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Research Paper

Study the Educational Implications of Constructivism Philosophy Based on the Klein Planning Model in Distance Learning

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Abstract

Today, education is one of the basic rights of humans and is a major factor in economic and social development. The main purpose of this study is to study the educational implications of constructivism philosophy based on the Klein planning model in distance learning. The method of this research is mixed research of Type exploratory design (identification of educational implications of constructivism) and the statistical population of this study has been formed by all specialists and postgraduate students (Ph.D.) of distance education planning in the academic year of 2017-2018. From this statistical population, a sample of 193 people (132 women, 61 males) was selected by random sampling. Data were analyzed using Confirmatory Factor Analysis (CFA) and structural equation analysis (SEM). The results showed that among the nine elements of the constructivism of the content element, teaching methods, materials and resources for learning and evaluation were effective on the target element of distance learning. Also, among the factors of constructivism, the target element, content, learning activities, teaching methods, materials and learning resources, and time were effective on the content element of distance learning. These results will have important implications for the teaching and learning process through distance learning. Based on this, specialists and distance learning educators can use these results to deepen learning, promote productivity and educational efficiency.

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Introduction

Recently, new educational approaches have emerged that adequately address these needs. Accordingly, open and distance education has been proposed as a practical solution to respond to these new educational demands, improve and enhance existing programs, and achieve better educational outcomes (*Draxler & Hadad, 2005*; *Fathy Karkaragh et al., 2021*). The philosophy of education aims to articulate the values, goals, and reasons behind all educational actions. Individuals who attempt to improve the education process without paying attention to philosophical foundations ultimately produce low-value, superficial opinions and models that are unrelated to education. Therefore, all educational approaches need strong philosophical foundations to achieve their educational goals. Relatively new theories known as constructivist theories in education and psychology have roots in past scientific and philosophical thoughts (*Crotty, 1998*; *Fosnot, 2013*). The constructivist approach is based on the premise that we all construct our own understanding of the world through our personal designs and experiences. In constructivism, the main focus is on preparing the learner to solve problems in both defined and ambiguous situations (*Marjal, 2003*). *Santrock (2004)* defines constructivism as a learning approach that emphasizes the learner's active role in constructing knowledge and understanding. It is necessary to mention that electronic learning environments are actually tools to meet the demands of a large number of eager learners in higher education; they are merely tools, and for these environments to be effective, similar to traditional environments, attention must be paid to the philosophy of design, planning, and teaching. In this research, based on *Klein (1991)* theory in a traditional environment and the nine elements of his curriculum planning model, the researcher intends to examine the educational implications of constructivist philosophy in electronic educational environments and answer the fundamental questions: What are the implications of constructivism in the form of the nine elements: 1- Goals 2- Content 3- Learning Activities 4- Teaching Methods 5- Learning Materials and Resources 6- Evaluation 7- Time 8- Space 9- Grouping in distance education?

Methodology

In this research, to achieve a deep understanding of the educational implications of constructivism on distance education and to increase the generalizability of the findings, relying solely on qualitative or quantitative methods was insufficient. Therefore, a mixed-methods research approach of the exploratory design (identifying the educational implications of constructivism) was employed. The main factors were identified based on the literature and previous research. The fundamental assumption in defining mixed methods is that combining quantitative and qualitative approaches provides a better and more acceptable understanding and documentation of the research issue compared to using a single approach (either quantitative or qualitative). As a result, researchers can use all available tools for data collection (such as

focus group interviews, questionnaires, etc). This research was conducted in two main phases. In the qualitative phase, grounded theory was utilized to identify the factors and indicators (implications) of constructivism in distance education based on Klein's model, which was extracted and designed. Then, in the quantitative phase, it was modeled using structural equation modeling and was tested based on actual data.

- Statistical Tests and Data Analysis

In this study, qualitative, descriptive, and inferential statistical methods were used to analyze the data. The qualitative data of the research were analyzed through a coding process.

- Statistical Population, Sampling Method, and Sample Size

In this study, the statistical population can be defined in two parts: qualitative and quantitative.

Qualitative Section: In the qualitative section, the statistical population was formed by specialists and information holders of the constructivism approach and distance education. Based on consultations and reviews conducted, professors and experts graduated in distance education constituted this population. For sampling in the qualitative section, a purposeful sampling method was utilized, where experts and information holders in this field were selected one by one for data collection. The sample size was determined based on the principle of reaching theoretical saturation and was finalized at 15 individuals.

Quantitative Section: In the quantitative section, the statistical population was composed of individuals involved in distance education and the philosophy of education, including doctoral students in distance education and doctoral students in the philosophy of education from Payame Noor University from previous years. In this section, a sample of 193 individuals (132 women and 61 men) was selected using a random sampling method. For selecting the research samples for the questionnaire implementation, a random sampling approach was used, individuals were selected, and the questionnaire was distributed among them. After providing necessary explanations for complete completion, the data was collected.

- Data Collection Tools and Methods

Qualitative Section: For collecting themes, components, and educational implications of constructivism, the interview method was used. After gathering the opinions of respondents, the items were extracted and the research questionnaire was developed based on this. The qualitative data of the research were analyzed through a coding process based on the systematic approach of grounded theory proposed by *Strauss and Corbin (1998)*. In this study, Klein's theory was used to integrate the items (*Strauss & Corbin, 1998*).

Quantitative Section: In the quantitative section, a questionnaire was created in the form of a five-point Likert scale based on the items derived from the qualitative section.

Researcher-Made Questionnaire: Following the interviews and

coding of sub-components and main components, a questionnaire was developed. After designing the questionnaire, its psychometric properties were tested to ensure validity and reliability. To confirm the reliability of the questionnaire and the internal consistency of the items, Cronbach's alpha coefficient was calculated for a preliminary sample (30 individuals).

Findings

- Questionnaire Analysis and Development

Based on table (1), the results and items mentioned in the table were interviewed and obtained based on the Grand Theory.

Table 1. Results and elements obtained from the grand theory during the interview process

Extracted items			
NO.	Description	NO.	Content Element
1	Lack of a clearly defined objective	1	Learner-centered selection of content
2	Long-term objectives	2	Textbook-based content
3	Emphasis on general and guiding objectives	3	Content that is stimulating and problem-based
4	Availability of education anytime and anywhere	4	Constructivist nature of the content
5	Development of negotiation and participation skills	5	Necessity for diverse content
6	Creating learning opportunities for everyone	6	Relevance of content to daily needs
7	Simplifying education and learning	7	Content as a tool in the learning process
8	Objectives that are negotiable and personalized	8	No reliance on predetermined content
9	Emphasis on developing critical thinking	9	-
10	Reduction of transportation costs	10	-
NO.	Teaching Method Element	NO.	Evaluation Element
1	The role of guiding and facilitating by the teacher in teaching	1	Lack of emphasis on pencil-and-paper tests
2	Emphasis on directive and consultative teaching methods	2	Emphasis on self-assessment and self-evaluation
3	Top-down approach in teaching	3	Integration of evaluation with teaching
4	Emphasis on mastery-based teaching methods	4	Emphasis on skills-based assessment
5	Focus on exploratory teaching	5	Simultaneity of teaching and evaluation
6	Teaching through examples and case studies	6	Focus on skills-oriented evaluation
7	Emphasis on peer learning in education	7	Continuous and ongoing assessment
8	Overemphasis on the teacher's role in teaching	8	Emphasis on process-oriented evaluation
9	Selection of teaching methods based on learners' needs and conditions	9	Focus on group assessment
10	Emphasis on problem-solving methods	10	-
NO.	Learning Materials And Resources Element	NO.	Learning Activities Element
1	Self-learning of educational materials and resources	1	Instructor and learner participation in educational design

2	Educational materials derived from the living environment	2	The role of the instructor in supporting and guiding the educational process
3	Educational resources appropriate to the needs, attractive and enjoyable	3	Emphasis on the active action and reaction of the learning environment
4	Emphasis on supplementary books, audio tapes and laboratory kits	4	Emphasis on prescriptive instruction in learning
5	Emphasis on self-learning materials	5	Emphasis on the learner-centeredness in the learning process
6	Emphasis on learning materials on personal goals	6	Emphasis on problem-solving skills
7	Relationship of educational materials with previous learning	7	Emphasis on the personalization of the learning process
8	-	8	Emphasis on challenging and complex problems
9	-	9	Emphasis on the learner's interests in the learning process
10	-	10	High emphasis on the learner's social interactions in education
NO.	The Element of Time	NO.	The Element of Place
1	Emphasis on the importance of time in learning	1	The role of the teacher in preparing the educational space
2	Emphasis on step-by-step learning	2	The activity-oriented nature of the learning environment
3	Emphasis on time planning in education	3	The absence of spatial limitations in learning
4	Examining ideas and thoughts over time	4	Emphasision a collaborative lear ning space
5	No time limit in learning	5	Emphasis on an attractive, pleasant, and activity-oriented environment

NO.	Grouping Element
1	Emphasis on the importance of instructors in learning
2	Specificity of grouping before instruction
3	Grouping of learners by the instructor
4	Emphasis on group interaction in learning
5	Fluidity of learner grouping
6	Emphasis on teamwork among learners

In this section, the researcher aims to design a questionnaire based on the items listed in Table (1). Therefore, the items mentioned in Table 1 were first transformed into a questionnaire using a five-point Likert scale, ranging from "Very low (1), Low (2), Medium (3), High (4), and Very high (5)." To ensure the validity and reliability and to extract the main items for quantitative statistics, confirmatory factor analysis tests were employed. Questionnaire elements include Objectives (Questions 1 to 8), Content (Questions 9 to 14), Teaching Method (Questions 15 to 21), Evaluation (Questions 22 to 26), Learning Materials and Resources (Questions 27 to 32), Learning Activities (Questions 33 to 38), Time (Questions 39 to 41), Place (Questions 42 and 43), and Grouping (Questions 44 to 46).It is important to note that the questionnaire does not contain reverse-scored questions, and all questions follow the same order. In examining the one or multiple-component structure of the questionnaire, the suitability for factor analysis was first assessed using the Kaiser-Meyer-Olkin (KMO) measure and

Bartlett's test of sphericity. The KMO value was found to be 0.923, and the Bartlett's Test statistic was 586.5841 with a significance level of 0.001, indicating that the sample and the correlation matrix are suitable for performing factor analysis, thus making factor extraction justifiable. To extract the factorial structure of the questionnaire, based on the correlation of the components, the Varimax rotation method was utilized, which means that principal component analysis was performed using the Varimax method on the 46 items of the researcher-constructed questionnaire related to distance education and constructivism based on Klein's nine components. In other words, to determine the most appropriate factors, the eigenvalues and the percentage of variance explained by each factor were co-+

nsidered. The identified factors were extracted using the principal component method along with Varimax rotation. The remaining items at this stage, which meaningfully explain the relevant factor, are presented in Table 2.

Table 2. Statistical indicators of questionnaire components in the distance education dimension after varimax rotation using principal component analysis

Indicators / Extractive agents	Eigenvalue	Percentage of variance explained	Cumulative percentage of variance explained
Objective	7/31	15/89	28/08
Content	5/60	12/19	38/98
Teaching Method	5/01	10/90	45/40
Evaluation	2/95	6/41	50/97
Learning Materials and Resources	2/56	5/57	56/54
Time	2/56	5/57	61/18
Place	2/14	4/64	28/08
Grouping	1/47	3/19	64/38
Learning Activities	1/41	3/06	67/44

In total, these 9 factors explain 67.44% of the variance in assessments from the perspective of specialists regarding distance education.

Table 3. statistical indicators of the components of the questionnaire in the constructivism dimension after Varimax rotation using principal component analysis

Indicators / Extractive agents	Eigenvalue	Percentage of variance explained	Cumulative percentage of variance explained
Objective	6/84	14/87	14/87
Content	5/75	12/51	27/40
Teaching Method	5/19	11/30	38/70
Evaluation	3/31	8/07	46/77
Learning Materials and Resources	2/21	4/80	51/56

Time	2/19	4/75	56/31
Place	2/00	4/35	60/67
Grouping	1/58	3/42	64/09
Learning Activities	1/17	2/54	66/64

In total, these 9 factors explain 66.64% of the variance in assessments from the perspective of specialists regarding the constructivism dimension. Furthermore, to ensure the convergent validity of the model and the scale, the values of two validity indices: composite reliability (cr) and average variance extracted (ave) for all factors in the two main dimensions of distance education and constructivism were examined. The results are summarized in table 3-4.

Table 4. Convergent validity results for questionnaire factors in the distance education dimension

Components	AVE	CR
Objective	0/611	0/742
Content	0/712	0/823
Teaching Method	0/599	0/861
Assessment	0/598	0/901
Learning Materials and Resources	0/632	0/901
Time	0/507	0/756
Place	0/632	0/832
Grouping	0/570	0/791
Learning Activity	0/608	0/791

The minimum acceptable value for composite reliability (cr) should be at least 0.7, and the minimum acceptable value for average variance extracted (ave) should be at least 0.5. Therefore, based on the fact that both values for all dimensions are greater than 0.7 and 0.5 respectively, the convergent validity of the questionnaire in the dimension of distance education is confidently confirmed based on the obtained results.

Table 5. Results of Convergent Validity for the Factors of the Questionnaire in the Constructivism Dimension

Components	AVE	CR
Objective	0/609	0/740
Content	0/711	0/822
Teaching Method	0/597	0/859
Assessment	0/597	0/900
Learning Materials and Resources	0/630	0/750
Time	0/506	0/753
Place	0/630	0/837
Grouping	0/569	786/0
Learning Activity	0/606	769/0

The minimum acceptable value for composite reliability (cr) should be at least 0.7, and the minimum acceptable value for average variance extracted (ave) should be at least 0.5. Therefore, considering that both values for all dimensions are greater than 0.7 and 0.5 respectively, the convergent validity of the questionnaire in the constructivism dimension is confidently confirmed based on the obtained results. Below are the results of the convergent validity of the questionnaire in the two dimensions of distance education and constructivism.

Table 6. Convergent validity results for questionnaire factors in the distance education dimension

Components	Objective	Content	Teaching Method	Assessment	Learning Materials and Resources	Time	Place	Grouping Learning Activity
Objective	1							
Content	0/713	1						
Teaching Method	0/694	0/748	1					
Assessment	0/751	0/715	0/697	1				
Learning Materials and Resources	0/611	0/632	0/774	0/644	1			
Time	0/608	0/709	0/695	0/777	0/730	1		
Place	0/536	0/459	0/782	0/832	0/503	0/746	1	
Grouping Learning Activity	0/714 0/687	0/623 0/509	0/862 0/711	0/635 0/641	0/695 0/803	0/720 0/785	0/618 0/411	1 0/593

Table 7. Convergent validity results for questionnaire factors in the constructivism dimension

Components	Objective	Content	Teaching Method	Assessment	Learning Materials and Resources	Time	Place	Grouping Learning Activity
Objective	1							
Content	0/709	1						
Teaching Method	0/678	0/754	1					
Assessment	0/745	0/733	0/686	1				
Learning Materials and Resources	0/607	0/664	0/781	0/569	1			
Time	0/605	0/714	0/682	0/789	0/741	1		
Place	0/544	0/430	0/712	0/856	0/513	0/744	1	
Grouping Learning Activity	0/712 0/656	0/569 0/532	0/876 0/707	0/634 0/644	0/689 0/812	0/718 0/761	0/683 0/448	1 0/589

The results of discriminant validity in tables (6) and (7) also show that the covariance relationship between none of the constructs in the two dimensions of distance education and constructivism exceeds 0.9. Therefore, the discriminant validity of the tool has also been confirmed.

Next, table (8) shows the descriptive statistics, including means and standard deviations, the factor loadings, and the alpha values assuming the removal of each item for the questionnaire. In this study, the confirmatory factor analysis was conducted using the lisrel 8.1 software to test the multifactorial model of the questionnaire.

Table 8. Mean values, standard deviations, factor loadings, and correlation coefficients for the questionnaire subscales

Factor loadings	Standard deviations	Mean	Items	Factor loadings	Standard deviations	Mean
Distance Learning				Constructivism		
α0=/647			Goal element	α0=/703		
0/66	0/94	3/18	Goal Element	0/73	1/08	2/88
0/59	0/88	2/44	1. Not having predefined goals	0/49	0/73	1/78
0/47	0/92	1/56	2. Emphasis on general and guiding goals	0/47	0/83	2/04
0/71	0/91	1/68	3. Availability of education at any time and place	0/58	1/03	2/14
0/76	0/84	1/66	4. Creating learning opportunities for everyone	0/55	0/90	2/04
0/49	0/82	1/76	5. Making teaching and learning easy	0/73	0/84	2/16
0/64	0/91	2/16	6. Goals being negotiable and personal	0/68	0/99	2/06
0/66	1/07	1/58	7. Emphasis on developing critical thinking	0/50	0/97	2/22
α0=/705			content element: α0=/81	α0=/668		
0/49	0/92	1/86	9. Content selection should be learner-centered	0/59	0/94	1/80
0/65	0/91	2/18	10. Content should be motivational and problem-centered	0/74	0/96	1/88
0/74	0/91	1/88	11. The need for diverse content	0/69	0/78	1/90
0/46	0/97	1/98	12. Content should be relevant to everyday needs	0/55	0/82	2/34
0/62	0/82	1/24	13. Content should be a tool in the learning process	0/59	0/77	2/36
0/83	0/83	2/34	14. No approval of predetermined content	0/53	0/85	2/40
α0=/765			Teaching method element	α0=/849		
0/59	0/88	2/48	15. The role of teacher guidance and facilitation in teaching	0/73	0/94	1/96
0/84	1/14	2/56	16. Emphasis on the method of guidance and consultation	0/66	1/15	2/18
0/73	1/09	2/46	17. Emphasis on the method of teaching to the level of mastery	0/52	0/93	2/02

0/49	1/03	2/32	18. Teaching by examples and samples	0/61	0/94	2/0
0/54	0/98	2/20	19. Emphasis on co-teaching in teaching and learning	0/71	1/08	2/18
0/71	0/83	1/86	20. Choosing a teaching method based on the needs and conditions of the learners	0/55	1/13	2/06
0/65	0/94	2/36	21. Emphasis on the method of problem solving	0/59	1/13	2/12
	α0=/754		Evaluation element		α0=/787	
0/65	0/95	2/30	22. De-emphasis on paper-pencil tests	0/48	0/87	3/36
0/72	0/98	2/36	23. Emphasis on self-assessment and self-assessment	0/72	0/94	2/0
0/77	0/99	2/56	24. Emphasis on skill-based evaluation	0/48	0/89	1/18
0/48	0/94	2/24	25. Concurrent teaching and assessment	0/53	0/99	1/94
0/59	1/08	2/12	26. Continuous and continuous assessment	0/44	0/91	2/12
	α0=/521		Element Of Learning Materials And Resources		α0=/738	
0/77	0/87	2/24	27. Self-learning of educational materials and resources	0/69	0/91	2/24
0/68	3/14	2/16	28. Educational materials derived from the living environment	0/73	0/94	2/26
0/69	1/07	1/84	29. Educational resources appropriate to the needs, attractive and enjoyable.	0/43	0/98	2/14
0/71	0/86	1/90	30. Emphasis on supplementary books, audio tapes, educational CDs, laboratory kits.	0/49	0/79	2/12
0/77	0/82	1/92	31. Emphasis on learning materials on personal goals	0/82	0/97	2/06
0/74	0/96	2/14	32. Educational materials being relevant and relevant to previous learning	0/58	0/80	1/82
	α0=/706		Learning Activities Element		α0=/849	
0/70	1/03	2/44	33. Teacher and learner participation in educational design	0/48	1/09	2/10
0/79	1/02	2/18	34. The role of the teacher is to support and guide.	0/46	1/02	1/82
0/47	0/97	2/22	35. Emphasis on the active action and reaction of the learning environment	0/83	0/91	2/02
0/76	0/92	2/08	36. Emphasis on learner-centeredness in the learning process	0/54	1/0	2/04
0/63	0/92	2/04	37. Emphasis on problem-solving skills	0/61	1/01	2/14
0/49	0/92	2/08	38. Emphasis on challenging and complex problems	0/57	1/14	2/20
	α0=/510		Time Element		α0=/528	

0/67	0/78	2/07	39. Emphasis on step-by-step learning	0/66	0/97	1/90
0/74	0/92	1/92	40. Reviewing ideas and thoughts over time	0/48	0/65	1/68
0/53	0/83	1/80	41. No time limit in learning	0/49	0/69	1/82
	α0=/466		Place Element		α0=/603	
0/51	0/85	1/74	42. Emphasis on an attractive and pleasant and activity-oriented environment	0/74	0/72	2/08
0/80	1/00	1/76	43. No spatial limitation in learning	0/69	0/94	2/26
	α0=/705		Grouping Element		α0=/739	
0/71	1/09	2/52	44. Emphasis on the importance of instructors in learning	0/47	0/77	2/08
0/52	1/07	2/06	45. Emphasis on group interaction in learning	0/61	1/85	1/86
0/45	1/08	2/26	46. Emphasis on teamwork between learners	0/68	0/91	1/82

- Data Analysis

To analyze the collected data, the question in question is first raised and after presenting the descriptive indicators of the variables such as the mean and standard deviation and the normality of the data distribution, the results of examining those questions are reported. In order to test the research questions, the "correlation matrix" test has been used. However, the condition for using parametric tests is to ensure the normality of the desired distributions; although the condition of the normality of the distribution is provided by the large statistical sample size, for complete certainty, the Kolmogorov-Smirnov test has been used, the results of which are as shown in Table (9). It can be seen that the significant level for all variables is greater than 0.05, so it can be said that all the desired distributions have a normal status.

Table 9. Descriptive Statistics and Normality Testing of the Data

Structure	component	Mean	(Standard Deviation	k-s	p-value
Constructivism	Objectives	3/78	0/77	1/71	0/061
	content	3/49	0/92	1/31	0/064
	Learning Activities	4/22	0/73	1/26	0/084
	teaching methods	2/89	0/91	1/30	0/070
	materials and resources	3/36	0/79	1/32	0/062

	assessment	3/10	0/84	0/084	0/052
	time	3/29	0/83	0/070	0/065
	location	3/44	0/84	0/614	0/074
	grouping	3/01	0/88	0/027	0/055
Distance Learning	Objectives	3/00	0/96	1/35	0/44
	content	4/01	0/92	1/36	0/11
	Learning Activities	3/36	0/87	0/140	0/06
	teaching methods	3/55	0/74	0/020	0/06
	materials and resources	2/27	0/76	0/103	0/067
	assessment	3/73	0/79	1/01	0/064
	time	3/69	0/81	0/87	0/166
	location	3/12	0/91	0/08	0/558
	grouping	3/37	0/88	0/013	0/071

- Inferential Statistics

In the previous section, after coding and factor analysis of the terms derived from the qualitative section, a questionnaire was developed, and its reliability was assessed from both the constructivist approach and the distance education approach. In this section, we first calculate the relationship of each item with the corresponding factor and the model fit based on confirmatory factor analysis for both approaches. Then, the data collected from the extracted questionnaire in the qualitative section and the psychometric actions in the quantitative section are analyzed to examine the overlap of the educational implications of constructivism and distance education. To assess this, the correlation between the importance of the factors from the perspective of constructivism and the perspective of distance education was initially calculated. The results are presented in Table (10):

Table 10. Correlation Matrix Between the Importance of Factors in the Constructivist Approach and Distance Education

Construct		Perspective of Distance Education									
Constructivist Perspective	Research Variables	Objectives	content	Learning Activities	teaching methods	materials and resources	assessment	time	location	grouping	Square Root (AVE)
	Objectives	0/709**	0/706**	0/453**	0/290**	0/698**	0/583**	0/668**	0/623**	0/415**	0/84
	content	0/735**	0/776**	0/386**	0/338**	0/738**	0/516**	0/710**	0/688**	0/332**	0/64
	Learning Activities	0/706**	0/688**	0/435**	0/138**	0/751**	0/523**	0/708**	0/746**	0/605**	0/79
	teaching methods	0/696**	0/737**	0/384**	0/289**	0/756**	0/582**	0/739**	0/702**	0/365**	0/82

materials and resources	0/652**	0/685**	0/471**	0/299**	0/368**	0/599**	0/682**	0/655**	0/340**	0/73
assessment	0/745**	0/776**	0/386**	0/076*	0/826**	0/553**	0/776**	0/836**	0/321**	0/75
time	0/624**	0/676**	0/340**	0/104	0/695**	0/493**	0/728**	0/731**	0/256**	0/80
location	0/368**	0/407**	0/427**	0/511**	0/398**	0/563**	0/410**	0/319**	0/386**	0/53
grouping	0/704**	0/717**	0/393**	0/188**	0/756**	0/555**	0/761**	0/730**	0/311**	0/79

Sig. = 0.01** & 0.05 *

The results of the correlation matrix indicate that the highest level of correlation was found in the content element, with a coefficient of r=0.776*r*=0.776. This was followed by the time element, with r=0.728*r*=0.728, and then the goal element, with r=0.709*r*=0.709. The lowest level of correlation was found in the teaching method element, with r=0.289*r*=0.289.

The calculated correlation values indicate that the extracted elements of the Klein model in distance education have a significant correlation with constructivist theory.

- Analysis of Research Questions

Question One: What are the educational implications of constructivism philosophy on the element of goals in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between goal selection in the constructivist approach and distance education (r=0.709, sig<0.05)(*r*=0.709, sig< 0.05). In other words, similar to constructivism, goals in distance education should ideally not be predetermined and fixed. Emphasis should be placed on overarching and guiding goals, distance education should be accessible at any time and place, opportunities for learning should be provided for everyone, education and learning should be facilitated, goals should be negotiable and personal, critical thinking development should be emphasized, and the educational system should reduce transportation costs.

Question Two: What are the educational implications of constructivism philosophy on the element of content in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between content selection in the constructivist approach and distance education (r=0.776, sig<0.05)(*r*=0.776, sig< 0.05). In other words, similar to constructivism, the content of distance education should be engaging, learner-centered, and problem-based, relevant to daily needs, not predetermined, diverse, and generated during the course of education.

Question Three: What are the educational implications of constructivism philosophy on the element of learning activities in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of learning activities in the constructivist approach and distance
education (r=0.435, sig<0.05)(*r*=0.435, sig< 0.05). In other words, similar to constructivism, learning activities in distance education should be learner-centered,

emphasize problem-solving skills, focus on challenging issues, consider social activities and learners' interests, and stress active learning by the learner.

Question Four: What are the educational implications of constructivism philosophy on the element of teaching methods in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of teaching methods in the constructivist approach and distance
education (r=0.289, sig<0.05)(*r*=0.289, sig< 0.05). In other words, similar to constructivism, teaching methods in distance education should emphasize problem-solving approaches, prioritize exploratory teaching, involve group and collaborative methods, utilize examples and case studies for instruction, and be chosen based on the needs and conditions of the learners.

Question Five: What are the educational implications of constructivism philosophy on the element of learning materials and resources in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of learning materials and resources in the constructivist approach and distance education (r=0.368, sig<0.05)(*r*=0.368, sig< 0.05). In other words, similar to constructivism, the element of learning materials and resources in distance education should be derived from the learners' living environments, be attractive and appealing to learners' needs, be related to prior knowledge, and provide a self-learning experience for the learner.

Question Six: What are the educational implications of constructivism philosophy on the element of evaluation in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of the evaluation element in the constructivist approach and distance education (r=0.553, sig<0.05)(*r*=0.553, sig< 0.05). In other words, similar to constructivism, the evaluation component of distance education should emphasize learner self-assessment and self-evaluation, be carried out in a group format, overlap with teaching, be a continuous and process-oriented evaluation, and emphasize skills assessment.

Question Seven: What are the educational implications of constructivism philosophy on the element of time in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of the time element in the constructivist approach and distance
education (r=0.728, sig<0.05)(*r*=0.728, sig< 0.05). In other words, similar to constructivism, the time element in distance education should emphasize the importance of time in learning, avoid time constraints for learning, specify a time schedule for learning, and stress step-by-step learning.

Question Eight: What are the educational implications of constructivism philosophy on the element of space in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of the space element in the constructivist approach and distance education (r=0.319, sig<0.05)(*r*=0.319, sig< 0.05). In other words, similar to constructivism, the space element in distance education should provide a collaborative learning environment, be appealing, pleasant, and activity-oriented, and have no restrictions on learning space.

Question Nine: What are the educational implications of constructivism philosophy on the element of grouping in distance education?

The results in Table 4-2 indicated that respondents believe there is a significant relationship between the selection of the grouping element in the constructivist approach and distance education (r=0.311, sig<0.05)(*r*=0.311, sig< 0.05). In other words, similar to constructivism, grouping in distance education should emphasize teamwork among learners, foster group interaction, be pre-established before instruction, and allow for fluid grouping of learners. After analyzing the correlation matrix between the elements of constructivism and distance education, in order to confirm the factorial structure of the questionnaire from the perspective of specialists (in two aspects: distance education and constructivism), a confirmatory factor analysis model was utilized with the LISREL software using the maximum likelihood method based on the variance-covariance matrix. The fundamental premise of the researcher is that each factor is related to a specific subset of variables, and before conducting the research, the researcher had a specific hypothesis regarding the number of factors in the model. It is noteworthy that the assumptions for conducting confirmatory factor analysis were observed. Below are the results of the confirmatory factor analysis for the two aspects of the questionnaire (constructivism aspect and distance education aspect) presented in both standard and significance coefficient (T-VALUE) formats.

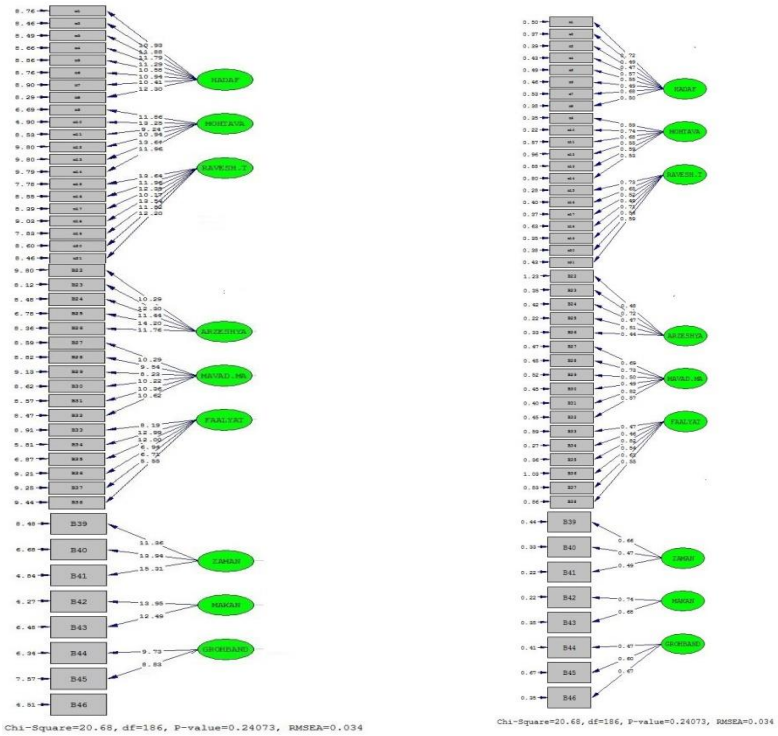

Figure 1. The tested model of the constructivism aspect in two formats: standard and significance coefficient

constructivism aspect of the questionnaire are presented in the table below for each of the recommended indices by Hu and Bentler (1999), which include the chi-square (χ2χ2), chi-square to degrees of freedom ratio (χ2/dfχ2/*df*), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), normed fit index (NFI) or Bentler-Bonett index, and the root mean square error of approximation (RMSEA).

Table 11. Fit indices of the tested constructivism model

Fit Indices Related to the Model	Obtained value	Accepted Domains	Fitting Results
Chi-Square (χ2)	20/68 > 0/00)P(	3 ≤ (Not statistically significant)	Disapproval
Chi-Square to Degrees of Freedom Ratio ((χ2/df)	0,11	$<3x^2/df$	Model Validation
Goodness of Fit Index (GFI)	0,91	GFI>0/90	Model Validation

Adjusted Goodness of Fit Index (AGFI)	0,91	AGFI>0/90	Model Validation
Comparative Fit Index (CFI)	0,92	CFI>0/90	Model Validation
Normed Fit Index (NFI) (Bentler-Bonett Index)	0,93	NFI>0/90	Model Validation
Root Mean Square Error of Approximation (RMSEA)	0,034	RMSEA≤0/10	Model Validation

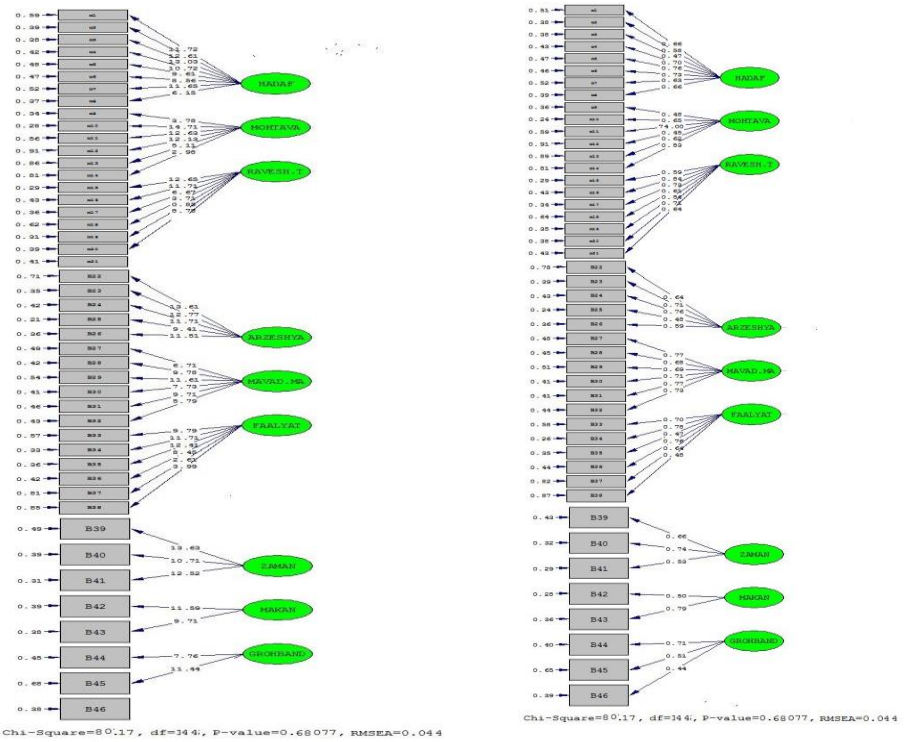

Figure 2. The tested model of distance education in two standard conditions and the significant coefficient condition

A detailed review of the goodness-of-fit indices for the structural model (Table 11) indicates that the components of the questionnaire in the constructivist aspect have a satisfactory fit.

The results related to the goodness-of-fit indices for the distance education aspect of the questionnaire for each of the proposed indices by Hoel and Bentler (1999) include chi-square (χ^2), chi-square divided by degrees of freedom (χ^2/df), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), normed fit index (NFI) or Bentler-Bonett index, and root mean square error of approximation (RMSEA), as presented in the table below.

Table 12. fit of statistical models or machine learning models in the field of distance education

Fit Indices Related to the Model	Obtained value	Accepted Domains	Fitting Results
Chi-Square ($\chi 2$)	80/17	3 ≤ (Not statistically significant)	Disapproval
Chi-Square to Degrees of Freedom Ratio (($\chi 2$/df)	0/55	$<3x^2/df$	Model Validation
Goodness of Fit Index (GFI)	0/90	GFI>0/90	Model Validation
Adjusted Goodness of Fit Index (AGFI)	0/91	AGFI>0/90	Model Validation
Comparative Fit Index (CFI)	0/91	CFI>0/90	Model Validation
Normed Fit Index (NFI) (Bentler-Bonett Index)	0/92	NFI>0/90	Model Validation
Root Mean Square Error of Approximation (RMSEA)	0/044	RMSEA≤0/10	Model Validation

A detailed review of the goodness-of-fit indices for the structural model (Table 12) indicates that the components of the questionnaire in the aspect of distance education have a satisfactory fit.

Discussion and Conclusion

At the end of any research activity, the researcher must present the results based on the testing of hypotheses and the acceptance or rejection of those hypotheses. The results obtained from the hypotheses are also based on the formation of suggestions for conducting research. It can be said that one of the important sections of research, which can actually serve as a pathway to translate theories into practice for future success, is the presentation of accurate conclusions and appropriate recommendations. Results that are derived from correct and precise analyses can help eliminate the obstacles and challenges faced by organizations in order to make the research more scientific. A review of the results of the objectives and the discussion of the conclusions regarding them indicates that:

Question 1: What are the educational implications of constructivism philosophy on the element of goals in distance education?

Based on the results obtained, respondents believe that there is a significant relationship between goal selection in the constructivist approach and distance education. In other words, similar to constructivism, the goals of distance education should not be predetermined and fixed; emphasis should be placed on general and guiding goals, distance education should be accessible anytime and anywhere, it should provide learning opportunities for everyone, facilitate teaching and learning, have agreed-upon and personal goals, emphasize the development of critical

thinking, and reduce transportation costs in the educational system.

Question 2: What are the educational implications of constructivism philosophy on the element of content in distance education?

According to the results, respondents believe that there is a significant relationship between content selection in the constructivist approach and distance education. In other words, similar to constructivism, the content of distance education should be stimulating, learner-centered, and problem-based; it should align with daily needs, not predetermined, diverse, and produced during the educational process.

Question 3: What are the educational implications of constructivism philosophy on the element of learning activities in distance education?

Based on the results, respondents believe that there is a significant relationship between the selection of learning activities in the constructivist approach and distance education. In other words, similar to constructivism, learning activities in distance education should be learner-centered, emphasize problem-solving skills, focus on challenging issues, highlight social actions and learners' interests, and encourage active learning.

Question 4: What are the educational implications of constructivism philosophy on the element of teaching methods in distance education?

According to the results, respondents believe that there is a significant relationship between the selection of teaching methods in the constructivist approach and distance education. In other words, similar to constructivism, teaching methods in distance education should emphasize problem-solving approaches, exploratory teaching, group and participatory teaching, be based on examples and case studies, and be selected based on the needs and conditions of the learner.

Question 5: What are the educational implications of constructivism philosophy on the element of learning materials and resources in distance education?

Based on the results obtained, respondents believe that there is a significant relationship between the selection of learning materials and resources in the constructivist approach and distance education. In other words, similar to constructivism, the element of learning materials and resources in distance education should be derived from the living environment, be attractive and appealing to needs, relate to prior knowledge, and allow for self-directed learning for the learner.

Question 6: What are the educational implications of constructivism philosophy on the element of assessment in distance education?

According to the results, respondents believe that there is a significant relationship between the selection of assessment in the constructivist approach and distance education. In other words, similar to constructivism, the element of assessment in distance education should emphasize self-assessment and self-evaluation by the learner, be conducted in groups, overlap with

teaching, be process-oriented and continuous, and focus on skill assessment.

Question 7: What are the educational implications of constructivism philosophy on the element of time in distance education?

Based on the results, respondents believe that there is a significant relationship between the selection of time in the constructivist approach and distance education. In other words, similar to constructivism, the element of time in distance education should emphasize the importance of time in learning, have no time constraints for learning, include a specific timeline for learning, and focus on step-by-step learning.

Question 8: What are the educational implications of constructivism philosophy on the element of space in distance education?

According to the results, respondents believe that there is a significant relationship between the selection of space in the constructivist approach and distance education. In other words, similar to constructivism, the element of space in distance education should foster a collaborative learning environment, be attractive, pleasant, and activity-oriented, and have no spatial limitations for learning.

Question 9: What are the educational implications of constructivism philosophy on the element of grouping in distance education?

Based on the results, respondents believe that there is a significant relationship between the selection of grouping in the constructivist approach and distance education. In other words, similar to constructivism, grouping in distance education should emphasize teamwork among learners, focus on group interaction, have predetermined groupings before learning, and allow for fluid group arrangements.

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