FACTORS AFFECTING THE EFFECTIVENESS OF ONLINE LEARNING OF THE INTERNATIONAL SCHOOL'S STUDENTS, THAI NGUYEN UNIVERSITY

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ABSTRACT

Online learning has been utilized as a complement to traditional schooling since the 1980s, but in the context of the Covid-19 pandemic, this environment has become mandatory. The purpose of this paper is to investigate factors affecting the effectiveness of online learning of the International School's students, Thai Nguyen University. An online survey was administered to 195 students. Exploratory factor analysis, multiple regression, and qualitative analysis methods were used to analyze the responses. The results of exploratory factor analysis showed that there were five main factors affecting students' online learning (i.e., instructor quality and course design, facilitating conditions, time management, student satisfaction and other factors). Multiple regression analysis confirmed that all five factors had an important influence on predicting the effectiveness of online learning. The findings of the qualitative study revealed that while online learning had no effect on students' academic achievement, the demand for social connection must be properly acknowledged. The lecture material was still monotonous, and numerous technological issues emerged; the research team has offered solutions to address the aforementioned issues.

CÁC YẾU TỐ ẢNH HƯỞNG TỚI HIỆU QUẢ VIỆC HỌC TRỰC TUYẾN CỦA SINH VIÊN KHOA QUỐC TẾ, ĐẠI HỌC THÁI NGUYÊN

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TỪ KHÓA

Covid-19
Học trực tuyến
Phân tích nhân tố khám phá
Phân tích quy hồi đa biến
Phân tích định tính

TÓM TẮT

Học trực tuyến đã được sử dụng như một phương pháp bổ sung cho cách học truyền thống từ những năm 1980, nhưng trong bối cảnh đại dịch Covid-19 thì môi trường này lại trở nên bắt buộc. Mục đích của bài báo này là tìm hiểu các yếu tố ảnh hưởng đến hiệu quả của việc học trực tuyến của sinh viên Khoa Quốc tế, Đại học Thái Nguyên. Khảo sát trực tuyến đã được thực hiện trên 195 sinh viên. Phương pháp phân tích nhân tố khám phá, hồi quy đa biến và phương pháp phân tích định tính được sử dụng để phân tích các câu trả lời. Kết quả phân tích nhân tố khám phá cho thấy có 5 yếu tố chính ảnh hưởng đến việc học trực tuyến của sinh viên, bao gồm chất lượng giảng viên và thiết kế khóa học, các điều kiện thuận lợi, quản lý thời gian, mức độ hài lòng của sinh viên, và các yếu tố khác. Phân tích hồi quy đa biến khẳng định rằng cả năm yếu tố đều có ảnh hưởng quan trọng đến việc dự đoán hiệu quả của việc học trực tuyến của sinh viên. Kết quả của nghiên cứu định tính cho thấy, mặc dù việc học trực tuyến không ảnh hưởng đến thành tích học tập của sinh viên, nhưng nhu cầu kết nối xã hội phải được thừa nhận một cách đúng đắn. Tài liệu bài giảng vẫn còn đơn điệu và xuất hiện nhiều vấn đề về công nghệ; nhóm nghiên cứu đã đưa ra các giải pháp để giải quyết các vấn đề nêu trên.

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1. Introduction

In reality, online learning is not a new topic since the 1980s. In the early years of adopting this new model, online learning has been shown to provide several advantages to learners: a) increased access to education facilities, b) customization of learning, c) flexibility to provide students with time and location and d) cost reductions in school facilities [1]. Along with the expansion of the internet and the considerable reduction in the cost of telecommunications equipment, the online teaching and learning model has accomplished many spectacular achievements in recent years. If in the past, the online learning model was largely for the remote audience who were unable to take part in face to face due to physical obstacles, currently online learning is an alternate choice to replace students who work or earn credits while they are studying [2]. Mental comfort, combined with strong support of technology infrastructure via various online learning tools (for example, Google Meet, Zoom, Microsoft Teams, Zalo...), has helped the online model to have a strong impact, with many positive signals such as improving student access and encouraging higher program completion rates [3], [4]. Today, the online learning model exists in parallel and complements the traditional teaching model at many different universities and countries [5].

In recent years, the world has witnessed terrible disasters brought by nature such as hurricanes, tornadoes, earthquakes, tsunamis... and most recently, the Covid-19 pandemic. The outbreak of Covid-19 has been severely affecting many countries, regardless of whether it is a superpower or an undeveloped country, even the coldest and most sparsely populated areas [6]. Faced with such risks and challenges, many countries have had to change their policies, and companies have to change their operating models to adapt to the "*new normal*" environment that shows no sign of ending [7]. Although some economic activities such as commercial aviation, tourism, sports, and other social activities have been forced to close for social distancing, education still has to be maintained in many parts of the world [8]. Along with regular classes, which are still in place in some places unaffected, most classes have transitioned to an online learning environment where lectures are delivered via email, video call, software, website, or social networking platform.

The transition from the traditional learning environment to the online learning environment is no longer an option for learners, but it is a must for students [9]. Previous studies on online learning, including comparing this model with the traditional classroom, the factors affecting the effectiveness of online learning were conducted in normal contexts. However, in this "*new normal*" society, whether such research results are still intact, consistent during this period is still an open question, especially for Vietnam, when online teaching is applied from primary school to university level. The International School, Thai Nguyen University has also implemented online teaching for students in such a context [10].

Therefore, there is a need to address the aforementioned issue, particularly for students from the International School so that online teaching may be extensively implemented and long-term, not only during the epidemic but also in the future. As such, the purpose of this paper is to explore factors affecting the effectiveness of online learning of the International School's students, Thai Nguyen University.

2. Materials and methods

2.1 Research questions

This paper attempts to answer the following research questions:

- What factors affect the effectiveness of online learning of the International School's students, Thai Nguyen University?
- How do these factors affect the effectiveness of online learning of the International School's students, Thai Nguyen University?

- What solutions are there to limit those influencing factors?

Based on previous studies [1] – [4] for online learning, a research model was proposed as shown in Figure 1.

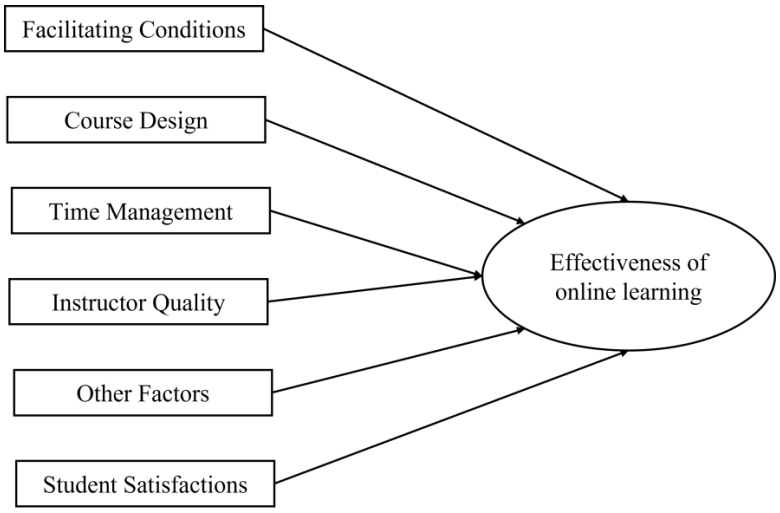

Figure 1. *The proposed research models*

2.2 Participants

The survey was sent to 250 students via Google Form and was conducted from June 6, 2021, to June 18, 2021. Before being sent to students, the questionnaire was sent to 5 lecturers to check the validity of the question to see if any questions need to be adjusted. The communication channels were email and social network (i.e., Facebook). The response rate was 79.6% (199 responses). The number of valid answers was 195 (97.98%). After removing duplicates, incomplete answers, and invalid answers (e.g., selecting only one answer), the final total data for analysis was 195. In terms of regions, 75 (38.46%) students live in cities, 37 (18.97%) live in districts, the rest 83 (42.56%) live in rural and mountainous areas. Most of the students participating in this study were first year students (45.36%), the rest were second year (24.23%), third year (10.82%), and final year (19.59%). The proportion of male accounted for 14.87%, while the rate of female accounted for 83.08%. Students who took a single-class online course accounted for 10.77 percent, 2 classes accounted for 8.72% and 3 or more classes accounted for 80.51%. Most online classes are conducted via laptops (49.74) and phones (46.15%). The main means of connecting to the internet is Wi-Fi/wireless network (82.56%). From this data, we can conclude that most students have experience for online learning.

2.3 Measures

After reviewing the survey questions used across the world and in the country, 24 questions were chosen and included in the research. The questionnaire employed in this study (see Table 1) consists of four questions designed to investigate the facilitating conditions [11] for online learning, four questions to assess course design [12], [13], three questions to student time management [14], six questions to assess teacher quality [14], three questions to explore other factors affecting online learning, and four questions to assess student satisfaction [3], [15]. A five-point Likert scale (1 = Disagree, 2 = Tend to disagree, 3 = Neutral, 4 = Tend to agree, 5 = Totally Agree) was used for each question.

Table 1. *Questionnaire surveying factors affecting students' online learning*

Code	Questions
Facilitating Conditions	
FC1	I have favorable conditions to support online learning.
FC2	I have the necessary knowledge to conduct online learning (e.g., using tools, websites, or software).
FC3	The media for online learning is fully compatible with my existing devices.
FC4	When I have trouble using online learning platforms, I can get help from others.
Course Design	
CS1	The course is well organized.
CS2	The course is designed to allow assignments to be completed in different learning environments.
CS3	The course is designed to allow me to take responsibility for my own learning.
CS4	Course content is designed in many different formats (e.g., PowerPoint, word, website, videos...).
Time Management	
TM1	I take all the online classes according to the schedule of the International School.
TM2	I complete all assignments on time.
TM3	I develop a plan and follow it to complete all the necessary work on time.
Instructor Quality	
IQ1	Instructors communicate and deliver lessons effectively.
IQ2	Instructors are enthusiastic about online teaching.
IQ3	Instructors care about students' learning.
IQ4	Instructors often respect student learning.
IQ5	I can reach the instructors outside of the online course.
IQ6	Instructors advise me whenever needed.
Other factors affecting online learning	
OT1	The noisy surroundings make it impossible for me to concentrate on my studies.
OT2	My health deteriorated as a result of online study (bad eyes, bad hearing....).
OT3	The interaction between teachers and students is not effective due to weak transmission lines.
Student Satisfaction	
SS1	Online classes are just as effective as the traditional classroom (classroom learning).
SS2	I enjoy learning more now that I am taking online programs.
SS3	I am satisfied with the quality of the online course.
SS4	I want to study online with follow-up classes.

2.4 Exploratory factor analysis

Exploratory factor analysis (EFA) is a statistical method used to reduce a set of many interdependent measurable variables into a smaller set of variables (called factors - immeasurable) to make them more meaningful but still contain most of the information content of the original set of variables [16]. Before performing EFA, the suitability of the measurement for the 24 survey items was evaluated through the use of descriptive statistics. In descriptive statistics, the research team calculated the mean of all responses and the standard deviation (SD) on each question. If the mean of a sentence was found to be close to 1 or 5, the team removed that answer from the table as it might reduce the standard of correlation among the remaining items [17]. After this step, the normality in the distribution was checked by testing for skewness and kurtosis before conducting exploratory factor analysis. In this study, six factors were used to determine the structural model of the preliminary questionnaire and its eigenvalue [18]. Only factors with eigenvalue ≥ 1 were retained in the analytical model [19]. Factor loading, or factor

weight, represents the correlation relationship between the factor and the observed variable [16]. The higher the value of the factor weight, the greater the correlation between that observed variable and the factor. The Kaiser-Meyer-Olkin (KMO) method was used to measure the relevance of the data for factor analysis. This method measures the appropriateness of sampling for each variable in the model and for the complete model [20]. The KMO measure varies between 0 and 1, and values above 0.5 are generally considered sufficient for EFA [21]. Bartlett test method is used to check whether the correlation level between questions is large enough for factor analysis to be statistically significant. Only when Bartlett's test is statistically significant (sig. < 0.05) will further analyzes be conducted**.**

2.5 Multiple regression analysis

After having results from EFA, factors with eigenvalues were used as independent variables for multiple regression analysis. The purpose of this method is to find out the degree of correlation between key factors to students' online learning [16]. The multiple regression model in this study is defined as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_n X_n$$

Where:

Y is a dependent variable reflecting students' online learning. This variable is calculated by taking the total value of student responses in six groups (24 questions).

β is the normalized regression coefficient.

Xs are the main factors that are retained.

2.6 Qualitative analysis

When conducting surveys with students, in addition to questions about general information such as gender, living area, equipment used... and quantitative questionnaires. The research team also asked open-ended questions to find out the advantages, disadvantages, difficulties and challenges of students for online learning that the available questions have not yet been measured. The data for the analysis were collected from two main sources: through open-ended questionnaires from the survey, and through student interviews. NVivo 7.0 software was used to support this qualitative analysis. NVino is designed to help researchers organize, analyze, and thoroughly understand unstructured data [22].

3. Results and discussion

3.1 Qualitative analysis

Table 2 displayed descriptive statistics of responses obtained from the survey questionnaire including responses with minimum, maximum, mean, standard deviation, deviation, and kurtosis. The data showed the diversity in students' perception of the problem of online learning, which is shown by the smallest (1) and the largest (5) values that coincide with the five-point Likert scale. For e-learning, the biggest benefit may be in terms of time management with the largest mean = 4.31 compared to the rest of the categories. However, the level of student satisfaction with the online class compared to the traditional one was at the average level (2.62), the lowest compared to all other scales. In general, all absolute values of deviation and kurtosis were less than 1, meeting the normal distribution suggested by Hair et al. [16].

Table 2. *Descriptive statistics of the survey*

	Min	Max	Mean	Standard Deviation	Skewness	Kurtosis
FC1	1	5	3.65	1.02	-0.152	-0.719
FC2	1	5	3.62	0.96	-0.277	-0.147

	Min	Max	Mean	Standard Deviation	Skewness	Kurtosis
FC3	1	5	3.79	1.06	-0.601	-0.233
FC4	1	5	3.65	1.08	-0.419	-0.409
CS1	1	5	3.50	1.03	-0.379	-0.125
CS2	1	5	3.61	1.10	-0.548	-0.173
CS3	1	5	3.75	0.97	-0.595	0.359
CS4	1	5	3.80	1.00	-0.633	0.181
TM1	1	5	4.31	0.82	-0.992	0.631
TM2	1	5	4.03	0.88	-0.769	0.702
TM3	1	5	3.89	0.90	-0.653	0.751
IQ1	1	5	3.48	1.10	-0.460	-0.128
IQ2	1	5	3.91	1.03	-0.627	-0.198
IQ3	1	5	3.87	1.05	-0.793	0.297
IQ4	1	5	4.06	0.98	-0.847	0.975
IQ5	1	5	3.58	1.08	-0.436	-0.244
IQ6	1	5	3.83	1.01	-0.652	0.174
OT1	1	5	3.45	1.11	-0.328	-0.359
OT2	1	5	3.03	1.23	-0.113	-0.803
OT3	1	5	3.67	0.94	-0.194	-0.299
SS1	1	5	2.62	1.14	0.304	-0.420
SS2	1	5	2.74	1.12	0.260	-0.200
SS3	1	5	3.13	1.07	-0.177	-0.265
SS4	1	5	2.80	1.21	0.168	-0.680

3.2 Exploratory factor analysis

Table 3. *Eigenvalues, Total Variance Explained of factors (only 10 results are listed with statistical significance)*

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.403	43.346	43.346	10.116	42.450	42.150	5.896
2	2.328	9.698	53.044	2.043	8.513	50.663	3.148
3	2.210	9.210	62.254	1.800	7.501	58.164	3.222
4	1.600	6.666	68.921	1.328	5.532	63.696	2.327
5	1.274	5.310	74.231	0.858	3.575	67.271	1.282
6	0.850	3.540	77.771				
7	0.662	2.757	80.529				
8	0.536	2.233	82.761				
9	0.454	1.894	84.655				
10	0.429	1.788	86.433				

Exploratory factor analysis was performed on 24 item questions with Varimax rotation. The analysis results from SPSS software allow the research team to extract the characteristic value for each factor. The Kaiser-Meyer-Olkin measurement verified the adequacy of sampling for

analysis with a value of 0.899, which was higher than that suggested by Kaiser [23] of 0.6 and Kim and Mueller [21] of 0.5.

Bartlett's test of sphericity gave the result $\chi 2\ (276) = 2218.308$, $\rho < 0.000$, indicating that the correlation between the question items was large enough to conduct exploratory factor analysis.

The data from Table 3 showed that there were five main factors formed from a set of 24 questions with an eigenvalue greater than 1. In other words, these 24 questions contribute 74.231% of the importance of influencing factors to online learning, the remaining 25.769% is due to other factors. The percentages explained by each factor are: factor 1 (43.346%), factor 2 (9.698%), factor 3 (9.210%), factor 4 (6.666%), and factor 5 (5.310%).

Table 4. *Rotated factor matrix*

	1	2	3	4	5
IQ3	0.836				
IQ4	0.822				
IQ2	0.805				
IQ6	0.783				
IQ1	0.736		0.397		
CS3	0.652	0.380			
CS2	0.645	0.480	0.332		
CS1	0.630	0.500	0.361		
CS4	0.567	0.450			
IQ5	0.525				
FC3	0.301	0.812			
FC1		0.778			
FC2		0.767			
FC4	0.492	0.563			
SS4			0.778		
SS3	0.372		0.770		
SS2			0.757		
SS1			0.746		
TM2				0.853	
TM1				0.810	
TM3				0.723	
OT1					0.686
OT2					0.636
OT3					0.495

The data in Table 4 showed that there is a shift in the question category among the main factors. The original model hypothesized that there are six factors influencing the effectiveness of online learning; nevertheless, the results of the study showed five fundamental factors that reflect the association between the questions. All items in course design (CS) are combined with teacher quality (IQ) to form a single factor. The loading factor of this group ranges from 0.525 to 0.836, with the larger value belonging to the quality of the trainers. There is a remarkable point in the rest of the data that the question items belong to the group of factors under the initial assumption. That shows that the data supports well the theoretical framework proposed by the authors.

3.2 Multiple regression analysis

The purpose of this analysis is to evaluate the influence of key factors obtained from EFA on students' online learning. Table 5 showed the factors that have an important influence on online learning (F (5, 189) = 350.775, p < 0.000), with R^2 = 0.903 indicating that 90.3% of online learning is explained by the above five factors.

Table 5. *Analysis of variance (ANOVA) with dependent variable is online learning*

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	39742.032	5	7948.406	350.775	0.000
Residual	4282.655	189	0.573		
Total	44024.687	194			

In general, the effectiveness of online learning (EOL) is determined by the following regression equation:

EOL = 86.749 + 8.791 * (Instructor Quality + Course Design) + 7.631 * (Facilitating Conditions) + 6.404 * (Student Satisfaction) + 4.457 * (Time Management) + 2.911 * (Other factors).

Table 6. *Model Summary*

Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	86.749	0.341		254.481	0.000
Instructor Quality + Course Design	8.791	0.342	0.584	25.722	0.000
Facilitating Conditions	7.631	0.342	0.507	22.327	0.000
Student Satisfactions	6.404	0.342	0.425	17.740	0.000
Time Management	4.457	0.342	0.296	13.040	0.000
Other Factors	2.911	0.342	0.193	8.516	0.000

Table 6 summarized the multiple regression model and parameters for each independent variable. The analysis results showed that all the extracted factors have an important influence on students' online learning (p < 0.000) in which the quality of lecturers and course design play an important role.

3.3 Qualitative analysis

The results of qualitative analysis through open-ended questions and interviews show some notable points as follows:

The first is about Facilitating Conditions, most students had no technological difficulties when taking online classes. This is demonstrated by 95.4% of students using laptops and phones through Wi-Fi and wireless connections (84.6%). Only a small part of students uses 3G/4G/5G packages to participate in online learning. The research team recommends that managers cooperate with telecommunications units to provide students with preferential packages at reasonable costs, especially in the context of the Covid-19 pandemic.

The second is regarding course design; even if the lecturer "carefully prepared the lesson, transmitted properly, and taught with enthusiasm," part of the information is still "monotonic," causing students' attention to dwindle. The research team suggests that leaders and lecturers collaborate with information technology departments to give technical assistance for more vividly transforming lectures, such as using contemporary technologies to create effects for lessons.

The third point is about time management; most students requested that there be a more appropriate time frame for online learning. According to the research team, online learning should be done in two ways: synchronous and asynchronous. The synchronous method necessitates the presence of both students and instructors at the same time. The benefit of this approach is that students' queries may be answered promptly, but it has a drawback in that it requires a reliable transmission connection. In contrast, the asynchronous technique allows teachers to record lectures and post them to the internet. Students can study whenever it is convenient for them.

Fourth, quantitative research reveals that instructor quality has a significant effect on online learning. We are now in the digital era, and digital transformation is a national task. Digital transformation enables schools and lecturers to approach students in totally new ways, which may disrupt the conventional or present style of teaching. As a result, instructors must continually enhance their ability to adapt to this shift.

Fifth is other factors affecting online learning, noise is the most mentioned factor in the open-ended question. Most of it is due to a software error that makes the class "extremely noisy, teachers have to fix devices during continuous teaching". This is a fairly common mistake when learning online and currently there is no complete software to overcome the above drawback. In addition, other factors including "eye pain" due to long-term viewing of the screen, hot due to the heat generation of computers/phones were also mentioned by students.

4. Conclusion and future work

This paper presented factors affecting the effectiveness of online learning. Results showed that there were 5 main factors affecting the effectiveness of online learning (i.e., instructor quality and course design, facilitating conditions, time management, student satisfaction and other factors). Of these five factors, the factor that plays the most important role is formed by grouping two hypothetical factors into a single common one. The remaining factors coincide with the initial hypothetical factor. Multiple regression analysis showed that all five factors have an important influence on predicting the effectiveness of online learning. Instructor quality and course design are considered to be the most important components affecting student learning. Although online learning does not affect students' academic performance, the need for social interaction needs to be seriously considered. The lecture content is still monotonous, and many technical problems arise, the research team has proposed solutions to overcome the above situation. Future work will examine the causal relationship among these factors by utilizing Structural Equation Modeling.

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