software can discern the learning requirements of students and deliver personalized content. However, there exist challenges, such as the elevated costs associated with accessing these technologies and the digital divide among various users. Consequently, advanced technology will prove effective only when it is universally and equitably accessible, accompanied by suitable training.

Perceived ease pertains to the manner in which students and educators assess virtual learning systems in regard to their simplicity and user-friendliness. When educational platforms are constructed to be straightforward and comprehensible, they become more accessible, allowing users to leverage their functionalities without necessitating extensive training. This can mitigate technological anxiety and enable learners to concentrate on the educational materials. Conversely, if platforms are intricate or lack adequate guidance, they may engender confusion and diminish student engagement. For instance, a learning platform characterized by a cluttered interface and superfluous options can obstruct the learning process rather than facilitate it. As the fundamental instruments of virtual education, educational software must embody intelligent design and robust

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functionality. Software that incorporates a diverse range of features, such as interactive assessments, live sessions, and learning management systems, can address the multifaceted needs of learners. For example, software that offers high-quality educational video content, real-time evaluations, and collaborative participation affords a comprehensive and effective educational experience. However, excessive intricacy or technical malfunctions within software can impede its effective utilization. Software achieves efficacy when it is user-friendly, stable, and sufficiently adaptable to cater to diverse requirements.

The function of the instructor in distance education transcends the mere provision of educational content; it necessitates the ability to cultivate an interactive and dynamic learning environment through the utilization of digital tools. Instructors who possess proficiency in contemporary technologies can facilitate classes that are both engaging and efficacious. For instance, a skilled instructor may employ digital whiteboards, group chat forums, or real-time polling mechanisms to enhance student engagement. However, a lack of proficiency in utilizing these tools may detract from the quality of instruction and engagement. Consequently, the training and empowerment of instructors to adeptly navigate modern technologies is an essential prerequisite for the success of distance education.

In the absence of motivation and interest, even the most sophisticated educational systems may lack efficacy. Students exhibiting strong intrinsic motivation are likely to be more self-directed and actively participate in virtual learning endeavors. Motivation can be derived from various factors, including captivating content, meaningful interactions with the instructor, and the attainment of clearly defined learning objectives. Conversely, a deficiency in motivation may precipitate apathy and diminished engagement. To enhance motivation, educational platforms may implement gamification strategies or incremental rewards to incentivize student participation. Ultimately, fostering an environment that considers the psychological needs of learners is a pivotal strategy for sustaining motivation.

Recent life circumstances, particularly those instigated by the COVID-19 pandemic, have facilitated an augmented acceptance of virtual education. Under these conditions, distance learning has emerged as a pressing necessity and has served as the primary alternative to traditional, in-person education for numerous individuals. These transformations have prompted students and professors to recognize the benefits associated with enhanced flexibility and diminished

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commuting costs. Nonetheless, these circumstances have also introduced challenges, including psychological stress stemming from social isolation and inadequate infrastructure in certain regions. To optimize the utilization of this educational modality, it is imperative to adapt the educational system to the evolving conditions and provide both psychological and technical support to learners.

The findings of the research further indicated that the causal elements influencing the assessment of the efficacy of distance education encompass: (legislative frameworks and directives, suitable technological infrastructure, support mechanisms for distance education, proficiency in information technology, time management skills, and the diversity and relevance of educational content).

Legislative frameworks and directives constitute the fundamental structural basis of distance education. These regulations encompass educational policies, standards for content quality, methodologies for assessment, and the delineation of rights and responsibilities of both students and educators. The establishment of clear and well-defined regulations can significantly influence the formulation of expectations and the articulation of educational processes. For instance, regulations that promote consistent attendance in virtual classrooms or establish criteria for the evaluation of online projects can engender a greater coherence within the learning experience. Conversely, the absence of such regulations may lead to disarray in educational planning and heightened learner dissatisfaction. Ultimately, governmental and institutional endorsement of comprehensive and efficacious regulations can facilitate the success of this form of education. Technological infrastructure represents the most pivotal prerequisite for the effective execution of distance education. This infrastructure encompasses high-speed internet connectivity, hardware apparatus (including computers and webcams), sophisticated educational software, and learning management systems. The presence of this infrastructure guarantees that the educational process is conducted seamlessly and with a high degree of quality. For example, a deficiency in stable internet connectivity may precipitate interruptions during online classes, while students' inability to utilize appropriate computing devices may diminish their participation levels. Nations or regions characterized by inadequate technological infrastructure frequently encounter greater obstacles in the implementation of distance education. Therefore, investment in the enhancement of technological infrastructure is imperative to attain increased operational efficiency.

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Technical and administrative support constitutes a vital element in facilitating the success of distance education. This support may encompass the provision of technical assistance to students and faculty, resolution of technological challenges, and the availability of consulting services.

For instance, in the event that a student encounters technical difficulties in accessing an online course, the support team should address the issue promptly and effectively. Institutions that provide robust support services can alleviate the anxiety associated with technology use and enhance user satisfaction. In contrast, a deficiency in support may disrupt the educational process and diminish overall efficacy.

Proficiency in the utilization of information technology tools is among the most critical competencies required of educators and students within the realm of distance education. These competencies encompass the use of educational software, file management, email communication, and information retrieval on the Internet.

Educators must be adept at employing tools such as digital whiteboards, video conferencing platforms, and learning management systems to convey concepts in an engaging and comprehensible manner. Furthermore, students must also possess sufficient proficiency in utilizing these tools. Although technology can facilitate numerous opportunities, it may also serve as a barrier to learning if users lack the requisite skills for effective use. Training programs and skill workshops can effectively mitigate this challenge.

Time management constitutes a pivotal advantage of distance education, which can profoundly influence overall efficiency. Through this modality, learners possess the autonomy to tailor their study schedules and class attendance in alignment with their individual timetables. For instance, students engaged in professional employment can allocate their study time during periods of availability. Furthermore, the elimination of in-person commuting contributes to the conservation of both time and energy resources. Nevertheless, the failure to adeptly manage time may result in the neglect of assignments and the forfeiture of valuable learning experiences. The utilization of instruments such as online calendars, time management applications, and digital alerts can significantly enhance this dimension.

The appeal, diversity, and functionality of educational materials exert a considerable influence on the efficacy of distance learning. Content that encompasses educational videos, interactive quizzes, podcasts, and collaborative activities can effectively engage students and augment their

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participation levels. For example, the incorporation of multimedia and interactive resources not only enhances the allure of instructional sessions but also enriches the learning experience. Conversely, the provision of monotonous or irrelevant content has the potential to diminish student motivation. Achieving a harmonious balance between the appeal and applicability of the content, along with delivering constructive feedback from the instructor, is essential for success in this domain.

Practical recommendations

• Formulate explicit guidelines delineating the rights and obligations of both students and educators within the digital realm.

• Institute rigorous quality benchmarks for online educational materials along with their assessment methodologies.

• Establish comprehensive frameworks aimed at safeguarding the privacy and security of user data within educational platforms.

• Formulate inclusive policies that promote equitable access to online education for all learners.

• Allocate resources towards the enhancement of high-speed and reliable internet connectivity in underserved and remote regions.

• Provide financial assistance or subsidies to facilitate the acquisition of essential hardware, such as laptops and tablets, for students in need.

• Utilize robust and reliable server infrastructure to mitigate disruptions during periods of peak demand.

• Create 24/7 support centers dedicated to addressing the technical challenges faced by both students and educators.

• Develop detailed instructional materials for effectively navigating educational tools and platforms.

• Organize webinars and workshops aimed at acclimating users to the employed technologies.

• Engage specialized teams to oversee and perpetually enhance the online educational infrastructure.

• Implement both introductory and advanced training programs designed to bolster the IT competencies of students and faculty.

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• Create digital learning initiatives that are either complimentary or offered at a minimal cost to users.

• Generate online educational resources, including instructional videos and interactive guides, for the purpose of teaching necessary tools.

• Design adaptable learning programs that empower students to tailor their study schedules according to individual requirements.

• Provide time management resources, encompassing online calendars and reminder applications.

• Instruct time management techniques through targeted courses or webinars.

• Recommend daily or weekly study schedules to assist students in optimizing their time management.

• Incorporate multimedia elements, such as videos, podcasts, and animations, to enhance the appeal of educational content.

• Develop collaborative activities and interactive projects that actively involve students in the learning process.

• Consistently refresh content to maintain its relevance and alignment with contemporary needs.

• Gather feedback from students to evaluate the strengths and weaknesses inherent in the educational content.

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Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by ethics committee of Islamic Azad University.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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