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Providing a training model for producing electronic content to prepare teachers to teach in the virtual space of schools

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ABSTRACT

Background and Aim: Virtual education is one of the types of education that has shown its role in recent years, especially during the Corona period. Therefore, the aim of the current research was to provide a model of electronic content production training for preparing teachers to teach in the virtual environment of elementary schools in Bushehr province. **Methods:** The current research method was mixed (qualitative-quantitative) and practical in terms of execution method. The qualitative research community included university experts of Bushehr in the academic year of 2020-2021-, of which 40 people were selected based on the rule of theoretical saturation and with the purposeful sampling method. The statistical population of the quantitative part included 552 university professors in Bushehr city in the academic year of 2020-2021, and the sample size was determined based on Cochran's formula of 225 and selected by random sampling. The tools of the qualitative part of the interview and the quantitative part of the questionnaire were made by the researcher. The validity of the qualitative part of the tool was done with face validity, and the reliability was 0.82 with the agreement coefficient between the coders. Also, in the quantitative part of the research, formal validity and reliability were obtained with Cronbach's alpha of 0.85. Qualitative part analysis was done by coding method in MAXQDA3 software and quantitative part was done by partial least squares method in Pls smart3 software. **Results:** In the qualitative section, 5 components (content, evaluation, technical infrastructure, planning and learning environment) and 41 indicators were identified for the e-learning model. Based on the results of the quantitative part, the factor load, which is the correlation coefficient between the implicit variable (e-learning) and the obvious variables in a model, is related to planning (0.74), content compilation (0.63), evaluation (0.58), technical infrastructure (0.51) and learning environment (0.5), respectively. Also, according to the results of structural equation modeling, the planning component with a coefficient of 0.42, content compilation with a coefficient of 0.21, evaluation with a coefficient of 0.18, technical infrastructure and learning environment with a coefficient of 0.14 respectively had the greatest effect on e-learning. E-learning is the necessity of the educational system in the future. **Conclusion:** It can be concluded that the first step is to ask professors and experts to identify and solve the challenges of e-learning and plan for the implementation of this system in the education system according to the components of content, evaluation, technical infrastructure, planning and learning environment.

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Introduction

In the current era, the use of modern educational tools with high flexibility, which can aid in more effective learning for students, appears essential (Seraji & Rostami, 2016). Previous studies indicate that the use of modern technologies plays a key role in educational development. For instance, McGoff and Salomon (2014) believe that the use of web-based educational tools plays a significant role in providing self-directed education and actively involves students in the teaching-learning process. Boutiki and colleagues (2015) also argue that the use of technology-based teaching tools and techniques in classroom lessons engages students in self-directed and collaborative activities, providing a collaborative platform for them to actively participate in their own learning, share information resources, and receive feedback (Ahmadi et al., 2020).

Currently, in the process of modern teaching and learning methods, the use of electronic content by various educational communities around the world has garnered special attention. Consequently, the stages of planning, designing, producing, and evaluating, as well as the roles and responsibilities of those involved in the process of producing electronic content, are of great importance due to their impact on the development of electronic education (Kazemi Ghareh Cheh et al., 2011). Therefore, the content element, as the first step, should be selected and employed with precision and according to valid criteria and principles (Seraji & Shahbazi, 2011). As one of the responsibilities of teachers, especially in smart schools, is to produce and use electronic content for classroom education (Jalali et al., 2010), web-based educational resources can be considered one of the most accessible and common information sources for electronic content production.

Teachers can use these web-based educational resources as valuable sources for producing the electronic content they need for classroom teaching (Mohammadi et al., 2015). However, sometimes the use of such resources is accompanied by challenges (Mohammadi & Abriz, 2015). Teachers will welcome and use these web-based educational resources if the content is reliable for them and easy to use (Harig & Zhao, 2009). Moreover, the interactive nature of web resources can motivate teachers to use them in line with their educational goals (Lin & Davis, 2012; Hu & Cheong, 2013). Accordingly, the evaluation of web resources for teachers' use, before they make a serious decision to use them, has been emphasized by scientific and research communities (Kim & Sin, 2011). Since factors such as the characteristics of the web-based educational resources themselves or the personal characteristics of users of these resources, like their skills and confidence in using web resources, play a significant role in teachers' acceptance and use to meet their classroom educational needs (Mohammadi & Mahmoudi, 2019), it seems that attention to this matter is essential to enhance the productivity of web resources for educational purposes in schools and educational environments.

Therefore, the development of teacher training to improve and refine their skills for creating electronic content in virtual school environments seems necessary. Considering this necessity, a search among existing literature on the topic of this research by the researchers shows that to date, no qualitative research in Iran has been conducted that provides a model for training in electronic content production to prepare teachers for teaching in the virtual space of primary schools in Bushehr Province; thus, the main goal of this research is to present a model for training in electronic content production to prepare teachers for teaching in the virtual space of primary schools in Bushehr Province.

Method

The current research is applied in nature and employs a mixed (qualitative-quantitative) method. In the qualitative part, the statistical population included educational experts in Bushehr city during the 2020-2021 academic year. Based on purposive sampling, 40 experts were selected following theoretical saturation principles for participation in the Delphi panel. The criteria for their selection included publications related to virtual and electronic education, faculty membership in one of the country's universities, and willingness to participate in the research. In the quantitative part, the statistical population comprised 552 university professors in Bushehr city during the 2020-2021 academic year, out of which 225 were selected as the sample size using random sampling.

Materials

[DOR: 20.1001.1.28212525.1402.4.0.32.0]

1. Semi-structured interview: In the qualitative part, semi-structured interviews were used, whose validity was confirmed through face validity, and reliability was established with a concordance coefficient of 0.82.

2. Researcher-made questionnaire: In the quantitative part, a researcher-made questionnaire consisting of 52 questions was used, based on qualitative findings. It included 47 indicators on a 5-point Likert scale (very high 5, high 4, moderate 3, low 2, very low 1). The validity of the quantitative data was also confirmed through face validity, and reliability was assessed using Cronbach's alpha, which resulted in 0.83.

Implementation

For data analysis, in the qualitative part, coding methods and MAXQDA3 software were used, while in the quantitative part, inferential statistical methods, exploratory factor analysis, and structural equation modeling were conducted using Smart Pls3 software.

Results

Initially, some demographic characteristics of the participants are presented. Accordingly, in the qualitative part, 70% of the sample (28 individuals) were male, and 12 were female. Additionally, 25 individuals (62%) held doctoral degrees, and 15 had master's degrees. In the quantitative part, 73 individuals (33%) were female, and 152 (68%) were male. In the research sample, 88% held doctoral degrees, and 12% had master's degrees.

Table 1. The extracted indicators by qualitative analysis

COde	Indicator	Value	Result
1	Designing course content and testability based on defined objectives	9	Approved
2	Emphasis on high-quality, valid, competitive, and research-based content	9	Approved
3	Readable resources	9	Approved
4	Designing content production systems	9	Approved
5	Audio and visual files	8.2	Approved
6	Slides and lecture notes	8.2	Approved
7	Development of content based on principles of multimedia educational design	8.2	Approved
8	Evaluation of learners	8.2	Approved
9	Assessment of the learning environment and teaching	8.2	Approved
10	Providing feedback and making corrections	8.2	Approved
11	Assessing entry behaviors	8.2	Approved
12	Performance evaluation	8.2	Approved
13	Learning assessment	8.2	Approved
14	Providing web-based and electronic services	8.2	Approved
15	Website design	8.2	Approved
16	Maintaining electronic content	8.2	Approved
17	Initial design of software and hardware platforms	8.2	Approved
18	Loading speed and bandwidth	8.2	Approved
19	Interface design	8.2	Approved
20	Online support	8.2	Approved
21	Availability of high-speed internet, appropriate educational software, etc.	8.2	Approved
22	Existence of an online center for enrollment and registration of learners	8.2	Approved
23	Analysis of objectives	8.2	Approved
24	Information dissemination and recruitment	8.2	Approved
25	Grouping learners	8.2	Approved
26	Analyzing learners	8.2	Approved
27	Formulating educational goals	8.2	Approved
28	Determining teaching-learning strategies	8.2	Approved
29	Assessing learners' needs	8.2	Approved
30	Defining behavioral objectives	8.2	Approved
31	Determining strategies for curriculum delivery	8.2	Approved
32	Determining media and educational materials	8.2	Approved
33	Determining the timing and location of education	8.2	Approved
34	Designing interaction	8.2	Approved
35	Reviewing learners' learning styles	8.2	Approved

[DOR: 20.1001.1.28212525.1402.4.0.32.0]

36	Reviewing professors' entry behaviors regarding e-learning	8.2	Approved
37	Emphasizing collaborative learning (cooperation and interaction)	8.2	Approved
38	Overcoming communication barriers	8.1	Approved
39	Familiarizing learners with effective interaction methods	8.1	Approved
40	Having interest and motivation to participate in activities, etc. in a distance learning environment	7.8	Approved
41	Ability to respond online and offline to assigned activities	7.3	Approved
42	Access to high-speed internet and bandwidth	6.9	Rejected
43	Focusing on self-learning and self-assessment of learners	6.2	Rejected
44	The system's commitment to providing services to learners	6.01	Rejected
45	Concern for the safety and security of the system	5.9	Rejected
46	Technical support for the learner	5.7	Rejected
47	Focusing on training professors, administrative staff, and students for delivering electronic education.	5.6	Rejected

The results from the collected data showed that 41 indicators were validated by experts for designing electronic education. Table 1 presents the identified indicators. For model fitting using PLS, two types of tests are discussed: the measurement model (related to the validity and reliability of the measurement tool) and the structural model (testing research hypotheses and the effect of latent variables on each other). In the first test, the reliability and validity of the model are examined. Test reliability relates to measurement accuracy and stability. Internal consistency reliability and composite reliability were assessed:

Table 2. Composite reiliability, AVE and Cronbach's Alpha

Variable	Composite	AVE	Cronbach's Alph
Content Development	0.85	0.54	0.85
Evaluation	1.29	0.55	0.83
Technical Infrastructure	0.90	0.47	0.64
Planning	0.80	0.51	0.92
Learning Environment	0.82	0.52	0.77
Instructional Design	0.71	0.58	0.96

Internal consistency reliability of items: The reliability of each item refers to the factor loadings of each observed variable, used to determine the extent to which measurement indicators (observed variables) are acceptable for measuring latent variables. The minimum acceptable value is 0.4. The results of examining factor loading coefficients show that some items have factor loadings less than 0.4; thus, the measurement model was re-examined after removing these items, and items with factor loadings above 0.4 were used in subsequent analyses.

Composite reliability (Dillon-Goldstein's ρ coefficient): The second criterion for reliability should be higher than 0.6. As observed in Table 2, the composite reliability coefficient for all research variables is at an acceptable level and above 0.6. The results of the factor analysis are presented in Table 3.

Table 3. Factor loadings and t-values

Component	Factor load	Indicator	Factor load	t
Content Development	0.63	Course Content Design and Testability Based on Set Objectives	0.72	4.17**
		Emphasis on High-Quality, Credible, Competitive, and Research-Based Content	0.64	3.84**
		Readable Resources	0.73	1.85
		Design of Content Production Systems	0.73	1.85
		Audio and Visual Files	0.56	5.73**

[DOR: 20.1001.1.28212525.1402.4.0.32.0]

		Slides and Lecture Notes	0.49	4.83**
		Content Development Based on Principles of Multimedia Instructional Design	0.71	4.14**
Evaluation	0.58	Learner Evaluation	0.68	2.21*
		Assessment of Learning and Teaching Environments	0.67	2.74**
		Providing Feedback and Corrections	0.62	2.88**
		Assessment of Entry Behaviors	0.62	2.88**
		Performance Evaluation	0.62	3.78**
		Learning Assessment	0.71	4.13**
Technical Infrastructure	0.51	Provision of Web-Based and Electronic Services	0.46	4.13**
		Website Design	0.70	4.83**
		Maintenance of Electronic Content	0.49	1.54
		Initial Design of Software and Hardware Platforms	0.40	2.8*
		Loading Speed and Bandwidth	0.36	3.13**
		Interface Design	0.33	1.85
		Online Support	0.50	2.84**
		Availability of High-Speed Internet, Suitable Educational Software, etc.	0.16	1.78
		Presence of an Online Center for Enrollment and Registration of Learners	0.56	5.15**
Planning	0.42	Objective Analysis	0.71	4.16**
		Information Dissemination and Recruitment	0.73	1.85
		Grouping of Learners	0.73	1.85
		Analysis of Learners	0.63	6.13**
		Formulation of Educational Goals	0.56	5.30**
		Determining Teaching-Learning Strategies	0.68	4.5**
		Assessing Learners' Needs	0.73	1.85
		Defining Behavioral Objectives	0.73	1.85
		Determining Strategies for Curriculum Delivery	0.55	1.96*
		Determining Media and Educational Materials	0.55	1.96*
		Determining Timing and Location for Education	0.69	4.8**
		Designing Interaction	0.73	1.85
		Examining Learners' Learning Styles	0.73	1.85
		Reviewing Professors' Entry Behaviors Regarding E-Learning	0.51	1.57
Learning Environment	0.14	Emphasizing Collaborative Learning (Cooperation and Interaction)	0.72	4.19**
		Overcoming Communication Barriers	0.65	2.7*
		Familiarizing Learners with Effective Interaction Methods	0.65	2.7*
		Having Interest and Motivation to Participate in Activities, etc., in Distance Learning Environments	0.50	2.58**
		Ability to Respond Online and Offline to Assigned Activities	0.50	2.84**

**p<0.01; *p<0.05

According to the data in Table 3, in the measurement models, factor loadings (path coefficients) related to indices with t-values ranging from 1.96 to 2.57 are significant at the 0.05 error level, and factor loadings for indices with t-values above 2.57 are significant at the 0.01 error level, marked with * and **, respectively. Subsequently, the results of the structural equation outputs are presented in Figure 1 and 2.

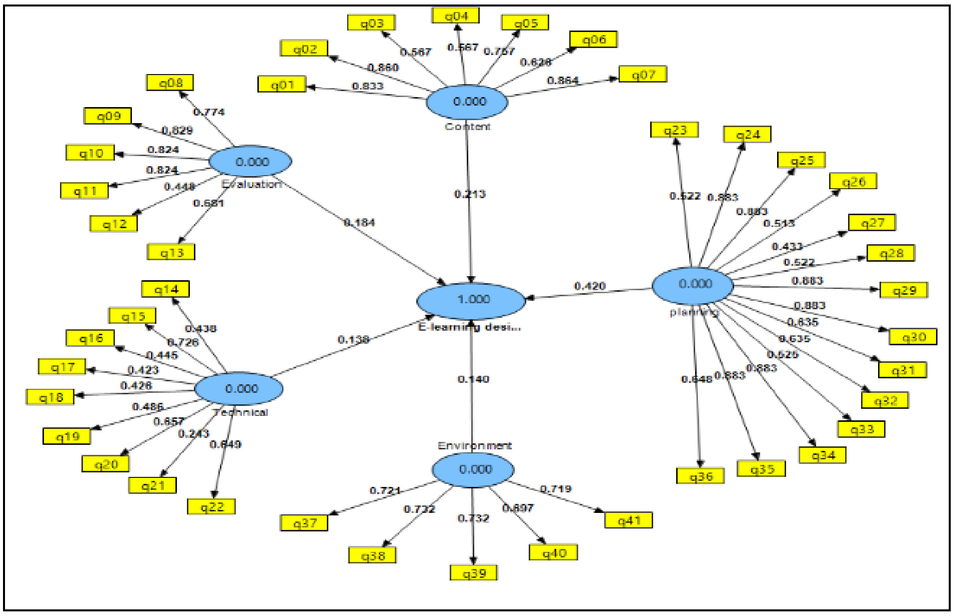

Figure 1. Factor loadings between observed variables

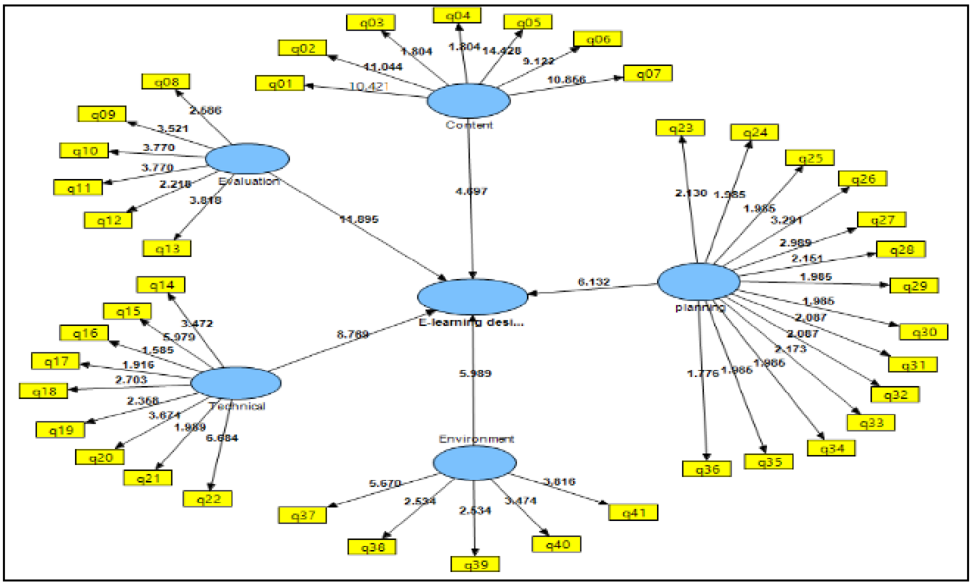

Figure 2. T-values in the measurement model

Table 4 presents the path coefficients in the structural model, related to the components of designing electronic education. Also, the results from estimating coefficients and t-statistics for evaluating the structural part of the model are presented in Table 4. If the t-values are greater than 1.96, it indicates the validity of the relationship between constructs, and hence, the confirmation of research hypotheses at the 95% confidence level.

Table 4. Factor loadings and t-values

Row	Component	Path coefficient	t
1	Content Development	0.21	4.70**
2	Evaluation	0.18	11.89**
3	Technical Infrastructure	0.14	8.77**
4	Planning	0.42	6.13**
5	Learning Environment	0.14	5.99**

**p<0.01; *p<0.05

Based on the results in Table 4, significant path coefficients and t-values indicate that the planning component, with a coefficient of 0.42, has the most significant impact on designing electronic education. Content development, with a coefficient of 0.21, ranks second in importance. Evaluation, with a coefficient of 0.18, ranks third in importance, and technical infrastructure and learning environment, with coefficients of 0.14, follow subsequently.

Conclusion

The aim of the current research was to provide a model for training teachers in electronic content production for virtual classroom teaching in primary schools in Bushehr province. In recent years, virtual and electronic education has increasingly garnered attention from experts and planners. The COVID-19 pandemic highlighted the necessity of virtual and electronic education, suggesting that it might soon become the primary educational platform, replacing traditional classrooms due to economic reasons and ease of implementation. Hence, the research's goal was to present a model for training teachers in electronic content production for virtual teaching in Bushehr province's primary schools. The qualitative results of the research identified five components (content, evaluation, technical infrastructure, planning, and learning environment) and 41 indicators for designing electronic education.

Based on the qualitative stage results, the first component of the electronic education design model is content. Studies such as Dertaj et al. (2018), Lester (2015), and Raboumen et al. (2020) also highlighted this component as crucial in electronic education design. This finding suggests that content closely relates to electronic education. The provided content should be implementable in an electronic education platform to enhance the effectiveness of this type of education. Although electronic learning differs from traditional education, the characteristics of content in electronic learning are such that they make it distinct from traditional formal methods. In electronic learning, content and learning materials need characteristics suitable for situations requiring high levels of learner autonomy and independence. Poor quality of electronic content will lead to disinterest in this educational system; thus, this component is one of the most influential on electronic education, especially in the university sector. Also, in the quantitative phase of the research, this component was the most correlated with electronic education, with a factor loading of 0.21.

Evaluation was identified as another component in the qualitative research phase. This finding aligns with studies by Dertaj et al. (2018), Lester (2015), and Azizi Far et al. (2018). Evaluation in electronic courses is essential to strengthen and improve the challenges of this type of education. In Iran, due to internet infrastructure problems and internet disruptions, evaluation can lead to improvements in virtual education. Moreover, evaluation allows for identifying gaps in the transfer of educational materials to students, hence closely relating to all electronic education components. The performance and satisfaction of users can prioritize its effectiveness. Evaluation reveals the current state of electronic education, making it a crucial component in determining the success or failure of the system's implementation. With a factor loading of 0.58, evaluation ranked second. Evaluation is crucial in education, as it can show students' satisfaction levels on one hand and professors' satisfaction on the other at the end of electronic education. The structural equation modeling results showed that evaluation positively and significantly impacts electronic education with a coefficient of 0.18.

Another component identified by experts in the qualitative research phase was technical infrastructure. This finding is consistent with studies by Azizi Far et al. (2018) and Foroughi and Yarmohammadi (2018), where hardware platforms and infrastructure were also identified as elements of the electronic education model. The first principle and step in electronic education relate to the readiness and response of infrastructures. Discussing virtual education without suitable infrastructure is futile. Although infrastructure problems and other hardware platforms vary according to development levels across regions in Iran, it is concluded that necessary infrastructures should be available in universities to facilitate electronic education without minimal challenges. Continuous disruptions in these teachings can negatively affect user satisfaction and, consequently, undermine the confidence and tranquility of electronic education. Thus, the existence of infrastructures as an essential component of electronic education must be considered in designing this system. The more advanced the technical infrastructure, the more successful the implementation of electronic education. According to the research's quantitative part, this variable's factor loading was 0.51, and its impact coefficient on electronic education was 0.14. This finding suggests that while the infrastructural component ranked last in electronic education design, it must be noted that in our country, hardware infrastructures for electronic education vary depending on regional development levels. This might be why infrastructural challenges were deemed less significant in this study.

Conflict of Interest

According to the authors, this article has no financial sponsor or conflict of interest.

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