

Representation of the Components and Indicators for Evaluating Learning Quality in Blended Learning at the Elementary Education Level

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Article Info

Article type:

Original Research

How to cite this article:

Abdollah Tabar Ghasemabadi, A., Kazempour, E., & Pali, S. (2026). Representation of the Components and Indicators for Evaluating Learning Quality in Blended Learning at the Elementary Education Level. *Iranian Journal of Educational Sociology*, 9(4), 1-13.

<https://doi.org/10.61838/kman.ijes.1480>



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ABSTRACT

Purpose: The present study aimed to identify the components and indicators for evaluating the quality of learning in blended education among elementary school students.

Methods and Materials: This study employed a qualitative research design using thematic analysis based on the Attride-Stirling approach. Data were collected through semi-structured interviews with 12 educational experts, including university faculty members, educational policymakers, school administrators, and instructional leaders selected through purposive sampling according to theoretical saturation criteria. The inclusion criteria consisted of professional experience in educational management, expertise in blended learning, and academic qualifications related to educational sciences. Data credibility and trustworthiness were established using Lincoln and Guba's criteria. The interview data were analyzed using MAXQDA 2020 software through open, axial, and selective coding processes, resulting in the extraction and organization of basic, organizing, and global themes related to learning quality evaluation in blended elementary education.

Findings: The findings resulted in the identification of five global themes, including blended learning implementation model, soft educational infrastructure, hard educational infrastructure, learning culture, and communication culture. In addition, 11 organizing themes and 53 basic themes were extracted from the interview data. The results demonstrated that effective evaluation of learning quality in blended education depends on the integration of educational planning, instructional content, teaching processes, technological infrastructure, educational environments, and communication systems. Furthermore, cultural dimensions such as students' and teachers' learning readiness, digital participation, communication skills, and family support were identified as influential factors affecting the effectiveness and sustainability of blended learning environments in elementary education.

Conclusion: The findings indicate that evaluating learning quality in blended elementary education requires a multidimensional framework integrating pedagogical, technological, organizational, and cultural dimensions. The interaction

among instructional planning, educational infrastructure, communication culture, and learning readiness creates the necessary conditions for effective blended learning implementation and meaningful evaluation of students' learning experiences. Therefore, strengthening both structural and human dimensions of blended education can contribute significantly to improving educational quality in elementary schools.

Keywords: *Evaluation, Learning Quality, Blended Learning, Elementary School Students.*

1. Introduction

The rapid transformation of educational systems in the twenty-first century has intensified the need for innovative teaching approaches capable of responding to learners' diverse academic, social, and technological needs. Among all educational stages, elementary education occupies a particularly significant position because it forms the foundation of students' cognitive, emotional, communicative, and social development. During this period, learners acquire the essential competencies and learning habits that influence their future academic success and lifelong learning trajectories. Accordingly, improving the quality of learning in elementary education has become one of the major priorities of educational systems worldwide (Li et al., 2018; Namara, 2018). Educational quality is widely recognized as a fundamental indicator of educational effectiveness and sustainable development, and international organizations such as UNESCO emphasize that educational systems must continuously enhance learning quality to prepare students for complex contemporary societies (Ridge & Kippels, 2019; Wagner et al., 2020). Consequently, schools are increasingly required to adopt flexible and technology-enhanced educational models capable of improving learning outcomes and ensuring educational continuity under changing social and technological conditions.

In recent years, rapid advances in information and communication technologies have substantially transformed teaching and learning processes. Educational institutions are no longer limited to traditional face-to-face instructional environments and increasingly integrate digital tools, online platforms, and interactive technologies into their educational practices. The emergence of digital learning environments has enabled schools to provide diverse learning opportunities through multimedia resources, online communication, educational software, and virtual collaboration spaces (Ghaffari & Fardanesh, 2016; Tkachuk, 2017). This transformation has changed students' expectations regarding learning and has encouraged educators to redesign instructional strategies that can

accommodate learners' individual differences, learning styles, and educational needs. In elementary education, the integration of digital technologies can enrich learning experiences by increasing students' engagement, motivation, creativity, and active participation in classroom activities (Pytash & O'Byrne, 2018; Razban et al., 2018). Therefore, educational systems increasingly seek approaches that combine the strengths of traditional instruction with the opportunities provided by digital technologies.

One of the most prominent educational innovations developed in response to these changes is blended learning. Blended learning refers to the purposeful integration of face-to-face instruction with online and technology-mediated learning experiences in a coordinated educational framework (Anthony et al., 2019; Bryan & Volchenkova, 2016). This approach attempts to combine the advantages of traditional classroom interaction with the flexibility and accessibility of digital learning environments. Blended learning enables students to participate in both synchronous and asynchronous learning activities while allowing teachers to diversify instructional methods and educational resources. The increasing popularity of blended learning is largely associated with its potential to enhance educational effectiveness, improve learner engagement, and provide flexible learning opportunities tailored to students' individual needs (Dakduk et al., 2018; Saltan, 2017). Moreover, blended learning environments encourage collaborative learning, independent learning, reflective thinking, and continuous interaction between teachers and students.

The COVID-19 pandemic further accelerated the adoption of blended and online learning approaches across educational systems worldwide. During this period, many schools and universities were forced to shift rapidly from traditional classroom instruction to remote and virtual learning environments. This unprecedented transition highlighted both the opportunities and challenges associated with technology-enhanced education (Bokolo, 2021). Educational institutions recognized that reliance solely on face-to-face instruction could no longer satisfy the demands

of modern education or ensure educational continuity during crises. As a result, blended learning emerged as a strategic approach capable of maintaining instructional continuity while preserving the advantages of direct teacher-student interaction. The experience of emergency remote teaching also revealed the importance of technological infrastructure, digital literacy, teacher preparedness, institutional support, and effective evaluation systems in achieving high-quality blended learning environments (De Montreuil Carmona & Irgang, 2020; Jnr, 2021). Consequently, educational policymakers increasingly emphasize the development of sustainable blended learning systems that can respond effectively to both ordinary and emergency educational conditions.

Research evidence consistently demonstrates that blended learning can positively influence students' academic achievement, motivation, engagement, satisfaction, and self-directed learning abilities. Studies have shown that blended learning environments create more interactive and learner-centered educational experiences compared with purely traditional instructional models (River et al., 2016; Wang, 2021). In elementary education, blended learning approaches can particularly support the development of creativity, critical thinking, communication skills, and independent learning habits among young learners. For example, multimedia storytelling, interactive educational resources, and digital collaborative activities can significantly improve students' learning experiences and attitudes toward education (Khaledi et al., 2022; Razban et al., 2018). Similarly, blended instruction has been associated with improvements in learners' academic success and educational satisfaction in various educational contexts (Mohammadi et al., 2017; Rajabi et al., 2017). These findings suggest that blended learning may provide an effective framework for enhancing learning quality when appropriately designed and implemented.

Despite these advantages, the successful implementation of blended learning requires careful attention to multiple organizational, pedagogical, technological, and cultural factors. One of the major challenges associated with blended learning concerns the adequacy of educational infrastructure. Effective blended learning environments require reliable internet access, digital devices, learning management systems, educational software, and appropriate classroom technologies (Keshavarz Ghiri & Mohseni, 2025; Suleri & Zwaal, 2022). In many educational systems, particularly in developing countries, unequal access to technological resources remains a significant obstacle to

educational equity and learning quality. Inadequate technological infrastructure may prevent students and teachers from fully participating in blended educational activities and may negatively affect educational outcomes. Furthermore, disparities in digital access among students can increase educational inequalities and limit opportunities for effective participation in virtual learning environments (Li et al., 2018; Pytash & O'Byrne, 2018).

Another important challenge relates to teachers' professional readiness and attitudes toward blended instruction. Teachers play a central role in designing, implementing, and evaluating blended learning experiences. Successful blended learning requires teachers to possess not only pedagogical competencies but also technological knowledge, digital literacy skills, classroom management abilities, and positive attitudes toward technology integration (Mirzaei, 2021; Mohammadi, 2023). Studies indicate that teachers' self-efficacy and acceptance of digital technologies significantly influence their willingness to implement blended instructional methods effectively (Mohammadi, 2023). Likewise, faculty and teachers require institutional support, professional development opportunities, and access to technological resources to successfully adapt to blended educational environments (De Montreuil Carmona & Irgang, 2020; Jnr, 2021). Without adequate preparation and support, teachers may experience difficulties in managing blended classrooms, designing interactive learning activities, and evaluating students' learning outcomes appropriately.

The quality of educational content and instructional design also plays a critical role in determining the effectiveness of blended learning environments. Blended learning requires educational content that is interactive, flexible, multimedia-based, and developmentally appropriate for learners' cognitive and emotional characteristics (Faraji et al., 2023; Nourizadeh & Zeinabadi, 2023). In elementary education, learning materials should be engaging, visually attractive, and capable of maintaining students' attention and motivation in both physical and virtual learning spaces. Moreover, instructional design in blended environments must facilitate meaningful interaction, collaborative learning, immediate feedback, and continuous assessment. Research suggests that thoughtfully designed blended instructional activities can improve students' sense of community, emotional engagement, and academic performance (Hieu & Yen, 2022; Pei et al., 2023). Therefore, evaluating the quality of blended learning requires consideration of instructional strategies,

educational resources, interaction patterns, and learner support mechanisms.

Evaluation and quality assurance constitute another fundamental dimension of blended education. Educational evaluation in blended environments extends beyond traditional assessment approaches and requires multidimensional frameworks capable of examining learning processes, learner participation, technological effectiveness, and educational outcomes (Abbasi Kasani et al., 2021; Rezazadeh et al., 2018). Several scholars have emphasized the necessity of developing comprehensive evaluation models specifically designed for blended and electronic learning environments. These models often include dimensions such as content quality, technological infrastructure, communication effectiveness, institutional support, learner satisfaction, teaching processes, and educational management (Paripour et al., 2020; Zahed Babelan et al., 2023). Similarly, studies focusing on educational quality evaluation highlight the importance of leadership, educational planning, teaching effectiveness, learner engagement, and organizational culture in improving educational quality (Chenari et al., 2020; Nasirian Samarini et al., 2019). Consequently, evaluating learning quality in blended elementary education requires an integrated framework that considers both structural and human dimensions of the educational process.

In addition to technological and pedagogical factors, cultural and social dimensions significantly influence the success of blended learning implementation. Effective blended education depends on learners' readiness for independent learning, family support, communication culture, and institutional attitudes toward innovation and technology integration (Ghaloujeh & Salimi, 2024; Wang & Raman, 2025). In elementary education, parents and families play an especially important role in supporting students' participation in virtual and blended learning activities. Students' motivation, communication skills, self-regulation abilities, and digital responsibility are also closely associated with the effectiveness of blended learning experiences. Furthermore, blended learning environments require educational institutions to establish collaborative cultures that encourage communication, participation, and continuous feedback among teachers, students, and families (Anthony et al., 2019; Pei et al., 2023). Therefore, cultural readiness and communication effectiveness should be considered essential components in evaluating blended learning quality.

Although numerous studies have examined blended learning in higher education contexts, research focusing specifically on evaluating learning quality in blended elementary education remains limited, particularly within the Iranian educational system. Existing studies have primarily emphasized technological acceptance, infrastructure requirements, teaching effectiveness, or educational satisfaction, while fewer investigations have attempted to identify comprehensive components and indicators for evaluating learning quality in elementary blended education (Narenji Sani et al., 2025; Paripour et al., 2020). Moreover, the unique developmental characteristics of elementary students necessitate evaluation frameworks specifically tailored to this educational stage. Elementary learners require greater guidance, interaction, emotional support, and age-appropriate instructional strategies compared with older students. Consequently, evaluation models designed for higher education or adult learners may not adequately capture the dimensions influencing learning quality in elementary blended learning environments.

Considering the increasing emphasis on blended learning within educational systems, the necessity of improving educational quality in elementary schools, and the limited availability of comprehensive evaluation frameworks in this field, identifying the components and indicators influencing learning quality in blended elementary education appears essential. Understanding these factors can assist educational policymakers, school administrators, teachers, and curriculum designers in developing more effective blended learning environments capable of enhancing students' academic achievement, engagement, and educational experiences. Therefore, the present study aimed to identify the components and indicators of evaluating learning quality in blended education among elementary school students.

2. Methods and Materials

The present study was qualitative in nature and based on thematic analysis, and in terms of purpose, it was categorized as an applied research study. The participants consisted of specialists and experts in the field of learning across the country, including directors-general of education departments, university faculty members, educational policymakers, teachers, and educational facilitators, all of whom possessed sufficient expertise and experience related to the subject under investigation. The selection criteria included having at least five years of managerial experience in the field of education, holding a master's degree or

doctoral degree in educational management or human resource management, having an organizational position related to education, and possessing scholarly publications and research activities such as articles and books, as well as participation in or facilitation of workshops on blended learning. The sample size was determined based on the principle of data saturation. Accordingly, 12 participants were selected through purposive sampling. Data were collected using in-depth semi-structured interviews. The collected data were analyzed using the Attride-Stirling approach (basic, organizing, and global themes) with the aid of MAXQDA version 2020.

3. Findings and Results

The number of participants, based on the principle of theoretical data saturation, was 12 individuals. Among them,

6 participants (50%) were male and 6 participants (50%) were female. Two participants (16.66%) had 11–20 years of work experience, while 10 participants (83.34%) had 21–30 years of work experience. Four participants (33.33%) were between 40 and 50 years old, and 8 participants (66.67%) were over 50 years old. Five participants (41.66%) held a master’s degree, while 7 participants (58.34%) held a doctoral degree. Four participants (33.33%) were university faculty members, 3 participants (25%) were educational policymakers, 2 participants (16.67%) were teachers/educational facilitators, 2 participants (16.67%) were directors-general, and 1 participant (8.33%) was an assistant director-general. The demographic characteristics of the sample are presented in Table 1.

Table 1

Frequency Distribution of the Qualitative Sample According to Demographic Information

Variable	Levels of Variable	Frequency	Percentage
Gender	Male	6	50
	Female	6	50
	Total	12	100
Work Experience	1–10 years	0	0
	11–20 years	2	16.66
	21–30 years	10	83.34
	More than 30 years	0	0
	Total	12	100
Age	Under 40 years	0	0
	40–50 years	4	33.33
	Over 50 years	8	66.67
	Total	12	100
Education	Master’s degree	5	41.66
	Doctoral degree	7	58.34
	Total	12	100
Organizational Position	University faculty member	4	33.33
	Educational policymaker	3	25
	Teachers/Educational facilitators	2	16.67
	Director-General	2	16.67
	Assistant Director-General	1	8.33
	Total	12	100

Open coding in qualitative research is conducted with the aim of identifying basic themes. Basic themes summarize and explain significant meanings related to the research subject within the text of semi-structured interviews. To identify the basic themes, the semi-structured interviews must first be reviewed. The review of each interview

transcript should be carried out at the earliest possible time following the interview. Accordingly, arrangements were made to conduct the initial interview.

Table 2 presents the distributions related to the review of semi-structured interviews in the qualitative study.

Table 2

Distributions Related to the Review of Semi-Structured Interviews in the Qualitative Study

Interview	Interview Duration (Minutes)	Interview Review (Minutes)	Interview Transcription (Minutes)	Interview Coding (Minutes)
1	75	93	101	170
2	69	86	93	142
3	80	99	108	173
4	80	99	108	166
5	76	94	103	165
6	100	123	135	215
7	102	125	138	219
8	72	89	97	156
9	70	87	95	152
10	86	106	116	186
11	100	123	135	212
12	96	118	130	200

The process of open coding in qualitative research (thematic analysis) concludes with the identification of basic themes. At the end of the open coding process, all basic

themes had been identified. Table 3 presents the basic themes.

Table 3

Basic Themes in Evaluating Learning Quality Based on Blended Learning Among Elementary School Students

Code	Basic Theme	Number of Related Text Segments
OP1	Re-education of educational content	7
OP2	Completion of educational content	2
OP3	Gamification of educational content	7
OP4	Assignment design based on educational content	5
OP5	Presentation of educational content produced in real time	2
OP6	Presentation of previously produced educational content	2
OP7	Long-term national goals	4
OP8	Long-term goals of the educational system	3
OP9	Alignment of the educational system with long-term national goals	4
OP10	Alignment of students with long-term national goals	3
OP11	Alignment of students' families with long-term national goals	3
OP12	Alignment of students with long-term educational system goals	2
OP13	Alignment of students' families with long-term educational system goals	3
OP14	Neutral selection of educational content	4
OP15	Integration of educational content	7
OP16	Selection of practical educational content	2
OP17	Updating practical educational content	2
OP18	Educational system communication model	7
OP19	Intra-school communication model	7
OP20	Intra-classroom communication model	3
OP21	Teaching model	7
OP22	Level of access to formal educational environments	4
OP23	Level of access to supplementary educational environments	6
OP24	Facilities of formal educational environments	4
OP25	Facilities of formal educational environments	4
OP26	Level of access to digital tools	3
OP27	Level of access to internet networks	7
OP28	Level of access to official educational media	5
OP29	Level of access to supplementary educational media	3
OP30	User interface of official educational media	3
OP31	User interface of supplementary educational media	4
OP32	Supervisability of official educational media	2
OP33	Supervisability of supplementary educational media	2
OP34	Students' learnability culture in real environments	4
OP35	Families' learnability culture in real environments	5
OP36	Teachers' learnability culture in real environments	5
OP37	Organizational learnability approach in real environments	5

OP38	Students' learnability culture in virtual environments	2
OP39	Families' learnability culture in virtual environments	7
OP40	Teachers' learnability culture in virtual environments	3
OP41	Organizational learnability approach in virtual environments	3
OP42	Students' communicability culture in real environments	6
OP43	Quality of students' communicability in real environments	2
OP44	Families' communicability culture in real environments	7
OP45	Teachers' communicability culture in real environments	6
OP46	Quality of teachers' communicability in real environments	2
OP47	Organizational communication management approach in real environments	6
OP48	Students' communicability culture in virtual environments	7
OP49	Quantity of students' communicability in virtual environments	3
OP50	Families' communicability culture in virtual environments	3
OP51	Teachers' communicability culture in virtual environments	4
OP52	Quantity of teachers' communicability in virtual environments	3
OP53	Organizational communication management approach in virtual environments	3

The second stage of coding the data extracted from the semi-structured interviews is called axial coding. Axial coding is conducted with the purpose of identifying organizing themes. Organizing themes summarize and

explain the basic themes and significant meanings associated with the research subject. Table 4 presents the qualitative matrix of organizing themes.

Table 4

Qualitative Matrix of Organizing Themes in Evaluating Learning Quality Based on Blended Learning

Organizing Theme	1	2	3	4	5	6	7	8	9	10	11	12
Planned implementation of blended learning	*		*	*	*	*	*	*	*	*	*	*
Crisis-based implementation of blended learning	*		*	*	*	*	*	*	*	*	*	*
Educational system outlook	*	*	*	*		*	*	*	*	*	*	*
Educational content	*		*	*	*	*	*		*	*	*	*
Teaching process	*	*	*	*	*	*		*	*	*	*	*
Educational environments	*	*	*	*	*	*		*	*	*		*
Educational technology	*	*	*	*	*	*	*	*		*	*	
Learnability culture in real environments	*	*	*	*	*	*	*	*	*	*	*	*
Learnability culture in virtual environments	*	*	*	*	*	*	*	*	*	*	*	*
Communicability culture in real environments	*	*		*	*	*	*	*	*	*	*	
Communicability culture in virtual environments		*	*	*		*	*	*	*	*	*	*

The identification of organizing themes must follow two principles. The first principle is semantic comprehensiveness, and the second is semantic exclusiveness of the organizing theme. Semantic comprehensiveness means that an organizing theme should summarize and explain the meanings of all underlying basic

themes. Semantic exclusiveness means that an organizing theme should be capable of distinguishing all its underlying basic themes from other basic themes. Table 5 presents the organizing themes of the model for evaluating learning quality based on blended learning among elementary school students.

Table 5

Organizing Themes in Evaluating Learning Quality Based on Blended Learning

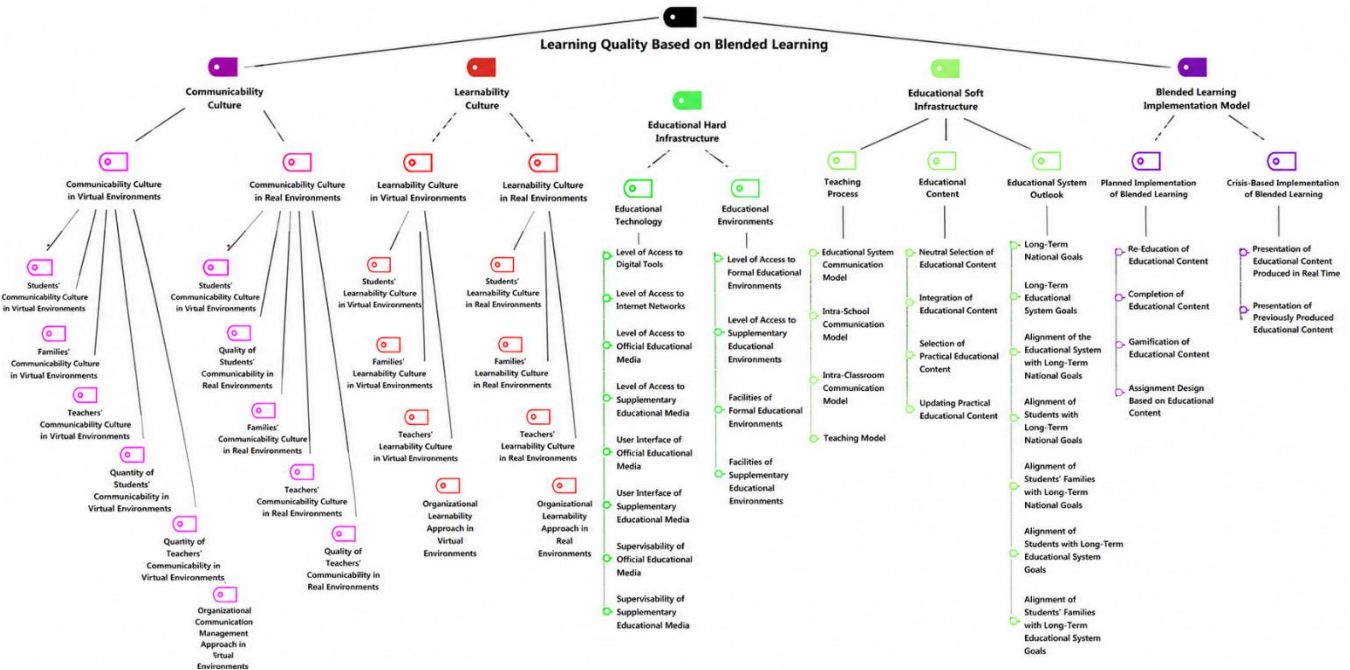
Global Theme	Organizing Theme	Basic Theme
Blended Learning Implementation Model	Planned implementation of blended learning	Re-education of educational content Completion of educational content Gamification of educational content Assignment design based on educational content Presentation of educational content produced in real time
	Crisis-based implementation of blended learning	Presentation of previously produced educational content
Educational Soft Infrastructure	Educational system outlook	Long-term national goals Long-term educational system goals Alignment of the educational system with long-term national goals Alignment of students with long-term national goals Alignment of students' families with long-term national goals Alignment of students with long-term educational system goals Alignment of students' families with long-term educational system goals
	Educational content	Neutral selection of educational content Integration of educational content Selection of practical educational content Updating practical educational content
	Teaching process	Educational system communication model Intra-school communication model Intra-classroom communication model Teaching model
Educational Hard Infrastructure	Educational environments	Level of access to formal educational environments Level of access to supplementary educational environments Facilities of formal educational environments Facilities of formal educational environments
	Educational technology	Level of access to digital tools Level of access to internet networks Level of access to official educational media Level of access to supplementary educational media User interface of official educational media User interface of supplementary educational media Supervisability of official educational media Supervisability of supplementary educational media
Learnability Culture	Learnability culture in real environments	Students' learnability culture in real environments Families' learnability culture in real environments Teachers' learnability culture in real environments Organizational learnability approach in real environments
	Learnability culture in virtual environments	Students' learnability culture in virtual environments Families' learnability culture in virtual environments Teachers' learnability culture in virtual environments Organizational learnability approach in virtual environments
Communicability Culture	Communicability culture in real environments	Students' communicability culture in real environments Quality of students' communicability in real environments Families' communicability culture in real environments Teachers' communicability culture in real environments Quality of teachers' communicability in real environments Organizational communication management approach in real environments
	Communicability culture in virtual environments	Students' communicability culture in virtual environments Quantity of students' communicability in virtual environments Families' communicability culture in virtual environments Teachers' communicability culture in virtual environments Quantity of teachers' communicability in virtual environments Organizational communication management approach in virtual environments

Following the completion of the coding process, the thematic network of learning quality evaluation based on

blended learning among elementary school students was designed in the form of Figure 1.

Figure 1

Final Output of Experts' Opinions Regarding the Research Components and Indicators



4. Discussion and Conclusion

The findings of the present study demonstrated that evaluating the quality of learning in blended elementary education is a multidimensional process influenced by structural, pedagogical, technological, and cultural factors. The thematic analysis identified five overarching themes, including the blended learning implementation model, soft educational infrastructure, hard educational infrastructure, learning culture, and communication culture. These findings indicate that the quality of learning in blended environments cannot be understood solely through technological access or instructional delivery, but rather through the interaction among educational planning, technological readiness, communication processes, cultural acceptance, and pedagogical effectiveness. The identified components collectively provide a comprehensive framework for understanding how blended education can be implemented and evaluated effectively within elementary schools.

One of the central findings of the study was the significance of the blended learning implementation model as a key determinant of learning quality. The results revealed that purposeful planning, structured integration of face-to-face and virtual instruction, and flexible implementation

during crisis conditions were among the most influential indicators affecting learning quality. This finding suggests that blended education is not simply the coexistence of online and traditional learning, but rather a systematic educational strategy that requires coherent planning, pedagogical alignment, and instructional integration. Effective blended learning environments appear to depend heavily on how educational activities, technological tools, and instructional objectives are coordinated. These findings are consistent with studies emphasizing that blended learning environments are most successful when they are intentionally designed to combine digital and classroom-based instruction in complementary ways (Anthony et al., 2019; Bryan & Volchenkova, 2016). Similarly, studies conducted within Iranian educational contexts have highlighted that structured planning and the purposeful integration of blended learning strategies significantly contribute to educational effectiveness and learner satisfaction (Narenji Sani et al., 2025; Zahed Babelan et al., 2023). The findings also align with the work of Mirzaei, who identified instructional planning, educational goals, and flexible teaching strategies as fundamental dimensions of

blended learning implementation in elementary education (Mirzaei, 2021).

Another important result concerned the role of soft educational infrastructure in enhancing learning quality. The study demonstrated that educational vision, instructional content, and teaching processes constitute essential dimensions of blended learning evaluation. This finding indicates that high-quality blended learning environments require more than technological resources; they also require coherent educational objectives, developmentally appropriate instructional materials, and interactive teaching processes. Educational content that is integrated, updated, interactive, and aligned with learners' needs appears to facilitate more meaningful learning experiences. Likewise, teaching processes characterized by communication, interaction, and flexible instructional strategies contribute significantly to students' engagement and participation in blended educational settings. These findings correspond with prior studies emphasizing that content quality and instructional design are among the strongest predictors of successful blended learning experiences (Faraji et al., 2023; Nourizadeh & Zeinabadi, 2023). Previous research has similarly shown that interactive educational content and learner-centered teaching approaches improve students' academic performance and educational satisfaction in blended environments (Khaledi et al., 2022; Mohammadi et al., 2017). Moreover, Pei and colleagues reported that a stronger sense of educational community and interactive learning processes positively influence students' emotional engagement and learning outcomes in blended education (Pei et al., 2023). These findings collectively suggest that blended learning quality is strongly dependent on the pedagogical coherence and instructional effectiveness of educational programs.

The findings also revealed the importance of hard educational infrastructure in determining the effectiveness of blended elementary education. Components such as educational spaces, access to digital devices, internet connectivity, educational media, and technological tools were identified as critical indicators influencing learning quality. This finding demonstrates that successful blended education requires adequate physical and digital infrastructure capable of supporting both online and face-to-face instructional activities. Without stable technological infrastructure, students may encounter difficulties accessing educational materials, participating in virtual activities, and interacting effectively with teachers and peers. These findings support earlier studies indicating that access to

technological resources is a prerequisite for effective blended learning implementation (Dakduk et al., 2018; Tkachuk, 2017). Likewise, Bokolo emphasized that technological readiness and facilitating conditions significantly influence the effectiveness of blended and remote learning environments (Bokolo, 2021). Studies conducted in Iranian educational settings have also identified educational infrastructure and technological accessibility as essential dimensions of educational quality and blended learning success (Paripour et al., 2020; Rezazadeh et al., 2018). Furthermore, the findings correspond with the work of Wang, who reported that educational technology and digital learning platforms positively affect students' engagement and communication in blended environments (Wang, 2021). Therefore, strengthening technological infrastructure appears necessary for improving educational quality in blended elementary education.

The study additionally highlighted the significant role of learning culture in shaping students' learning quality within blended educational environments. The findings showed that learning culture in both physical and virtual environments contributes substantially to students' participation, motivation, and readiness for learning. This suggests that blended learning effectiveness depends not only on technological access or instructional quality but also on learners' attitudes, behaviors, and willingness to engage in educational activities. In physical classrooms, learning culture involves active participation, responsibility, collaboration, and respect for educational processes. In virtual environments, however, learning culture additionally requires digital responsibility, self-regulation, independent learning skills, and appropriate use of online educational resources. These findings support previous research emphasizing the importance of learner readiness and educational culture in blended learning implementation (Ghaloujeh & Salimi, 2024; Wang & Raman, 2025). Similarly, studies have demonstrated that students' self-regulation skills, educational motivation, and family support significantly influence learning outcomes in blended educational settings (Hieu & Yen, 2022; Mohammadi, 2023). In addition, Shahbeig and colleagues found that teachers' and administrators' attitudes toward blended learning affect the feasibility and effectiveness of implementing blended instructional approaches within schools (Shahbeig et al., 2020). Consequently, developing positive learning cultures in both physical and virtual

learning spaces appears essential for enhancing learning quality in blended elementary education.

Another notable finding of the present study was the identification of communication culture as a major component influencing learning quality. The results demonstrated that communication patterns in both physical and virtual environments significantly contribute to educational effectiveness, learner engagement, and collaborative learning. Communication culture in face-to-face settings includes interpersonal interaction, classroom dialogue, collaborative learning activities, and supportive teacher-student relationships. In virtual learning environments, communication culture extends to digital interaction, online collaboration, ethical communication practices, and participation in virtual educational communities. The findings suggest that blended learning environments are more effective when they facilitate meaningful interaction and continuous communication among learners, teachers, and families. These results are consistent with previous studies indicating that communication and interaction are central dimensions of successful blended learning experiences (Anthony et al., 2019; Pei et al., 2023). Likewise, studies have shown that collaborative learning opportunities and flexible communication systems improve learner satisfaction and academic engagement in blended environments (River et al., 2016; Saltan, 2017). Research conducted by Zahed Babelan and colleagues also identified communication culture as an important dimension of educational quality in electronic and blended learning systems (Zahed Babelan et al., 2023). Therefore, fostering effective communication culture appears crucial for improving both educational experiences and learning quality within blended elementary education.

The findings of this study further suggest that evaluating learning quality in blended elementary education requires a holistic and multidimensional framework rather than isolated assessment criteria. Traditional evaluation approaches focusing exclusively on academic achievement or technological access may fail to capture the complexity of blended educational environments. Instead, evaluation frameworks should incorporate dimensions related to instructional planning, educational content, technological infrastructure, learner engagement, communication culture, organizational support, and educational flexibility. These findings correspond with previous research emphasizing the need for comprehensive educational evaluation models in blended and online learning environments (Abbasi Kasani et al., 2021; Paripour et al., 2020). Similarly, Nasirian Samarin

and colleagues highlighted that educational quality evaluation should consider instructional processes, management systems, learner support, and institutional structures simultaneously (Nasirian Samarin et al., 2019). The present study extends this literature by specifically focusing on elementary education and identifying contextually relevant components affecting learning quality in blended learning environments.

Furthermore, the study findings indicate that blended learning may serve as a valuable strategy for improving educational continuity and flexibility within elementary education systems. The integration of physical and digital learning opportunities allows schools to respond more effectively to diverse educational conditions, including emergency situations, technological transformations, and changing learner needs. This finding aligns with prior research suggesting that blended education increases educational resilience and provides opportunities for more adaptive learning experiences (Bokolo, 2021; Mitra, 2023). In particular, blended learning environments can facilitate individualized instruction, differentiated learning opportunities, and continuous access to educational resources. These advantages may contribute to more inclusive and sustainable educational systems capable of supporting diverse student populations. Therefore, educational policymakers and school administrators should consider blended learning not merely as a temporary technological solution but as a strategic educational approach capable of improving educational quality and flexibility in elementary schools.

One limitation of the present study was that the findings were derived from qualitative interviews with educational experts and specialists, which may limit the generalizability of the results to all educational settings and populations. In addition, the study focused primarily on the perspectives of policymakers, educational leaders, and experienced educators rather than directly examining students' and parents' experiences within blended learning environments. Another limitation concerns the contextual nature of the findings, as educational infrastructures, technological accessibility, and cultural conditions may differ across regions and educational systems. Furthermore, the study concentrated specifically on elementary education, and therefore the identified components may not fully apply to secondary or higher educational contexts.

Future research is recommended to examine the identified components quantitatively and validate the proposed framework through large-scale empirical studies involving

students, teachers, school administrators, and parents. Comparative studies across different educational levels and geographical regions may also provide deeper insight into contextual differences affecting blended learning quality. In addition, future investigations should explore the relationship between blended learning quality indicators and specific educational outcomes such as academic achievement, creativity, digital literacy, and socio-emotional development. Longitudinal studies examining the long-term effects of blended education on learners' academic and psychological development would also contribute significantly to the literature. Moreover, future studies may investigate the effectiveness of specific blended instructional models and digital technologies in improving elementary students' learning experiences.

Based on the findings of the present study, it is recommended that educational policymakers develop comprehensive strategic frameworks for implementing blended learning in elementary schools. Schools should be equipped with adequate technological infrastructure, reliable internet access, and modern digital educational tools to support effective blended instruction. Teacher professional development programs should also focus on enhancing educators' digital competencies, blended instructional design skills, and online classroom management abilities. Furthermore, educational content should be redesigned in interactive and multimedia formats appropriate for elementary learners' developmental characteristics. Schools are additionally encouraged to strengthen communication and learning cultures by promoting collaborative learning activities, supportive teacher-student interactions, and active family participation in educational processes. Finally, comprehensive evaluation systems specifically designed for blended elementary education should be established to continuously monitor and improve the quality of students' learning experiences.

Authors' Contributions

Authors equally contributed to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all participants for agreeing to record the interview and participate in the research.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

All procedures performed in studies involving human participants were under the ethical standards of the institutional and, or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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