

Barriers to the Integration of E-learning in an Iranian Education System

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ABSTRACT

Introduction: Some people expect that the quality of teaching and learning will be improved by using technology, while empirical evidence has proven the opposite. But education is too complicated to improve its quality simply by employing new technologies. The purpose of this study is to investigate the barriers to the use of ICT in primary school in North Khorasan province in early 2021 academic years.

Methods: To do so, we used a mixed method. In the qualitative part of the study, interview questions were identified using scientific resources and focal group. Then, 14 primary teachers and experts, who had experience of working in a school with minimal ICT equipment were selected using purposeful sampling. The exclusion criterion was the subjects' unwillingness to continue cooperation. The qualitative data were analyzed using Colaizzi method. Based on qualitative findings, a researcher-made questionnaire with 22 items and 6 subscales was developed. The validity of the questionnaire was confirmed by experts, and its reliability was obtained from 0.61 to 0.92 for its various parts. To ensure the accuracy of the questionnaire, we performed exploratory factor analysis and confirmatory factor analysis on the questionnaire. In the quantitative part of the study, the sample was randomly selected according to the size and access to technology in the classroom.

Results: Quantitative analyses revealed that there was a negative association ($r=-0.182$; $P=0.021$) between the teaching-learning quality and the use of emerging technology. Regression test showed that the most important barrier to the ICT use in school was "Equipment and infrastructure" ($\beta=-0.256$; $P<0.001$) and then the "Budget and monetary resources" ($\beta=-0.148$; $P=0.053$), "Teachers' self-confidence" ($\beta=-0.119$; $P=0.137$), and "Teachers' knowledge and skill" ($\beta=-0.058$; $P=0.473$).

Conclusion: The quality of teaching and learning is not improved by the mere presence of ICT equipment. Based on the findings of the current study, if the managers intend to remove the obstacles related to the integration of ICT in education, they have to provide sufficient "Equipment and infrastructure" and "Budget and monetary resources", and plan for improving "Teachers' self-confidence" and "Teachers' knowledge and skill".

Keywords: ICT, barriers to ICT use, Primary Schools, emerging technologies, online learning

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Introduction

The prevailing mentality has long been that new technologies or media lead to better and more effective learning (1). With the introduction of ICT in the education system or the expansion of e-learning and virtual education, it was assumed that we would see many changes and developments in the field of education (1). It soon became clear that this assumption was not always true, and that the success of ICT-related projects or other areas of e-learning was largely unassured and with many constraints. Some studies show the positive effect of using ICT on academic achievement and some indicate its negative effect. For example, Zhang and Li (2) investigated the students' intention to use tablets based on a technology acceptance model. They examined the associations between perceived usefulness, perceived ease of use, attitude, the purpose of use, self-efficacy, technological anxiety, and family support. The results of their research showed the successful performance of technology. Moreover, Lysenko et al. (3), in a study on the use of technology to develop students' literacy in Kenya, concluded that the use of technology made a positive, albeit small, change in reading. Gradually, on the other hand, research has shown the failure, inefficiency, and ineffectiveness of some of these experiences, as well as identification of their causes. For instance, Amez and Baert (4) examined the barriers to the use of ICT in schools. In their revision, they reviewed the findings of 490 studies in the first phase and 23 studies in the second phase. They found that there were implications for smartphone use and academic achievement. According to the results, the number of studies which have emphasized the negative impact of smartphone use on academic achievement is significantly higher.

Mora et al. (5), in a longitudinal study, examined the application of the One Laptop per Child program. The results of this study showed the negative impact of this program on the performance of Spanish-Catalan

students in English and mathematics. This negative effect was more pronounced in boys than girls.

In contrast, Mercer et al. (6) concluded that the application of digital technology has led to positive results in supporting classroom conversations and flourishing the students' thinking. Based on the report, it is not the equipment that affects the quality of teaching and learning, but the teaching method and instructional design. According to Clark (6), different media are no different in terms of being media; they just have to be selected efficiently and effectively according to the goals and requirements of the learning environment. Nguyen (7) listed 355 studies that did not indicate a significant association between traditional methods and online learning.

From the very beginning of the introduction of ICT in the Iranian education system in the early 2000s, many advantages were imagined for the use of ICT. It was assumed that with the application of ICT, educational management, registration, presentation of educational contents, and method of teaching and evaluation would change, and the teacher-centered system would be replaced by student-centered. In addition, the new system was expected to save the training time and costs and further improve the education system in administering educational justice. This notion has existed in some other countries as well (8-12).

Despite the high potential of ICT, there is insufficient evidence showing that the use of ICT in school has been successful in the education system. On the contrary, there is ample evidence that the plan has been largely unsuccessful. Overall, the results of previous studies suggest that there is no guarantee for the success of projects and plans related to the use of ICT in school, as there are many barriers to their success (8-10). As mentioned, there are many reports on failure, non-efficiency, and non-effectiveness of some electronic learning experiences (7, 13-15)

and various research has explored the reasons for this failure (16). Some experts have tried to explore barriers to accepting these plans by combining ICT and curriculum or developing schools that use ICT. In general, other experts do not grant any credit to the application of special media for training (17). Among new theorists, Siemens and Tittenberger (18) believe that, in most cases, new digital technologies are mostly used to back up logistic and technical processes, and other software and official essentials are not considered. Hence, no special educational change has occurred.

Because of the brief introduction above, the present research seeks to answer these questions: what are barriers to the use and implementation of ICT in schools as well as the effective use of ICT equipment by primary school teachers in North Khorasan Province? How could these barriers be prioritized? In light of these prioritizing barriers, where is the starting point of the education system to remove the barriers and improve the quality of teaching-learning with ICT equipment?

There are various studies on the barriers to integrating ICT with the curriculum. If we accept that the Covid-19 pandemic was a good opportunity to integrate technology with education, it is important to examine the factors that prevented this integration. Singh et al. (19) studied the obstacles with which teachers in public-funded elementary schools in India encountered during the COVID-19 pandemic. They found five barriers including physical environmental constraints, socioenvironmental limitations, parental support, issues of effective learning, and health and well-being hazards that effect using ICT in teaching and learning. Collado et al. (20) studied the features that affect the students' response to self-learning modules in Philippine public school. In their research, they found out that household food security and parental involvement were the predictors of the students' satisfaction, but Internet access is not so important. Parczewska's (21) study showed the difficulty with which parents

were faced in home schooling during the COVID-19 pandemic, and it was beyond their abilities. The present study aimed to identify the barriers to the use of new technologies in education from the perspective of primary school teachers in North Khorasan Province.

Methods

Qualitative Part

The current study was conducted in early 2021 academic year. The current research is a mixed method, which first used a qualitative method, followed by a quantitative method. This order was chosen because the results of the qualitative part were necessary for the quantitative part, and there was an interaction between these two sources. Given the purpose, nature, and subject of the research, Colaizzi's (22) method was used based on Husserl's descriptive phenomenological method for analyzing the data. Colaizzi's method is a seven-step model for analyzing qualitative data in phenomenological studies. In the first step, at the end of each interview, the recorded statements of the participants were transcribed; then, the transcribed materials were read several times to understand the feelings and experiences of the participants. In the second step, meaningful information, statements related to the central phenomenon, were identified. In the third phase, the related themes were extracted. At this stage, after identifying the important phrases of each interview, we made an attempt to extract a theme from each phrase that expressed the meaning and the purpose of the interviewees. After extracting the theme, according to the fourth stage, we categorized the themes based on the similarities. At this stage, thematic categories of the concepts were formed. In the fifth stage, the themes were combined to form more general categories; this was done to comprehensively describe the central phenomenon. In the sixth step, we presented a comprehensive description of the studied phenomenon. The final step involved validation. This step was done by referring to each interviewee and presenting the results of

the interview to him/her and receiving his/her opinion about the degree of conformity of the findings with the opinions presented by him/her.

In order to prepare the interview questions, were first studied the scientific resources related to the subject, and the important topics in this field were extracted; then, a pilot interview was conducted with a number of teachers, experts and university professors as a focal group to determine important issues related to the research topic. The findings of these two steps were combined; thus, the interview questions were identified. In the next step, semi-structured interviews were conducted with 14 teachers, principals, and experts who were selected using the purposeful sampling method (Table 1).

The main inclusion criterion was experience and work in schools that had minimal ICT equipment. The exclusion criterion was the subjects' unwillingness to continue cooperation. At the beginning of

each interview, the purpose of the interview was stated and permission was obtained to record the content of the interview. Among 14 interviewees, 10 agreed to record the interview sessions. In addition, the participants were assured about the confidentiality of information. Interviews lasted from about 15 to 45 min. The important topics that were followed in the interview process involved barriers and challenges of integrating emerging technology in education. In order to determine the accreditation of the findings, we sent the results to the interviewees, and finally the findings were approved by them; there was also an attempt to use a structured process based on Colaizzi's method to categorize the data. The qualitative data analysis phases are summarized in the Table 2. Finally, four themes were extracted.

Quantitative Part

This part of the research was included in the cross-sectional research. The data obtained

Table 1: Demographic information of teachers, principle and experts interviewed

Row	Interviewee code	City	Gender	Position
1	Teacher Code 1	Bojnord	Man	Teachers
2	Teacher Code 2	Bojnord	Man	Principals
3	Teacher Code 3	Bojnord	Woman	Experts
4	Teacher Code 4	Esfraim	Man	Teachers
5	Teacher Code 5	Esfraim	Woman	Principals
6	Teacher Code 6	Shirvan	Man	Teachers
7	Teacher Code 7	Shirvan	Man	Principals
8	Teacher Code 8	Shirvan	Woman	Experts
9	Teacher Code 9	Bam and Safi Abad	Woman	Teachers
10	Teacher Code 10	Jajarm	Man	Teachers
11	Teacher Code 11	Raz and Jargalan	Woman	Teachers
12	Teacher Code 12	Farouj	Woman	Teachers
13	Teacher Code 13	garne	Man	Teachers
14	Teacher Code 14	Mane and Samlaqan	Man	Teachers

Table 2: Detailed analysis of the data based on Colaizzi's (1978) method

Phase	Action
1	Transcription of the recorded interviews
2	Extraction of meaningful information
3	Extraction of related themes
4	Categorization of the extracted themes
5	Combination of the categorized themes
6	Description of each main themes
7	Accreditation of the main themes

from qualitative phases provided the basis for designing a researcher-made questionnaire. The statistical population in the quantitative section included primary school teachers who had the experience of working in a school with minimal ICT equipment. According to statistics obtained from the Department of Education of North Khorasan Province, they were about 5917 teachers. Among these, about 4039 teachers could use technological equipment. Random sampling was used. The G Power software was used to select the sample size. Based on an Alpha of 0.05 and a confidence level of 0.95 for the correlation test, this software suggests 115 subjects as the sample size. Considering the possible dropouts, we increased the sample size to 180 people. For selecting the sample, the complete list of school teachers who had access to minimal ICT equipment in 9 regions of North Khorasan province (Table 3) was prepared from the General Department of Education and selected in each city according to the number of teachers present in the sample. Among the male and female teachers of each city, the number obtained in the sample was randomly selected. The work was done in such a way that a number from one to ten was chosen randomly, for example number 3; the number was chosen according to the size of the sample and the community, for example 5. The second person present in the sample was number 8. The third person was number 13 and so on until the end. Then, the questionnaire link was sent to all of them, and with repeated

follow-ups, a total of 161 questionnaires were completed and ready for statistical analysis.

The questionnaire was designed based on a Likert scale (including absolutely true, true, somewhat, false, and absolutely false). The questionnaire consists of 6 subscales, and the score of each subscale can be obtained separately or their scores can be added together and used as a total score related to the obstacles. The questionnaire contains 22 items. The amount of Content Validity Ratio (CVR) in all items was higher than the standard value (0.50). Also, all the components of the questionnaire had a Content Validity Index (CVI) higher than 0.85. Also, exploratory and confirmatory factor analysis was used to determine the construct validity and Cronbach's alpha was used for reliability. The results are reported in the finding section. Face validity of the questioner was checked and confirmed by 4 experts in the education field. Some modifications were done using the expert comments including rewriting some questions.

Statistical Methods

In the quantitative part, Amos software version 24 and SPSS software version 25 were used to analyze the tool and findings. In inferential analysis, Pearson correlation coefficient and stepwise regression method were used to prioritize the barriers to the integration of emerging technology in educational system. The steps of the research are shown in Figure 1.

Table 3: Statistics of primary teachers in North Khorasan province who had access to minimal ICT equipment and sample size based on Gpower

Row	Region	Men	Women	Total	Sample
1	Esfrain	174	338	512	23
2	Bam and Safi Abad	44	120	164	7
3	Bojnord	376	1010	1386	53
4	Jajarm	82	114	196	11
5	Raz and Jargalan	130	81	211	11
6	Shirvan	281	443	724	33
7	Farouj	110	159	269	14
8	garne	73	64	137	7
9	Mane and Samlaqan	199	241	440	21
Total		1469	2570	4039	180

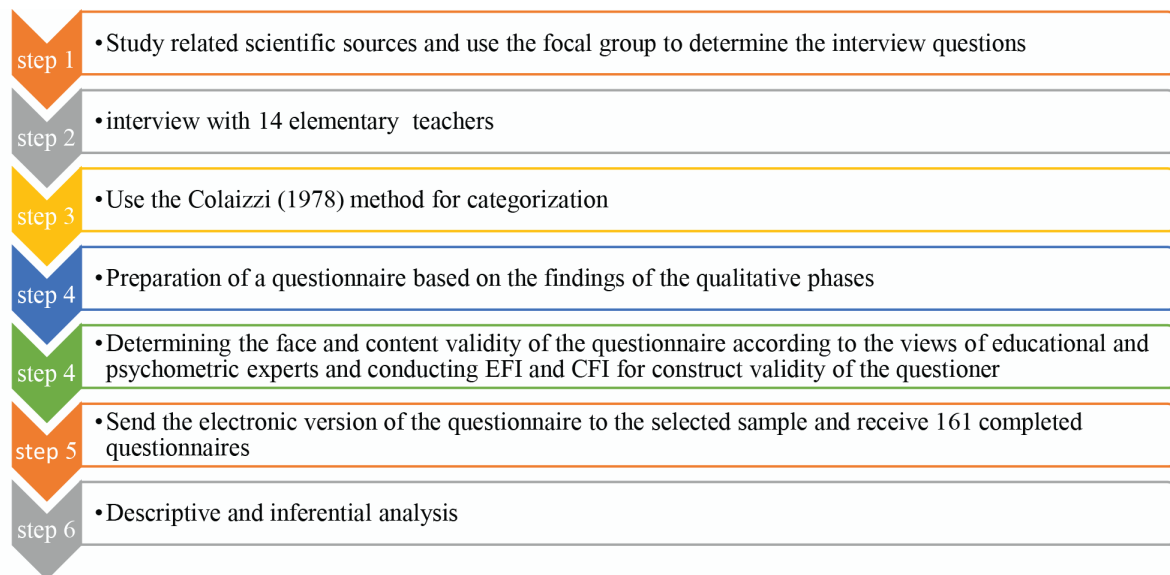


Figure 1: Steps of conducting research

Result

In this section, the findings of the qualitative and quantitative study were analyzed. In the qualitative section, a summary of the categories and subcategories obtained from the interview was presented, which has been analyzed based on the Colaizzi's method. In the quantitative section, after examining the form of data distribution, we examined the question of "Does technology improve the quality of teaching and learning?" Finally, we addressed the important question of "What is the order of priority of barriers to the use of technology in education?"

According to the qualitative findings, experts and primary school teachers listed various factors as barriers to the use of ICT in schools. The results of the interviews with primary school teachers and principals about barriers to the use of ICT in school are presented in Table 4. This Table only includes the concepts and final categories. As observed in the Table, the extracted categories include Teachers' knowledge and skill, Teachers' self-confidence, equipment and infrastructure, and budget and monetary resources.

Based on the findings of the qualitative part, a questionnaire of 22 questions with six components was compiled. After distribution among the research sample, 161 complete

questionnaires were obtained.

In order to check whether the developed scale will repeat the assumed structure among the people present in the studied community or not, we performed exploratory factor analysis with principal components model and Varimax with Kaiser Normalization rotation on the data using AMOS software version 24. The value of KMO was 0.784, which indicates the adequacy of the selected sample. Also, Bartlett's sphericity test was equal to 1784.719 and significant at $P < 0.001$ level, which showed that (the correlation of the data in the population was not zero. According to these results, it is possible to perform factor analysis on the data. In the following part, the direction of data analysis was obtained by using multiple rotations of two factors that had eigenvalues higher than one, and their items had factor loadings higher than 0.35. In the initial analysis, 5 items had a common load. After they were removed, six factors were obtained that explained 70.95% of the variance in total. As can be seen in Table 3, all factor loadings were more than 0.3, which indicates a strong relationship between the factors, and each factor is loaded under its own component. The number of question, factor loadings and Eigenvalue are displayed in the Table 5.

Table 4: Findings of the interviews

Concepts	Categories
Veteran teachers have low technical knowledge and skills	Teachers' knowledge and skill
Teachers' inadequate knowledge and skill is the reason for their resistance to the use of ICT in school	
Teachers' inadequate knowledge and skill is the reason for their fear of using ICT in school	
Teachers feel that students are more tech-savvy than they are	Teachers' self-confidence
Teachers' fear and resistance is rooted in their lack of knowledge and skill	
The quality of purchased equipment is low	Equipment and infrastructure
There is not enough equipment	
Equipment is not up-to-date	
Internet bandwidth is low	
Schools are facing a lack of funding for educational technology	Budget and monetary resources

Table 5: Factor analysis for the quality of teaching and learning, rate of usage, from technologies, teachers' self-confidence, teachers' knowledge and skill, equipment and infrastructure, budget and monetary resources

Item	Component 1: quality of teaching and learning	Component 2: Rate of usage from technologies	Component 3: Teachers' self- confidence	Component 4: Teachers' knowledge and skill	Component 5: Equipment and infrastructure	Component 6: budget and monetary resources
18	0.891					
19	0.874					
17	0.812					
20	0.811					
21	0.800					
22	0.778					
16	0.753					
15	0.703					
1		0.874				
3		0.832				
2		0.760				
10			0.866			
12			0.845			
11			0.823			
5				0.861		
6				0.798		
4				0.636		
8					0.750	
7					0.746	
9					0.708	
14						0.897
13						0.884
Total Variance Explained			70/955			

The scree plot (Figure 2) shows the eigenvalues for each item. As shown in Figure 2, item 1 had the highest eigenvalue.

In order to check other models and find the desired hypothetical model more

precisely, confirmatory factor analysis with the maximum likelihood model was used. For confirming the consistency of the scale items in terms of content and infrastructure dimensions, a confirmatory factor analysis

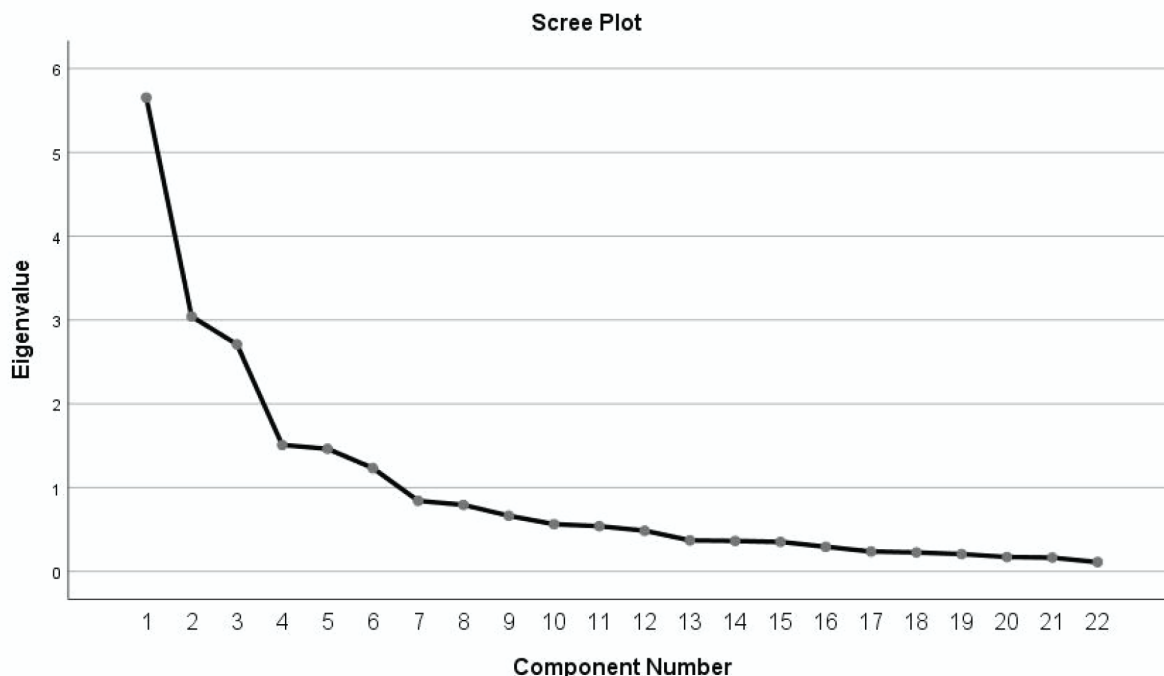


Figure 2: Scree plot of eigenvalue for each item

Table 6: Characteristics of the goodness of fit of the scale of usage, obstacles to the use of technology in education and the quality of teaching and learning

Hypothetical Model	χ^2	df	p	χ^2/df	RMSEA	CFI	RFI
Six factors	361.068	194	<0.001	1/861	0.073	0.901	0.757

with a six-factor pattern was performed on the scale. As can be seen in Table 6, the comparative fit index (CFI=0.901) and the relative fit index (RFI=0.757) had a range between zero and one, which indicated that the model had a good fit. The closeness of these two indices to one indicated a better fit of the model. The Root Mean Square Error of Approximation (RMSEA=0.073) index was less than 0.08, which indicates the good fit of the model.

Figure 3 shows the standardized path coefficients of the scale with a six-factor structure.

The reliability of the questionnaire after removing 5 items and the correction of items is presented in Table 7.

As to the findings of the quantitative section, to consider the relationship between the “rate of use from ICT” and the “quality of teaching-learning” based on the normality of the distribution of variables, was used Pearson

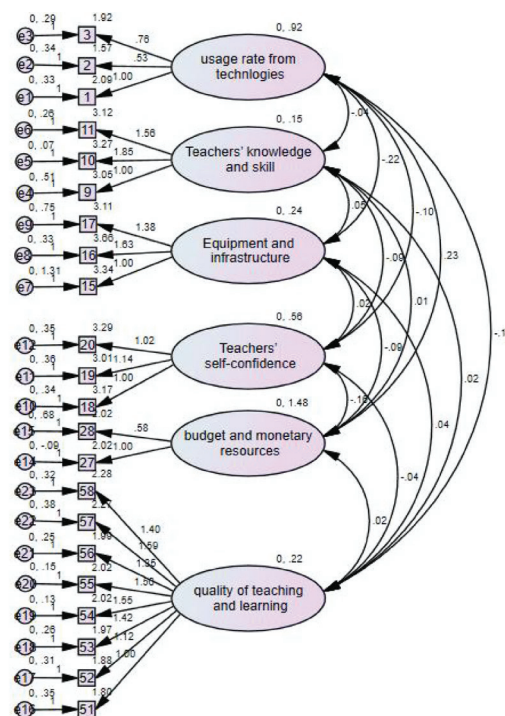


Figure 3: Chart of the standardized coefficients of the path of the six-factor structure of the scale of usage, obstacles to the use of technology in education and the quality of teaching and learning

Table 7: Reliability of the researcher-made questionnaire based on Cronbach's alpha

Subscales	Number of items	Cronbach alpha coefficient
Rate of usage from technologies	3	0.80
Teachers' knowledge and skill	3	0.73
Equipment and infrastructure	3	0.61
Teachers' self-confidence	3	0.84
Budget and monetary resources	2	0.80
Quality of teaching and learning	8	0.92

Table 8: Pearson test results on the relationship between variables of teachers' use of equipment and quality of teaching-learning

Variable	Quality of teaching-learning	
	The correlation coefficient	Significance level
The rate of ICT usage	-0/182	0/021

Table 9: Results of step-wise regression test for the priority of barriers

Variables	SE	Unstandardized Coefficients		Standardized Coefficients	t	P-value
		β	Std. Error	β		
Equipment and infrastructure	2.260	-0.244	0.074	-0.256	-3.294	<0.001
Budget and monetary resources		0.173	0.089	0.148	1.947	<0.053
Teachers' self-confidence		-0.112	0.075	-0.119	-1.496	<0.137
Teachers' knowledge and skill		-0.074	0.102	-0.058	-0.719	<0.473

Dependent Variable: rate of usage from technology

correlation (Table 8). According to the data, there was a negative relationship between the use of ICT and the quality of teaching-learning ($r=-0.182$; p value= 0.021). This means that, contrary to expectations, not only the use of ICT does not increase the quality of learning, it also decreases it. Technology alone is not able to increase the quality of teaching and learning, besides, attention should be paid to appropriate teaching and learning methods.

For priority of barriers related to the use of ICT equipment, we used standard coefficients obtained from step-wise regression, the priority of these barriers was determined according to these coefficients (Table 9).

As the results of Table 9 show, and considering the importance of Beta Standardized coefficients in determining

the priority of barriers to the use of ICT in education, "Equipment and infrastructure" ($\beta=-0.256$; $P<0.001$) was the highest and then the "Budget and monetary resources" ($\beta=-0.148$; $P<0.053$), "Teachers' self-confidence" ($\beta=-0.119$; $P<0.137$), and followed by "Teachers' knowledge and skill" ($\beta=-0.058$; $P=0.47$).

Discussion

Proponents of equipping schools with technology believe that technical solutions drive education into the future (23). Because education is an inherently political issue (10), powerful global actors such as the Organization for Economic Co-operation and Development (OECD) also support this approach (24). However, regardless

of the goals, teaching-learning processes, curriculum content, classroom management, assessment methods, etc., technology alone cannot make much positive difference in education. According to Clark, the medium conveys the message, not improves it (17).

The integration of ICT in the educational process is a difficult task (1, 4, 25, 26); in fact, it is associated with various obstacles. The present study was designed to determine the barriers to the integration or use of ICT in the teaching and learning process in North Khorasan Province. To achieve this goal, first scientific sources were used to identify the obstacles that other countries had experienced. Previous studies in developed and developing countries have pointed to the importance of Teachers' beliefs and attitudes, Lack of knowledge and skill, Lack of self-confidence, Mental norms, and Perceived competency of teachers) as the variables related to teacher; also, Lack of equipment/resources, Weak educational/professional development opportunities, Inappropriate class situation, Lack of appropriate educational software, Lack of technical supports, Lack of budget, Lack of time, Curriculum and teacher guide, Nature of education and training in elementary education, Resistance to change, Ineffective policies and programming, Students, Culture of the school, Large number of students, Organizational factors, Weakness of leadership, Role of people and feedback, Complexity of ICT integration, and Evaluation system were considered as the variables related to the structure that act as an important barriers to the integration or use of ICT in the teaching and learning process (27-35).

Then, in a depth and semi-structured interview with primary school teachers, experts and managers, four barriers (including Teachers' knowledge and skill, Teachers' self-confidence, as the variables related to the teacher and Equipment and infrastructure, Budget and monetary resources as the variables related to structure) to the use of ICT in education were identified. Findings of this study indicated

that barriers to the integration of ICT in North Khorasan schools were consistent with those of other countries (28-31).

Findings indicated that nearly two decades of hardware and software investment in extending ICT in schools has not led to its widespread and effective use. According to the findings, the use of ICT does not have a positive association with improving the teaching and learning quality; besides, it may lead to a decline in the quality of the teaching-learning process. These findings are in line with those of (27-35).

One of distinctions of the finding of this research is its attempts to mark the starting point for the education system by prioritizing barriers in terms of their importance. In this regard, the most important factors that underlie the failure to use ICT in school, in the order of priority, include lack of "Budget and monetary resources", "Equipment and infrastructure", "Teachers' self-confidence", and "Teachers' knowledge and skill".

Limitation and Suggestions

The main limitation of the current research is that it was conducted during the COVID-19 pandemic, so that the interviews were conducted over the phone and the questionnaires were sent and received electronically. The study was conducted in North Khorasan province and in primary schools. It is suggested that the study should be repeated in normal times and face-to-face in other provinces and educational levels.

Conclusion

According to the findings of this study, if the managers of the educational system intend to remove the obstacles related to the integration of ICT in education, in the first step it is necessary to provide sufficient resources and then provide appropriate education to change the teachers' self-confidence, knowledge and skill. Given that, the use of ICT does not have a positive association with improving the teaching and learning quality and may lead to a decline in the quality of

the teaching-learning process. The important point is to simultaneously pay attention to other aspects of teaching and learning such as goal, content, teaching-learning methods, evaluation methods, etc. to improve the quality of teaching and learning.

Authors' Contribution

All authors participated in design of the study, collecting and analyzing the data, drafting the manuscript, and finalizing the manuscript. All the authors reviewed the manuscript and approved the final version. They take full responsibility for the content and writing of this article.

Conflict of Interest: None declared.

Ethical Consideration

Written informed consent was obtained from all the participants. All of them were engaged in the study voluntarily, and their names were not mentioned in the scripts. Moreover, the Ethics Committee of Bojnord University approved the protocol of this study (Ethics code: IR.UB.REC.1401.017).

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