



Designing a model for the development of questioning skills in students based on the school environment using grounded theory and structural equation modeling

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Background and Aim: One of the most important skills needed by today's society is the skill of questioning. Therefore, it is necessary to study this issue by designing a suitable model in the field of teaching questioning skills. Accordingly, the aim of the current research is to design a model for the development of communication skills in students based on the school context.

Methods: The current research was a mixed (quantitative-qualitative) study that was conducted in the qualitative part of the database theory and MaxQDA software was used for data analysis. The statistical population of the qualitative part included professors and experts in the fields of education management, questioning education, and children's education. The sampling method is of a targeted type, which reached saturation by conducting a total of 10 interviews with professors and experts in the fields of education management, questioning education, and children's education. After this stage, the little stage started. Descriptive research method was used in this section. The statistical population of the research in this section were education teachers of Neishabur city. Therefore, 413 questionnaires were selected based on available sampling method and Cochran's formula. Quantitative data analysis was performed using Pearson correlation and structural equation modeling. Confirmatory factor analysis and path analysis tests were used in PLS software.

Results: In the qualitative section, nine main categories were identified as effective strategies, these strategies had 49 open codes. The validity of the questionnaire was evaluated using content validity and construct validity as well as questionnaire validity. Its reliability was also confirmed with Cronbach's alpha, homogenous reliability and composite reliability. The results indicated the confirmation of the extractive model and qualitative components extracted in the previous step. Based on this, the effect of causal conditions and compulsive buying phenomenon was equal to 0.27, the effect of questioning skill phenomenon on strategies was equal to 0.324, and the effect of background components on strategies was equal to 0.258. The influence of strategies on outcomes is equal to 0.584. The influence of the interventionists on the results was equal to 0.113. The influence of interventionist control components on strategies was equal to 0.113. Also, the moderating rate of interventionist control variable in the relationship between strategies and outcomes was equal to -0.089. All relationships were significant according to their significance level.

Conclusion: It can be concluded that the questioning skills development model in the present study has good validity and reliability and it is suggested to be implemented as a trial and pilot.



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Introduction

The ability to ask and answer questions plays a fundamental role in learning. Inquiry is one of the cognitive processes that can stimulate critical thinking among students. However, it can be seen that students still lack mastery in the skill of inquiry and are still in lower levels of thinking in their questions (Zulkefli & Hashem, 2019). On the other hand, student questions become an important aspect of classroom interaction. They indicate whether the learning process is effective or not. Additionally, instructors realize to what extent students understand the material presented in class. A good question possesses qualities such as creativity, sound structure, and knowledge enhancement (Firmansyah & Sata, 2021). Inquiry is a pathway to critical thinking, a cognitive process facilitated through questioning that leads students to integrate ideas into a cohesive concept or idea, ultimately shaping the individual as a whole (Zulkefli & Hashem, 2019). The skill of inquiry plays a fundamental role in learning. A characteristic of exceptional learning is good questioning, especially from large groups of children. Such categorizations can stimulate children's curiosity, imagination, and motivation to acquire new knowledge. Pierce (1978) explains that in the learning process, teachers use questions to encourage, guide, and assess students' thinking skills. For students, engaging in inquiry is an essential part of discovery-based learning, involving information seeking, validating what is studied, and considering unknown perspectives (Deliyanni, Priyatno & Jaman, 2020). Abdullah (2007) stated that employing inquiry skills for systematic investigation in any subject area is essential. The questions used in the teaching and learning process help in fostering students' critical thinking about the subject presented in class. Moreover, it also enables students to explore and understand problems, guiding them toward further research for a deeper understanding of concepts taught by the teacher. A question is a verbal statement requesting an answer or response from the listener (Priyatna, Atami, Santosa & Surya, 2019). Taylor (2012) states that education should focus not just on teaching students how to think for themselves but also on providing an opportunity to attain wisdom. However, contemporary schools have become tools rather than educational institutions,

creating a distorted culture that believes education revolves around assessment obsession through exams (Zulkefli & Hashem, 2019; Hashem, 2017b; Taylor, 2012). Dewey (1897) and Lippmann (2003) argue that education, as described above, fails in cultivating research, critical thinking, logical reasoning, and judgment. According to Dewey (1897), education is not merely the transmission of knowledge, but should also enhance thinking (Zulkefli & Hashem, 2019). Woo & He (2021) mentioned that overall, the use of technical platforms has helped teachers to raise and address students' doubts, aiding students in enhancing their understanding by guiding them in formulating questions. Teacher-researcher collaborative design methods have also been transferred to teacher professional learning opportunities, as they manage effective access and use of research-based educational understanding in their daily practice. Rahman (2021) also concluded in his research that through assisted digital learning, students' questioning abilities can be improved beyond previous levels. Some studies show that inquiry supports the most important active learning method in students and reinforces their knowledge structure. The ongoing evolution in education emphasizes the importance of engaging students with continuous questions and believes that focusing on question-centric thinking in education is the source of developing critical thinking in students. However, in some common methods of informal education in the country, such as the phenomenon of the university entrance exam, curiosity and creativity are not instilled in students, but the Fundamental Transformation Document, as the most important official education document of the country, emphasizes the education system's approach to critical thinking programs from childhood and in the family nucleus. In this regard, education has planned programs, some of which are included in textbooks and most of which are considered in informal and extracurricular programs. Research results show that changing parental educational attitudes through their training by teachers and teachers' use of active teaching methods and creating harmony between teachers' performance and parents in relation to students, have led to skills such as self-confidence, being opinionated, progress in studies, and strengthening the power of

reasoning and analysis. This shows that education has greatly influenced the improvement of critical thinking and questioning skills in students. A society that needs a vast portion of its citizens to have problem-solving skills must start from early childhood, then systematically expand and cultivate these qualities during school years (Mirzakhani, 2020) and teach the skill of inquiry in schools to deliver curious and inquisitive students to society and universities. The prerequisite for this is the existence of a model as a practical guide for the authorities, a model in which the contextual conditions, interventions, causal conditions, and consequences of this issue are correctly identified. Therefore, a comprehensive model for developing students' inquiry skills should be developed, considering the school's local environment, stemming from the Fundamental Transformation Document in Education. That is, through a comprehensive review in the field of developing inquiry skills and with a view to the local school environment in the province, identify the causal factors affecting the development of inquiry skills, the context and conditions that lead to this development, the intervening conditions in the development of inquiry skills, and then, by formulating appropriate strategies for the development of inquiry skills in the students of Khorasan Razavi province, complete the research model and identify the consequences arising from the implementation of these strategies, and finally, identify the existing obstacles in implementing this model in the country. As is evident, this research is the need of the day for the country and Iranian society and, through a comprehensive review and using a grounded data analysis method and interviewing experts, is in the effort to present a local model tailored to the cultural characteristics of the society. Therefore, the fundamental question of this research is: What is the model for developing inquiry skills in students of Khorasan Razavi province based on the local school environment?

Method

The current research method is mixed (qualitative - quantitative) and is fundamental in purpose and exploratory in result. Due to the novelty of the research topic, limited knowledge, and the need for development of

this subject in Iran, lack of existing theory in this area, and the inability of existing research in the community to answer the research questions, a grounded theory approach, which is an inductive method from specific to general, was chosen for the qualitative part. The qualitative sample consisted of experts and academics in the fields of educational management, inquiry-based learning, and child education, selected through purposive sampling. A total of 10 experts familiar with the topic were interviewed based on certain criteria (at least 5 years of experience in marketing, publications in education, doctoral or at least bachelor's degree, and willingness to interview), following the principle of theoretical saturation. Strauss and Corbin's method was used for data analysis. The researcher, through constant comparison of data and verbatim transcription of interview texts, field notes, and recorded instances, and processes of conceptualization, interpretation, and theorizing, extracted the essence of the acquired information. Each interview was coded and analyzed before the next interview. For this purpose, open, axial, and selective coding stages were conducted. The researcher sought the main variable and existing process in the data. Repeated review of data, codes, emerging categories, memos, and diagrams written during data analysis helped in writing the main story, enabling the researcher to determine the study's main variable. In the quantitative part, the population included teachers of the second primary education phase, selected using convenient sampling based on Morgan's table, totaling 413 individuals. Quantitative data analysis was performed using Pearson correlation and structural equation modeling. Confirmatory factor analysis and path analysis tests were utilized in PLS software.

Materials

1. Interview: The method of data collection in the qualitative part was deep interviewing, where repetition in the received information was observed from interview number 9; however, to ensure greater reliability, 10 interviews were conducted. Data collection lasted from June 2022 to October 2022. Given that this study considered one main question and six sub-questions, interview protocol questions were designed to address these questions. It's worth mentioning that during the interviews, in addition to note-taking and audio recording,

exploratory questions were also raised depending on the interview situation and respondents' answers.

2. Researcher-constructed questionnaire: The research tool was a questionnaire based on qualitative findings. In this study, to determine the reliability of the questionnaire, three criteria were used: Cronbach's alpha coefficient, composite reliability, and convergent validity (using average variance extracted). The reliability coefficients Cronbach's alpha, composite reliability, and convergent reliability for the questions are calculated between 0.7 and 1, which is more desirable the closer it is to 1 (Henseler et al., 2015). The values of average variance extracted should also be more than 0.5 for this index; it means that the construct explains about 50% of the variance of its indicators. If the conditions for AVE and CR are met, it can be said that convergent validity is strongly confirmed (Bahmani, Mahdavi Rad & Baluchi, 2016). These conditions were met in the components of the current research, indicating that the components have strong convergent validity.

Implementation

After conducting the interviews and transcribing them, the interview texts were entered into the MaxQDA software for open coding analysis, after which the researcher proceeded to subsequent interviews. In this phase, the text of each interview was studied multiple times, and main sentences were extracted and recorded as textual codes corresponding to the participant's statements or interpretative codes (researcher's interpretation of the statements). These codes, similar in meaning, were then categorized. The

first step involved collecting qualitative data from in-depth interviews with participants. In the open coding process, numerous themes emerged, which, through a back-and-forth review and analysis process, reduced the initial qualitative data set to fewer categories.

Results

As shown in the table below, a total of 217 open codes were identified in the initial coding, including 11 codes for actors, 37 for causal conditions, 12 for phenomena, 33 for context, 45 for intervening conditions, 49 for strategy, and 30 for outcomes. These numbers decreased after being converted into subcategories and main categories. The next step was axial coding, which involves connecting subcategories to categories, as coding on the axis occurs within a category and links categories at the level of properties and dimensions. In this stage, initial codes and categories created during open coding, which were related to each other, were centered around a common axis. Constant comparison of codes is essential at this stage. The researcher then compares each category with others to ensure that they are distinct from one another. Then, by focusing on conditions leading to the phenomenon under study, contexts in which the phenomenon occurred, and strategies used to control the phenomenon, selective coding and the main variable were determined. A summary of open, axial, and selective coding of the research data is presented in the table below. The figure below shows the axial coding paradigm of the qualitative process model of the current research, and the components of the qualitative model will be explained further.

Table 1. Codings and categories

Main category	Sub-themes	Codes frequency
Causal conditions (11 codes)	The student themselves	1
	School	4
	Family	2
	Society	4
Causal conditions (37 codes)	Education policies	10
	Teaching methods in school	4
	Existing behaviors in school	5
	Family environment	5
	Knowledge-enhancing skill	7
	Personality-building skill	6
Phenomenon (12 codes)	Informed family	6
	Human-development oriented school	6

Contextual conditions (33 codes)	Receptive society	6
	Systematic education system	13
	Individual factors	8
	Family factors	6
Intervening conditions (45 codes)	Teacher factors	3
	School-related factors	6
	Weaknesses in the education system	7
	Components of the social community	10
	Strengthening students	12
	Empowering parents	8
Strategies (49 codes)	Empowering teachers	10
	Changing teaching and learning methods	4
	Appropriate national planning for enhancing student skills, especially inquiry	6
	Developing the intellectual and cultural environment of schools	5
	Empowering and enhancing the educational capacity of schools	8
	Creating a foundation for inquiry in schools	6
	Promoting a culture of inquiry in society	4
	Personal development of students	4
	Scientific and intellectual growth of students	2
Consequences (30 codes)	Skill development of students	5
	Educational system growth	5
	Societal growth and development	4
	The student themselves	5
	School	7

The Fornell-Larcker method was used to assess discriminant validity. The Fornell-Larcker criterion examines discriminant validity at the construct level, meaning that the Fornell-Larcker value for each construct with itself should be higher than its value with other variables. For example, the value of this test for

strategies with itself (0.9) and with other variables is less than this value (0.9). This applies to the rest of the variables as well; thus, according to the Fornell-Larcker test results, all variables meet the condition of having discriminant validity.

Table 2. Divergent validity

	Modifying interveners	Strategies	Contextual conditions	Causal conditions	phenomenon	Consequences	Controlling interveners
Modifying interveners	1.000						
Strategies	0.083	0.730					
Contextual conditions	-0.063	0.321	0.863				
Causal conditions	-0.043	0.276	0.254	0.833			
Core phenomenon	0.006	0.374	0.194	0.270	0.887		
Consequences	-0.049	0.620	0.329	0.197	0.298	0.798	
Controlling interveners	-0.019	0.380	0.426	0.363	0.292	0.337	0.788

The table below examines the status of questionnaire items based on the estimated t-value. If the obtained t-value with 95%

confidence is greater than 1.96, it indicates the appropriateness of the particular question from the consumer's perspective. Based on the

obtained results, all items are significant in terms of the t-value and factor loading (greater than 0.5).

Table 3. Factor loadings

Effect	Factor loading	SD	t	p
Appropriate national planning to strengthen students' skills (especially inquiry) <- Strategies	0.765	0.027	27.923	0.000
Creating a foundation for inquiry in schools <- Strategies	0.692	0.034	20.356	0.000
Changing teaching and learning methods <- Strategies	0.764	0.028	27.315	0.000
Strengthening students <- Strategies	0.702	0.029	24.165	0.000
Empowering teachers <- Strategies	0.723	0.030	23.872	0.000
Empowering and increasing the strength of schools in education <- Strategies	0.756	0.028	27.441	0.000
Empowering parents <- Strategies	0.750	0.030	25.382	0.000
Society <- Causal Conditions	0.861	0.023	36.788	0.000
Receptive society <- Contextual conditions	0.813	0.033	24.435	0.000
Informed family <- Contextual conditions	0.841	0.023	37.371	0.000
The student themselves <- Causal Conditions	0.817	0.032	25.204	0.000
Strategies * Controlling interveners <- Modifying Interveners	1.067	0.054	19.777	0.000
Developing the intellectual and cultural environment of schools <- Strategies	0.714	0.032	22.385	0.000
Personal development of students <- Consequences	0.795	0.025	31.547	0.000
Scientific and intellectual growth of students <- Consequences	0.842	0.021	40.352	0.000
Promoting a culture of inquiry in society <- Strategies	0.695	0.036	19.264	0.000
Skill development of students <- Consequences	0.802	0.030	26.703	0.000
Educational system growth <- Consequences	0.781	0.022	35.066	0.000
Societal growth and development <- Consequences	0.768	0.026	29.448	0.000
Existing behaviors in school <- Causal Conditions	0.849	0.025	33.535	0.000
Education policies <- Causal Conditions	0.859	0.025	34.735	0.000
Teaching methods in school <- Causal Conditions	0.798	0.029	27.236	0.000
Weaknesses in the education system <- Controlling Interveners	0.792	0.032	24.535	0.000
Family factors <- Controlling Interveners	0.768	0.032	24.344	0.000
Individual factors <- Controlling Interveners	0.784	0.030	26.238	0.000
School-related factors <- Controlling Interveners	0.735	0.041	18.129	0.000

Teacher factors <- Controlling Interveners	0.818	0.024	34.159	0.000
Components of the social community <- Controlling Interveners	0.828	0.026	32.246	0.000
Family environment <- Causal Conditions	0.811	0.029	27.972	0.000
Human-development oriented school <- Contextual conditions	0.903	0.013	70.990	0.000
Knowledge-enhancing skill <- Core Phenomenon	0.847	0.034	25.212	0.000
Personality-building skill <- Core Phenomenon	0.925	0.016	57.137	0.000
Systematic education system <- Contextual conditions	0.892	0.015	58.871	0.000

For the overall evaluation of the model, certain criteria were introduced. One of these criteria is the model fit index or the goodness-of-fit in structural equation modeling based on the variance-based approach, commonly known as the Standardized Root Mean Square Residual (SRMR). The desirable benchmark for this

index is less than 0.08 (Henseler et al., 2015). According to the results in the table regarding the overall evaluation of the empirical model in this research, the value of the SRMR index is 0.04. This value indicates that the model generally confirms and supports the hypothetical data.

Table 4. Fit model indecies

Index	Saturated model	Estimation
SRMR	0.060	0.078
d_ ULS	5.832	9.738
d_ G	2.826	2.872
Chi-square	5,476.008	5,499.260
NFI	0.700	0.699

After testing the outer model, the inner model representing the relationships between the latent variables of the research is presented. The inner model allows for the examination of research hypotheses. The tested conceptual model is shown in Figures 1 and 2. The numbers written on the lines are the T-values and beta coefficients derived from the regression

equation between variables, representing the path coefficients. The numbers within each circle indicate the coefficient of determination (explaining the latent construct by its indicators or observable variables) related to the model's endogenous constructs. In the figures below and also in Table 5, the relationship between the research variables is presented.

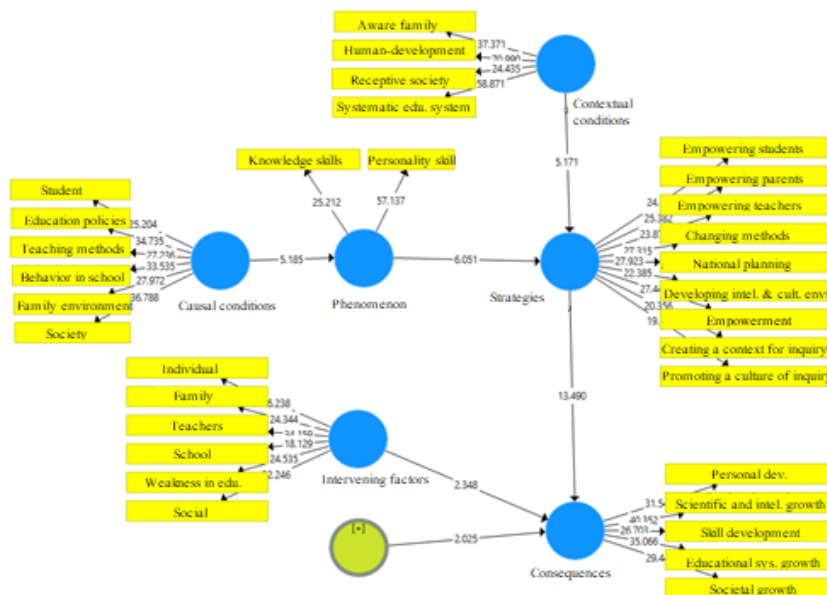


Table 1. T-values in the model

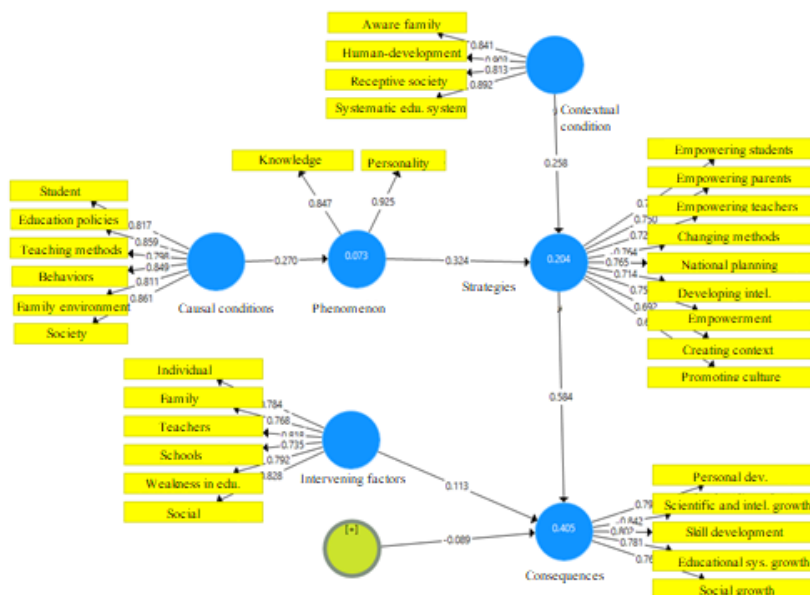


Figure 2. Standard coefficients in the model

Table 5. Direct effects and t-values				
	Direct effect	t	p	Condition
Modifying Interveners -> Strategies	0.07-	1.33	0.18	Approved
Strategies -> Consequences	0.28	5.37	0.00	Approved
Contextual conditions -> Strategies	0.19	3.63	0.00	Approved
Causal Conditions -> Core Phenomenon	0.42	9.65	0.00	Approved
Interveners -> Strategies	0.31	5.75	0.00	Approved
Core Phenomenon -> Strategies	0.22	4.95	0.00	Approved

Based on the above table, the impact of causal conditions and the phenomenon of compulsory buying was 0.27, the impact of the inquiry skill phenomenon on strategies was 0.324, the impact of contextual components on strategies was 0.258. The impact of strategies on outcomes was 0.584. The impact of interveners on outcomes was 0.113. The impact of control

components of interveners on strategies was 0.113. Also, the moderating effect of control variables of interveners in the relationship between strategies and outcomes was -0.089. All these relationships were significant in terms of their significance level ($p < 0.01$). The paradigmatic model of the research is shown in the figure below.

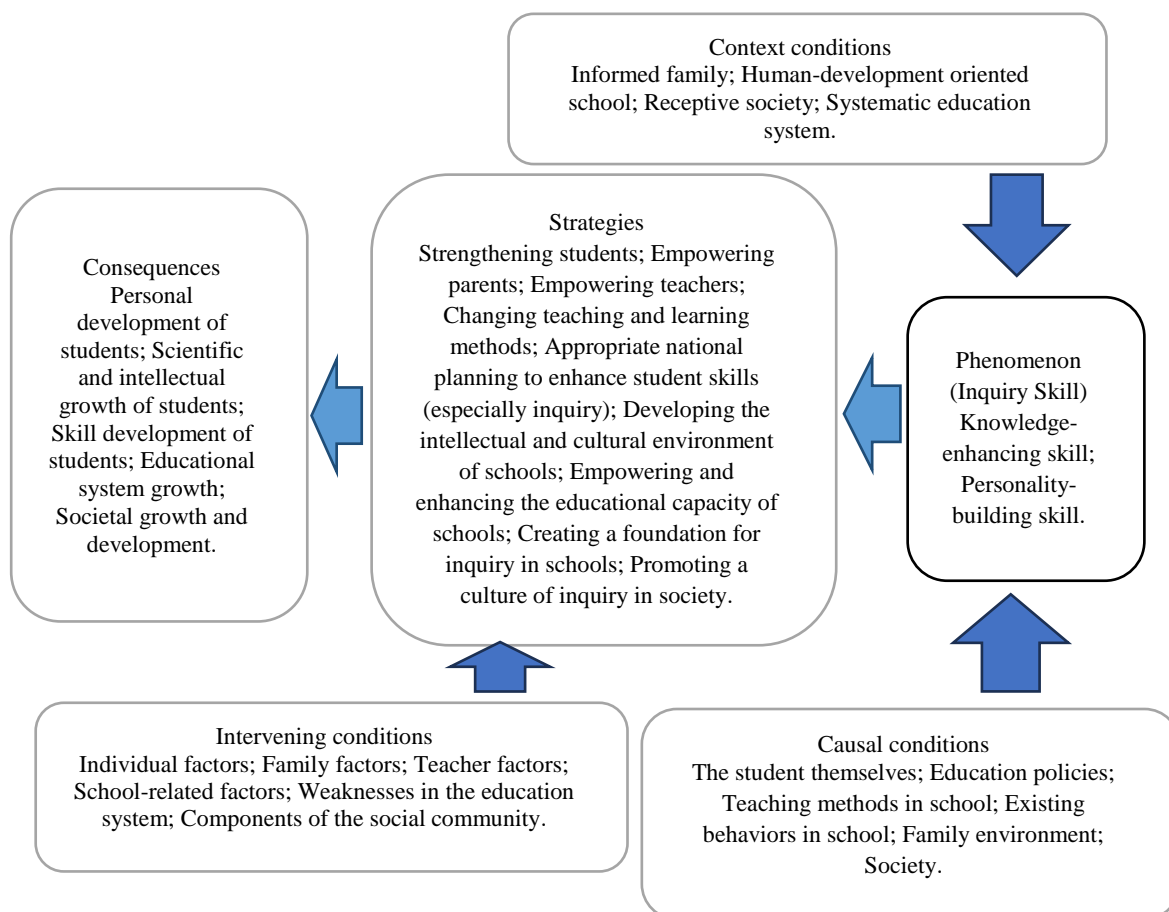


Figure 3. Paradigm model

Conclusion

The aim of this research was to design a model for the development of inquiry skills in students of Khorasan Razavi province based on the local school environment. Accordingly, a mixed qualitative-quantitative approach was used in this research. In the qualitative part, the model for developing inquiry skills in the students of Khorasan Razavi province based on the local school environment was designed using grounded theory and interviews with experts. In the quantitative part, a questionnaire was designed and distributed to the intended statistical population to test this model. After that, codes that were conceptually similar were

categorized. The total number of open codes obtained was 217. A total of 217 open codes, including 11 for actors, 37 for causal conditions, 12 for phenomena, 33 for context, 45 for intervening conditions, 49 for strategy, and 30 for outcomes, were identified in the initial coding. The next step was axial coding, which involves relating categories to subcategories; coding occurs within a category and links categories at the level of properties and dimensions. In this phase, initial codes and categories created during open coding, which were related, were centered around a common axis. Structural equation modeling and testing relationships in SmartPLS software were used to test the model extracted from the grounded

data process. For this purpose, a researcher-constructed questionnaire was developed using the extracted codes and, after being validated by the guide professor, confirming face and content validity. Then, the questionnaire was distributed to the respondents (sample), who expressed their opinions on it. Confirmatory factor analysis was used to examine the construct validity between components, items, and their dimensions. For this purpose, confirmatory factor analysis was initially taken for all the components present in the model. The results of the confirmatory factor analysis confirmed the items extracted from the qualitative part, and considering the factor loading of each of these items (which was above the standard value of 0.3) and also the significant number (which was above the standard value of 1.96), these items were confirmed and used in the process of structural equation modeling. Additionally, suggestions and strategies were provided based on the research results.

In advising parents, it can be said that asking questions can create a sense of insecurity for students (children). Parents and educators should create an environment where asking questions is considered a strength, not a weakness or a sign of ignorance. If children acquire good listening skills, their ears become more attuned to the sounds around them, and this attention and focus will directly impact their creativity and innovation. Therefore, this skill should be strengthened alongside other skills. Teachers and parents should value and respect the questions and answers of students. Mocking in this regard can permanently close the path of inquiry for a student. Parents and teachers can transform inquiry into an enjoyable and exciting process by using subjects of interest or relying on children's natural curiosity. Parents play a key role in educating their children and can enhance their students' progress in academics, sports, etc. Parents should minimize the use of hurtful words. Help your child to use the words "no," "can't," "don't want to," "never," "maybe," and "if" less often, as these words stop them before they start; emphasize the sentence "I will do it." Work on phrases like "yes, I can" and "I want to do more"; emphasize to the student that setting goals is very important. A person who learns how to set goals and achieve them in class will feel ownership over their academic progress. When a person learns these principles, they

eagerly accept your help in achieving success; teach students to be responsible. Most parents hold students accountable for their actions in school, but as parents, they must also be accountable for their children's performance; parents should help with their children's homework or invest in their education, their positive involvement in school activities is important; remind students of the importance of helping others. Help children so they are not always at the center of receiving help and sometimes help others.

Teachers are also advised to be careful in selecting their teaching methods and to use question-and-answer-based methods as much as possible. Always create an environment for generating questions in students' minds during teaching and avoid giving ready answers. Teachers should always designate even short opportunities in the classroom specifically for questioning and inquiry. Place students in various group activities to guide them towards better and more thoughtful questions.

Teachers are advised to give students time to think, as this is when they become familiar with what they know and don't know and develop a desire to ask questions. It must be made clear to teachers that they need continuous growth and improvement and should believe in their need for professional advancement and capacity building to make every effort in this direction. Our teachers need to become familiar with various types and dimensions of questions to know what they want from students; a good question can lead to better questions and answers.

Schools are recommended to strive to familiarize teachers with modern methods of developing students' skills through up-to-date and new training courses and have the ability to implement these teachings. Also, efforts should be made to make in-service training courses valuable for teachers and to design valuable courses focusing on the needs of society and students' educational needs; these courses should be designed so that teachers participate in them with more enthusiasm and higher motivation and enhance their capabilities in educating skilled students. In-service courses conducted in education should be skill-enhancing, practical, and operational. If school educators can plan for the development of children's senses, the necessary foundation for enhancing attention and curiosity will be

provided, which in turn will be the prelude to developing creativity and innovation in them.

Also, the existing shortcomings in the educational system, which are evident to teachers and the educational system, should be comprehensively examined and addressed with proper planning and implementation. Changes in textbooks in educational courses should always be reviewed, and courses in line with new textbooks should be offered to enhance teachers' capabilities. By creating a learning environment in the education system, interest in the growth and development of skills in teachers should be increased. Training should be based on existing needs, and the participation of teachers should be considered in designing courses to make the courses more practical and operational. Efforts should be made to ensure the content of in-service courses is up-to-date and constantly updated for the dynamic and complex conditions of the present era.

Finally, it is evident that children's questions should be welcomed, praised, and encouraged. Efforts should be made to show them the benefits their questions have in learning or discovering something, highlighting the value and importance of it. Use mass media to strengthen the spirit of inquiry in society and increase the capacity for responsiveness in all members of society. National planning for the development of skill and skill-oriented students and organizing national campaigns for cultural development is also necessary and essential.

Conflict of Interest

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

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