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Predictive Model for Student Academic Decline During Virtual Education in the COVID-19 Pandemic

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A B S T R A C T

Academic decline has always been a primary concern for researchers in the field of education. Recently, the COVID-19 pandemic has shed new light on this phenomenon. This study aims to identify factors affecting academic decline during the COVID-19 pandemic and develop a model to predict academic decline during virtual education. The present research employed a mixed qualitative-quantitative methodology. The study population included all mothers, students, and teachers of middle and high school levels in the city of Sabzevar in 2021. A sample of 30 individuals was selected through purposive sampling due to data saturation, considering inclusion and exclusion criteria, and interviewed. Following the identification and validation of qualitative categories and factors, a questionnaire was designed and administered to 384 participants (mothers, students, and teachers of middle and high school levels). The unlimited population responded to the researcher-made 49-item questionnaire on the challenges of virtual education impacting academic decline during the COVID-19 pandemic. To test the research hypotheses, descriptive statistics and structural equation modeling (SEM) using SPSS 20 and PLS Smart software were utilized. The findings indicated that, following qualitative interviews, six main grounded theory categories emerged, encompassing 12 fundamental factors. These included two causal factors (lack of motivation and academic isolation), one central factor (academic decline), three contextual factors (quantity and quality of electronic devices, internet quality, and software and hardware deficiencies), three intervening factors (role pressure on parents, web usage culture, and learning environment), and two strategies (ineffective teaching and inappropriate assessment) and one outcome (reduced learning). Ultimately, the structural equation modeling validated the conceptual model designed based on grounded theory. The results indicated that 12 fundamental factors influenced academic decline during virtual education amidst the COVID-19 pandemic, leading to the development of a significant predictive model for academic decline in virtual education.

Keywords: *Academic Decline, Virtual Education, COVID-19 Pandemic.*

1. Introduction

The issue of "academic decline" is considered one of the oldest and most recognized educational problems, often referred to as the bane of education (1). This issue is prevalent in all countries, whether advanced industrial or developing, and has manifested uniquely across different times (2). Various definitions of academic decline have been proposed. In some studies, it is defined as any disruption in the student's educational process or a decrease in student performance from a satisfactory level to an unsatisfactory level. It is also described as a problem manifested in multiple aspects such as frequent school absences, dropping out before the scheduled time, grade repetition, poor academic quality, or memorizing information instead of understanding it (3).

Academic decline can be categorized into quantitative and qualitative types. Quantitative decline refers to the percentage of students in an educational course who, due to failing or dropping out, could not successfully complete the course. Qualitative decline refers to the failure to achieve set goals or the partial realization of these goals (4). In some studies, the primary criteria for academic decline have been evaluated through the average or GPA of learners or failure to pass courses (5).

Similar to other fundamental issues, academic decline is influenced by numerous factors, including individual student characteristics, family factors, school-related problems, and social factors (6). Individual characteristics influencing academic decline include physical, mental, and psychological problems, lack of motivation for learning, lack of goals, learning disabilities, poor self-concept, behavioral disorders, and anxiety and stress related to academics (7). Family issues are significant because parents greatly influence their child's physical, mental, and psychological development. Thus, any neglect or failure to meet a student's needs can create conditions for academic decline (8).

Another crucial factor affecting academic decline is the teaching process. If the teaching-learning process is not conducted properly, it will result in decreased academic performance among students (9). Often, the reduction in the quality of the teaching-learning process is not solely due to the teacher's abilities but sometimes due to crises such as natural disasters, wars, and dangerous disease outbreaks that challenge the possibility of in-person and formal education. A combination of structural and skill deficiencies leads to a decline in the quality of the teaching process (10).

Recently, one of the most significant global challenges has been the outbreak of the dangerous and highly contagious coronavirus. This disease made any gatherings, including family, educational, social, and work gatherings, dangerous and emphasized quarantine and staying home to save lives (11). COVID-19 forced formal and informal education systems to find alternatives, leading to the cessation of in-person classes and the virtualization of school, university, and educational institute education (12). COVID-19 created specific educational anxiety, particularly in countries with less developed internet infrastructure and virtual teaching skills, posing new management challenges for education at the national level (13).

Continuous school closures due to COVID-19 and the shift to virtual education significantly impacted students' academic status. The usual supervision and control from both family and teachers over students' academic performance were lacking due to the pandemic (14). During exams, since education was virtual, students could easily cheat, and it was uncertain whether they were genuinely participating in the online sessions (15). In this situation, the role of families became very important, but since families were unprepared and caught off guard, they lacked adequate supervision over their children's academic status, leading to significant academic decline compared to the past (16).

Considering the economic, social, and cultural consequences of this virus on all aspects of people's lives worldwide, one of the national functions severely impacted by the current crisis is education (17). Due to social distancing measures, with the onset of the pandemic, the educational systems of countries, both in education and higher education sectors, effectively shut down (18). From the beginning of school and university closures to help eliminate the disease, the concern of developing and implementing educational programs for continuing education at home during home quarantine became the biggest challenge for educational systems (19). This type of education depended not only on the teacher's performance but also on the collaboration between parents and teachers, the availability of technical infrastructure, and quality electronic tools (20). Even the World Health Organization

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declared in a statement that distance learning through radio, podcasts, television, and online education is one of the best ways to continue and complement in-person education (5). However, this time virtual education had to necessarily replace in-person education. Thus, given the problem created in the global education system, virtual education became the only remaining method of education to compensate for the lack of in-person education. This type of education has been growing in developed countries for years and has provided a new opportunity for teachers, students, professors, educational planners, and educational institutions, but quality implementation was not feasible in many countries (3).

Virtual teaching posed problems for teachers, professors, and educational centers, such as unfamiliarity with new technology and unknown challenges (11). Despite the change in conditions and the significant difference between virtual and in-person education, teachers still used traditional and familiar methods in this new environment. Due to their older average age and unfamiliarity with social media-based teaching methods, teachers continued to use traditional methods, with the only difference being that teaching files were sent to social networks, which also led to reduced student learning in this environment. Moreover, due to the pandemic conditions, the Iranian education system entered the virtual education space without any infrastructure and readiness. There was no opportunity to train teachers for teaching in this environment, while education in this space required specific methods that teachers had not been trained in (15).

Simultaneously, the pandemic and the academic year necessitated that all students turn to virtual and online classes and follow their educational programs through social networks or the internet. This level of acceptance and dependence indicates that not only officials and parents do not oppose using the internet, but they emphasize and insist on utilizing the virtual space. Many limiting factors exposed students to academic decline. The limitation of in-person education on one hand and the unregulated virtual space on the other hand raised concerns that everyone, especially young people and teenagers, would turn to virtual space under any pretext, and this need would become an excuse to justify greater dependence on the virtual space (5). It is evident that preventing them from using the virtual space is complex and difficult, and one of the problems arising from students' entry into virtual education and excessive dependence on it is their academic decline.

Generally, previous research before the emergence of COVID-19 and the necessity of virtual education followed two approaches. Some studies showed that virtual education could be more effective than traditional education in learning, and using virtual space and social networks did not significantly impact academic decline. However, research supporting the positive effects of virtual education was generally conducted under normal conditions, and a hidden point is that formal in-person education still existed, and virtual education was not as extensive, mandatory, continuous, and accompanied by the anxiety of disease. However, most research indicates that virtual education negatively affects students' academic performance, leading to a significant decline in their performance (16, 17).

Given the importance of academic decline in the education system for students, parents, and educational policymakers, especially during the COVID-19 pandemic, this study aims to qualitatively investigate the factors involved in student academic decline during virtual education in the COVID-19 pandemic and provide a model for its predictors. Therefore, the main research question is, what factors influence student academic decline during the COVID-19 pandemic, and can a meaningful model for these factors and their relationships be provided?

2. Methods and Materials

2.1. Study Design and Participants

The present research used an exploratory mix-method study. The qualitative research population included all middle and high school students, teachers, and parents in the city of Sabzevar in 2021. The research sample was selected purposefully and interviewed until the findings reached theoretical saturation. The qualitative research sample consisted of 30 individuals, including 10 male and female students, 10 mothers of students, and 10 male and female teachers. In the qualitative method, more samples can be selected as long as new information can be obtained from the sample group. However, sampling ends with data saturation. The number 30 was chosen because new information was obtained until the 30th individual, and after the 30th, the data

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reached saturation, previous information was repeated, and there was no need for further sampling for interviews.

In the quantitative part of the research, the population included all middle and high school students, teachers, and parents in the city of Sabzevar in 2021. In the quantitative phase, the sample consisted of 384 individuals, including 100 male and female students, 100 mothers of students, and 184 male and female teachers. This sample size was chosen due to the unlimited population of these individuals and based on the appropriate sample size for an unlimited population (384 individuals). The sampling method used was multi-stage cluster sampling. Four schools were selected from middle and high school students, four classes from each school, and approximately six students from each class. Similarly, mothers were selected from those who were more involved in their children's education than fathers. For selecting teachers, 24 schools (12 middle and high schools, for boys and girls) were selected, and approximately eight teachers (four men and four women) were randomly selected from each school.

2.2. Measures

2.2.1. Semi-Structured Interview

In the qualitative phase, data were collected using grounded theory (to study the processes), providing various forms of qualitative data. In the present study, semi-structured interviews were used in the first phase to collect data. The use of semi-structured interviews allowed the researcher to benefit from the advantages of structured interviews, preventing digression and framing and targeting questions, and from the advantages of open interviews, discovering new and unpredictable information, theorizing, adding previous theoretical foundations, and gaining deeper information. Before conducting interviews with the sample group, based on the preliminary study results and identified indicators in the theoretical foundations and literature review and research objectives, the interview content was prepared and reviewed by researchers and experts in psychology and educational sciences. After modification and approval, the interviews were conducted. The duration of each interview, considering the conditions, tolerance, and interest of the participants, was 45 to 60 minutes. At the beginning of the interview, the research purpose, procedures, risks, and benefits, the voluntary nature of participation, confidentiality for participants, the participant's right to withdraw from the research at any time, and methods to protect the participant were explained. Informed consent forms were obtained from participants at the start of the interview. The interviews were recorded and then transcribed. To maintain confidentiality, all names were coded during transcription, and only the codes were referenced during data analysis and reporting results.

2.2.2. Researcher-Made Questionnaire

After extracting important factors influencing academic decline during the COVID-19 pandemic, each factor was formulated as a question in the questionnaire and analyzed for psychometric properties, including confirmatory factor analysis. This questionnaire had 49 questions, scored on a scale from very low (1 point), low (2 points), medium (3 points), high (4 points), to very high (5 points). It assessed six main factors and 12 sub-concepts. These factors included the context (electronic tool background, quantity and quality of internet, software and hardware deficiencies), the central factor (academic decline), causal factors (academic isolation, lack of motivation), strategies (ineffective teaching, inappropriate evaluation), intervening factors (role pressure on parents, culture of using tools and web space, inappropriateness of home environment for learning), and outcomes (reduced learning).

2.3. Data Analysis

Data analysis in this section was conducted in two stages. In the first stage, qualitative analysis using grounded theory was performed. The obtained categories were used to develop a model for predicting academic decline. In the second stage, for analyzing the data from the researcher-made questionnaire on factors influencing academic decline based on the conceptual model of grounded theory, factor analysis and structural equation modeling (SEM) were used with SPSS version 22 and Smart PLS software.

3. Findings and Results

Demographic information in the student section shows that most students were between 13 and 18 years old, with the least number of students aged 19 to 20, with only 2

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individuals. In terms of educational level, most students were in grades six to nine, with one participant each in grades ten and eleven. Regarding gender, there were 5 boys and 5 girls in the interviews.

Demographic information in the teacher section indicates that most teachers were between 31 to 40 years old, followed by those aged 20 to 30, with only one teacher aged 41 to 50, and none older than 50. In terms of years of service, most teachers had between 11 to 20 years of service (4 teachers), followed by those with 1 to 10 years (3 teachers) and 21 to 30 years (2 teachers). No teachers had more than 31 years of service. In terms of gender, there were 5 male and 5 female teachers in the interviews.

Demographic information for parents (mothers) shows that most mothers were between 20 to 30 years old (5 mothers), followed by those aged 31 to 40 (4 mothers), with only one mother aged 41 to 50, and none older than 51. Most mothers had 1 to 2 children (6 mothers), while 3 mothers had 3 to 4 children, and only one mother had 4 to 5 children. The sample consisted solely of mothers, with no fathers included.

This study identified 52 subcategories from the descriptive codes derived from the interview texts. These were categorized into 12 main categories and organized into 6 phenomena, including causal conditions, central phenomenon, intervening conditions, contextual factors, strategies, and outcomes. It is important to note that the analyzed categories are not definitive and are only referenced within this study. Answering the main research question involves constructing structural relationships and assessing model fit indices. Using the qualitative research method and the paradigm model provided by Corbin and Strauss (2007), the extracted categories were identified within the paradigm model framework. After assessing the participants' views, the three groups of categories were combined into contextual frameworks and presented in Table 1.

Table 1

Combined Main Categories

Combined Main Themes from Subcategories (Initial Quotes)	Subcategories (Initial Quotes)
Context and Background Challenges	1. Electronic tool background
	2. Quantity and quality of internet
	3. Software and hardware deficiencies
Intervening Factors Challenges	4. Culture of using tools and web space
	5. Role pressure on parents
	6. Inappropriateness of home environment for learning
Central Factor Challenge	7. Academic decline
Causal Factors Challenges	8. Lack of motivation
	9. Academic isolation
Ineffective Strategies Challenges	10. Ineffective teaching
	11. Inappropriate evaluation
Outcome Phenomenon Challenge	12. Reduced learning

Descriptive analysis of the research variables based on central parameters (mean, maximum, and minimum) and dispersion parameters (standard deviation and range) by research indices is presented in Table 2.

Table 2

Descriptive Analysis of Research Variables

Variable	N	Mean	SD	Max	Min	Range
Electronic tool background	384	3.75	0.751	5	1.33	3.67
Quantity and quality of internet	384	3.89	0.711	5	1.40	3.60
Software and hardware deficiencies	384	3.90	0.879	5	1	4
Context and background	384	3.86	0.678	4.83	1.33	3.50
Academic decline	384	3.75	0.848	5	1.33	3.67
Academic isolation	384	3.89	0.787	5	1.80	3.20
Lack of motivation	384	3.65	0.834	5	1.40	3.60
Causal factors	384	3.77	0.745	4.90	1.90	3

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Ineffective teaching	384	3.83	0.911	5	1.33	3.67
Inappropriate evaluation	384	3.63	0.839	5	1.50	3.50
Strategies	384	3.72	0.821	5	1.57	3.43
Role pressure on parents	384	3.64	0.751	5	1.57	3.43
Culture of using tools and web space	384	3.62	0.766	5	1.50	3.50
Inappropriateness of home environment	384	3.60	0.829	5	1	4
Intervening factors	384	3.63	0.703	4.79	1.50	3.29
Outcomes	384	3.71	0.878	5	1.33	3.67

According to the data in Table 2, the variable 'electronic tool background' has a mean of 3.75 and a standard deviation of 0.751, the variable 'quantity and quality of internet' has a mean of 3.89 and a standard deviation of 0.711, and the variable 'software and hardware deficiencies' has a mean of 3.90 and a standard deviation of 0.879. The contextual index has a mean of 3.86 and a standard deviation of 0.678. The academic decline index has a mean of 3.75 and a standard deviation of 0.848. The variable 'academic isolation' has a mean of 3.89 and a standard deviation of 0.787, and the variable 'lack of motivation' has a mean of 3.65 and a standard deviation of 0.834. The causal factors index has a mean of 3.77 and a standard deviation of 0.745. The variable 'ineffective teaching' has a mean of 3.83 and a standard deviation of 0.911, and the variable 'inappropriate evaluation' has a mean of 3.63 and a standard deviation of 0.839. The strategies index has a mean of 3.72 and a standard deviation of 0.821. The variable 'role pressure on parents' has a mean of 3.64 and a standard deviation of 0.751, the variable 'culture of using tools and web space' has a mean of 3.62 and a standard deviation of 0.766, and the variable 'inappropriateness of home environment for learning' has a mean of 3.60 and a standard deviation of 0.829. The intervening factors index has a mean of 3.63 and a standard deviation of 0.703, and the outcomes index has a mean of 3.71 and a standard deviation of 0.878.

The KMO value in this study is 0.707, which is above 0.6, indicating that the sample is adequate for factor analysis. The results of the factor loading analysis are presented in Table 3. As shown, all factor loadings are above 0.5, indicating that the model has suitable reliability. The average variance extracted (AVE) values for all constructs are above 0.5, showing the validity of the research variables. Additionally, the composite reliability values for all components are above 0.7, confirming the reliability of the research questionnaire.

Table 3

Factor Loadings, Composite Reliability, and Average Variance Extracted (AVE) of the Research Measurement Model

Component	Question No.	Factor Loading	Significance Statistic	AVE	Composite Reliability
Context				0.740	0.895
Electronic tool background	Q01	0.862	47.428	0.720	0.885
	Q02	0.813	31.896		
	Q03	0.870	73.567		
Quantity and quality of internet	Q04	0.688	20.432	0.627	0.893
	Q05	0.689	16.909		
	Q06	0.851	52.753		
	Q07	0.809	26.332		
	Q08	0.898	94.997		
Software and hardware deficiencies	Q09	0.864	45.196	0.793	0.939
	Q10	0.926	114.133		
	Q11	0.903	83.812		
	Q12	0.868	76.456		
Central Factor				0.631	0.837
Academic decline during COVID-19	Q13	0.842	50.572	0.631	0.837
	Q14	0.782	28.852		
	Q15	0.757	34.023		
Causal Factors				0.847	0.917
Academic isolation	Q16	0.780	30.146	0.653	0.904
	Q17	0.785	39.045		
	Q18	0.826	49.387		

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	Q19	0.883	82.320		
	Q20	0.762	27.789		
Lack of motivation	Q21	0.790	47.179	0.641	0.899
	Q22	0.816	40.657		
	Q23	0.827	43.164		
	Q24	0.751	30.822		
	Q25	0.816	44.758		
Strategies				0.890	0.942
Ineffective teaching	Q26	0.862	63.346	0.757	0.903
	Q27	0.857	60.424		
	Q28	0.891	61.172		
Inappropriate evaluation	Q29	0.825	52.986	0.728	0.914
	Q30	0.895	57.645		
	Q31	0.830	42.437		
	Q32	0.860	55.435		
Intervening Factors				0.743	0.896
Role pressure on parents	Q33	0.699	22.220	0.582	0.907
	Q34	0.777	26.729		
	Q35	0.732	23.713		
	Q36	0.749	27.245		
	Q37	0.785	37.427		
	Q38	0.818	45.856		
	Q39	0.776	36.108		
Culture of using tools and web space	Q40	0.805	32.877	0.584	0.848
	Q41	0.790	41.861		
	Q42	0.768	33.929		
	Q43	0.689	21.976		
Inappropriateness of home environment	Q44	0.811	40.510	0.711	0.881
	Q45	0.825	49.556		
	Q46	0.892	65.337		
Outcomes				0.814	0.929
Reduced learning	Q47	0.763	24.845	0.814	0.929
	Q48	0.908	112.196		
	Q49	0.902	48.638		

The primary criterion for evaluating latent endogenous variables in the path model is the coefficient of determination (R^2). This index indicates what percentage of the variance in the endogenous variable is explained by the exogenous variables. Values of 0.19, 0.33, and 0.67 for latent endogenous (dependent) variables in the structural path model are described as weak, moderate, and substantial, respectively. However, if the latent endogenous variable is influenced by only one or two exogenous variables, moderate R^2 values are acceptable. As shown in Table 4, the variables 'lack of motivation' and 'academic isolation' can explain 61.1% of the variance in academic decline during the COVID-19 pandemic, which is acceptable. According to Table 6, the predictor (Q^2) for academic decline during the COVID-19 pandemic is 0.357, which is considered strong. Therefore, it can be said that the examined structural model has good quality, and the observed values are well reconstructed, indicating that the model has a high predictive ability and can predict the latent endogenous variable. As shown in Table 6, academic decline during the COVID-19 pandemic can explain 37.9% of the variance in strategies, which is acceptable. According to Table 4, the predictor for strategies is 0.420, which is considered strong. Therefore, it can be said that the examined structural model has good quality, and the observed values are well reconstructed, indicating that the model has a high predictive ability and can predict the latent endogenous variable. As shown in Table 4, the variables 'culture of using tools and web space,' 'role pressure on parents,' and 'inappropriateness of home environment for learning' can explain 69.1% of the variance in strategies, which is weak. According to Table 4, the predictor for strategies is 0.583, which is considered appropriate. Therefore, it can be said that the examined structural model has good quality, and the observed values are well reconstructed, indicating that the model has a high predictive ability and can predict the latent endogenous variable. As shown in Table 4, the variables 'electronic tool background,' 'quantity and quality of internet,' and 'software

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and hardware deficiencies' can explain 51.1% of the variance in strategies, which is acceptable. According to Table 6, the predictor for strategies is 0.429, which is considered strong. Therefore, it can be said that the examined structural model has good quality, and the observed values are well reconstructed, indicating that the model has a high predictive ability and can predict the latent endogenous variable. As shown in Table 4, the variables 'ineffective teaching' and 'inappropriate evaluation' can explain 38.8% of the variance in outcomes, which is moderate. According to Table 4, the predictor for outcomes is 0.367, which is considered strong. Therefore, it can be said that the examined structural model has good quality, and the observed values are well reconstructed, indicating that the model has a high predictive ability and can predict the latent endogenous variable.

Table 4

Path Coefficients and T-Statistics of the Model

Path	Path Coefficient	T Statistics	Significance Level	Conclusion	R^2	Q^2
Lack of motivation → Academic decline during COVID-19	0.301	6.589	0.001	Confirmed	0.611	0.357
Academic isolation → Academic decline during COVID-19	0.541	12.950	0.001	Confirmed		
Academic decline during COVID-19 → Strategies	0.616	15.696	0.001	Confirmed	0.379	0.420
Culture of using tools and web space → Strategies	0.262	4.431	0.001	Confirmed	0.691	0.583
Role pressure on parents → Strategies	0.655	13.323	0.001	Confirmed		
Inappropriateness of home environment → Strategies	0.366	6.505	0.001	Confirmed		
Electronic tool background → Strategies	0.430	9.673	0.001	Confirmed	0.511	0.429
Quantity and quality of internet → Strategies	0.470	8.189	0.001	Confirmed		
Software and hardware deficiencies → Strategies	0.346	6.288	0.001	Confirmed		
Ineffective teaching → Reduced learning	0.349	4.982	0.001	Confirmed	0.388	0.367
Inappropriate evaluation → Reduced learning	0.311	4.461	0.001	Confirmed		

Another criterion introduced for model fit is the overall fit index (GOF), calculated by taking the geometric mean of the average communalities and R^2 values. This index ranges from zero to one, with values closer to one indicating a good model fit. The average communalities value is 0.508, and the average R^2 value is 0.533. According to the formula, the GOF index value is 0.520, which is higher than the threshold of 0.36, indicating that the model has a good ability to predict the latent endogenous variable.

4. Discussion and Conclusion

Based on the information obtained from qualitative analysis and the results of selective coding, the causal factors identified were two fundamental factors: lack of motivation and academic isolation. The core factor identified was the fundamental factor of academic decline. The contextual factors identified included the fundamental factors of electronic tools background, quantity and quality of internet, and software and hardware deficiencies. The intervening factors identified included the cultural factors of using tools and web space, role pressure on parents, and the inappropriateness of the home environment for learning. The instructional and educational strategies identified included ineffective teaching and inappropriate evaluation. Finally, the outcome that emerged in interaction with the concept of academic decline was reduced learning. The final output of the path relationships of various factors resulted in a model explaining academic decline, specifically the reduction in learning. The results of this study are consistent with the findings of some studies (15, 16).

In explaining these findings, it can be stated that the meaningful paths of various factors affecting academic decline during the COVID-19 pandemic led to the creation of a significant model within the framework of grounded theory. The core category was academic decline, which was related to several other variables. This category was influenced by causal factors, including lack of motivation and academic isolation. Additionally, this category formed a meaningful path with instructional and educational strategies during the COVID-19 pandemic, which included ineffective teaching and inappropriate evaluation. Moreover, in this context, the core category was indirectly influenced by intervening factors (culture of use, role pressure on parents, and inappropriate learning environment) and contextual factors (electronic tools background, software and hardware deficiencies, and quantity and quality of

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internet) on strategies. Ultimately, the implementation of ineffective strategies resulted in reduced learning outcomes for students during the COVID-19 pandemic.

Overall, it can be said that executing any educational project requires necessary measures to control causal factors. The reduction in motivation and the feeling of academic isolation due to quarantine conditions during the COVID-19 pandemic became fundamental causal factors for the ineffectiveness of educational efforts during this period (15). The lack of motivation can lead to a lack of effort in acquiring and retaining information, resulting in minimal output (4). On the other hand, according to research, collective spirit in performing educational activities leads to better learning. In contrast, the lack of competition and collaboration in a private and solitary environment reduces the attractiveness of education and leads to reduced learning (5). This does not necessarily mean that virtual education always leads to these conditions, but during the specific circumstances of the COVID-19 pandemic, due to the lack of previous experiences and the creation of a unique experience in teaching and education, the negative aspect had a more significant impact (7).

Furthermore, with the increased likelihood of academic decline following isolation and reduced motivation, other factors such as concurrent intervening factors and the learning and educational environment also intervened. In many cases, it was reported that efficient electronic tools and high-speed internet for virtual work and interaction were not available. Additionally, non-educational uses of tools and the busy home environment for learning efforts wasted the educational system's efforts. One of the important factors in effective learning is a calm, attractive, and engaging learning environment (9). Hence, all these factors led to ineffective and low-yield instructional and executive strategies characterized by a lack of supervision, widespread cheating, and difficulty in feedback, ultimately leading to reduced learning among students. Therefore, academic decline, at the heart of these complex interactions, will not lead to better outcomes than reduced learning, given the presence of harmful intervening factors and contexts, along with causal factors and inefficient and low-yield strategies (14).

The core category of academic decline, exemplified by reduced grades and decreased academic ability, stemmed from two fundamental factors: first, the lack of motivation and subsequently, academic isolation. Many texts mention that learning results from conscious effort, and motivation plays a significant role in this effort (6). Academic motivation and the effort to learn are usually influenced by internal and external factors (12). External motivating factors for students, such as receiving approval and avoiding penalties in virtual classrooms, were somewhat sidelined. Teachers did not have access to students and could not create healthy competition among them or apply their supervision to encourage healthy academic effort (19). Moreover, collective learning and gaining approval from peers due to academic isolation did not exist. Face-to-face interaction is one of the most influential educational factors in transferring academic concepts between teacher and student, and with its reduction or elimination, many interfering factors in this two-way relationship can disrupt learning outcomes (13). Overall, the lack of face-to-face interaction, loss of academic pressure and emphasis, and the absence of motivational interactions in virtual teaching led to academic isolation and lack of motivation being identified as causal factors in students' academic decline.

In general, it can be said that the specific conditions of quarantine, studying in isolation, occasional help from parents, and numerous interfering factors in this process caused stress among students and paved the way for avoiding difficult academic responsibilities in favor of surrounding pleasures such as gaming (15). Especially less educated parents during the COVID-19 period could not effectively supervise learning, evaluation, and practice for students. Consequently, due to the attractiveness of other recreational activities, most students' time was spent on virtual and non-virtual entertainment (16). These conditions led to a drift away from studying and academic activities, reduced grades, and diminished problem-solving abilities.

Therefore, it can be said that the core factor of academic decline due to the specific conditions of the COVID-19 pandemic, the elimination of in-person school education, and the nearly complete elimination of competition and collective face-to-face activities, combined with the lack of previous experience with virtual education and the inexperience of some teachers and parents, as well as the impact of causal factors like lack of motivation and academic isolation, led to students' academic decline. This, in turn, affected formal school educational strategies,

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resulting in reduced learning. Thus, academic decline, as a product of causal factors and the specific conditions of the COVID-19 pandemic, served as a bridge for the indirect influence of these factors on executive strategies and was considered a key indicator in the model. To control it, many factors such as the aforementioned causal factors, strategies, contexts, and existing backgrounds need to be reformed.

Given the results, it can be said that reduced learning due to causal factors such as decreased motivation and student isolation at home, as well as temporary academic decline and the intervention of intervening and contextual factors that rendered teaching strategies ineffective, resulted in reduced learning from the perspective of most respondents. Therefore, if virtual education is to be effective, it must be reformed in all paths, from causal and core factors to intervening and contextual factors and strategies, to follow an appropriate teaching and learning path that helps increase students' learning.

This research was conducted on the student, teacher, and parent population in the city of Bojnord. Due to some environmental and cultural differences, generalizing the findings to other populations is limited. Another limitation of the research was that some concurrent and intervening variables, such as simultaneous use of supplementary educational classes, economic status, etc., were not controlled in the quantitative part due to the nature of correlation studies, which may have influenced the results. Another limitation was that due to the spread of the coronavirus and quarantine conditions, the researcher attempted to include fathers' opinions in the study, but due to the lack of cooperation, this group was excluded from the study.

Given the potential impact of economic factors and financial resources on contextual factors and virtual education backgrounds leading to academic decline during the COVID-19 period, it is suggested that future research examine family income status as a mediating variable. It is also suggested that a detailed experimental study be designed to compare the impact of teachers' technological skills on effective virtual teaching and the use of virtual teaching tools on students' academic progress. Additionally, since part of the problems and factors affecting academic decline is due to stress from the COVID-19 outbreak and another part is related to the overall issues of virtual education, it is recommended to compare the results of this research with the results of other studies conducted under non-crisis conditions without pandemic viruses.

Authors' Contributions

Z.D. and S.H.S.B. conceptualized the study, designed the research framework, and developed the initial research questions. A.B. led the qualitative data collection process, conducting and analyzing the interviews with participants. M.R.R. was responsible for the quantitative phase, including designing the questionnaire and performing the statistical analysis using SPSS 20 and PLS Smart software. All authors contributed to drafting the manuscript, with Z.D. and S.H.S.B. focusing on the introduction and literature review, A.B. detailing the qualitative methodology and findings, and M.R.R. presenting the quantitative results and model validation. Each author reviewed and approved the final manuscript.

Declaration

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

Transparency Statement

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

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki. This study was approved by the Ethics Committee

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