

Investigating determinants of effective game-based learning implementation in primary education

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ABSTRACT

The purpose of this study is to identify the factors influencing the organization of game-based learning (GBL) activities in primary schools and to validate the reliability, validity of these factors. The research sample consisted of 621 primary school teachers, randomly divided into two groups: 311 samples were used for exploratory factor analysis (EFA), and 310 samples for confirmatory factor analysis (CFA). The EFA results uncovered seven latent factors, accumulating for over 68.995% of the data variance. The CFA validated the seven-factor model, with model fit indices passing acceptable standards, implying high reliability and validity of the measurement structure. The primary factors influencing the organization of GBL activities in primary schools include confirmation, teaching environment, students, belief, motivation, perception, and competence. The findings affirm that this seven-factor model accurately reflects critical dimensions of organizing GBL activities in our current context. Thus, these results provide a scientific foundation for teachers, educational administrators, and researchers to enhance and promote GBL activities in primary education effectively.

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1. INTRODUCTION

Contemporary developments in educational innovation and instructional practice emphasize the importance of fostering student engagement and optimizing the learning process. Of the available approaches, game-based learning (GBL) has emerged from the idea of incorporating games into the educational process as a fun medium to capture students' attention and interest in the learning topic, while also providing a collaborative and intuitive teaching environment [1]. Prior research suggests that incorporating GBL approaches is both promising and practical, as it significantly enhances students' enthusiasm, engagement, and motivation towards learning. As such, these positive influences have been shown to contribute meaningfully to the development of students' skills and the improvement of their academic outcomes [2]. Notably, primary school students are closely associated with cognitive, emotional, and physical development. Thus, making these benefits especially relevant for their overall growth and success [3], [4].

Numerous studies address specific types of GBL from different subject perspectives, but the ideas, purposes, and implications of teaching are perceived similarly across many countries. For example, using language-learning games based on spoken dialogue provides students with opportunities to speak English in an interactive environment, helping to enhance their memory and concentration [4], [5]. Traditional games

can strengthen emotions and help build honesty as a character trait within students' social skills [1], [6]. The role of games as an important interactive tool in mathematics learning activities [2], [7]–[9].

Nowadays, information technology influences the development of human society. Most of the research on GBL focuses on digital games [10]. Digital games featuring animated graphics and engaging sound effects motivate students to learn and evoke positive emotions. Digital games mentioned in many studies include: interactive game PowPow [11]; Kahoot games [8], [12], AI learning experiences [13], ScienceSpots AR [14], media games such as Quizizz, Sudoku, Visual Novel, Puzzle, Hack and Slash [15], [16]. Although digital game environments cannot provide direct interaction [10], they still positively affect students' learning achievement and enthusiasm for participation [17].

Along with the growing interest in GBL, a common challenge for primary school teachers is balancing the entertainment aspect of games—ensuring they attract and motivate learners—while still achieving the intended learning objectives [18]. Elementary school teachers are aware of the benefits of GBL and what factors contribute to students' GBL effectiveness [19]. This suggests that minimal efforts have been devoted to examining the factors that influence elementary school teachers' organization of GBL activities, leaving a gap in the research. Achieving long-term success in education depends heavily on teachers' willingness to design processes for organizing GBL activities and creating games to support teaching, stimulating motivation for both teachers and students [19]. Therefore, the purpose of our study is to investigate the influencing factors using an exploratory factorial method and confirm the obtained components. The results of this study will answer the following questions:

- What factors might influence the organization of GBL activities in primary schools?
- How reliable and validated are these factors for use in new studies?

2. LITERATURE REVIEW

2.1. Game-based learning

Prior studies demonstrated that utilizing GBL had positive effects on student motivation and improved learning outcomes. For example, Donasari *et al.* [20] explored the effects of GBL when integrating different teaching methods and media in the classroom. Students' positive responses to flashcard games and visual worksheets were consistent with the observations, suggesting that GBL can create a fun learning atmosphere. Bang *et al.* [7] utilized games as a means for students to engage in learning within a story context, enabling them to access mathematical concepts and understand math problems within the real-life context of the story. Along with this research direction, other authors have also proposed forms of GBL organization in teaching different subjects. Research on spoken dialogue-based language learning games emphasizes their positive effects on students' emotions, motivation, and English learning ability [4]. Research on the application of games in mathematics learning has developed an Android-based educational game to increase primary school students' interest in learning mathematics [1]. Other studies have confirmed that digital GBL should be encouraged in teaching to help develop students' skills [10], [11]. In addition, Hasmarita *et al.* [21] concluded that traditional games have a significant influence on the character development of primary school students. Therefore, GBL organization in primary schools is a type of teaching that encourages effective and engaging experiential learning, helping students develop their own skills, as well as cultivate positive values necessary for effective learning.

2.2. Organizing game-based learning activities in primary schools

Recognizing the importance of using GBL as a method in education to support effective learning, several studies have focused on clarifying primary school teachers' perceptions of organizing GBL activities and factors influencing the effectiveness of GBL. For example, from a student-centered teaching perspective, schools can use their own traditional games or develop computer games that are suitable for educational purposes. Nugraha *et al.* [1] demonstrated the significance of motivation, positive experiences, and student characteristics in GBL, thereby proposing teaching methods that can create connections between these factors and learning outcomes across different educational environments [22].

Schools are actively seeking technology solutions to support personalized and lifelong learning for students. Although there are initial setbacks, if technology is designed to meet specific developmental and educational goals, it can positively impact students. Digital learning games, especially those with engaging real-world contexts, help students actively participate, think exploratively, and self-regulate their learning. The design and organization of learning games should focus on learners' cognitive, motor, and executive functions. At the same time, educational technology should be integrated with subject curricula to enhance the effectiveness of teaching and learning [7]. According to Kim *et al.* [18], players' abilities can be enhanced under specific conditions, including play contexts, positive interactions, and successful experiences in games.

Elementary school students are closely connected to developments in emotional, cognitive, and psychomotor domains. The use of interactive multimedia creates an active learning environment for students. Combining interactive media, such as text, images, sound, video, and animation, always creates a more positive atmosphere for students, free from pressure, and helps both teachers' and students' activities become more effective. Therefore, optimal learning requires teachers to be creative and innovative in their approach. Teachers can use game-based interactive multimedia as a learning tool to drive innovation and address problems [3].

However, from another perspective, games can also consume a lot of classroom time. Teachers often face challenges related to time constraints, students' learning behaviors, their ability to organize games, and a lack of active student participation. According to Ucus [19], five main aspects contribute to improving the effectiveness of GBL for students: the learners themselves, the learning environment, pedagogy, teachers, and context. Previous studies [23], [24] showed that teachers' experience in organizing games and their level of confidence directly affect the effectiveness of GBL activities.

Although these findings exist, little is still known about the factors influencing the organization of GBL activities in primary schools. Therefore, the analysis shows that there is a need for a study to clarify the factors affecting the organization of GBL activities in primary schools and the relationship between those factors, in order to orient new research in solving difficulties, improving practical applications, using learning games and enhancing students' abilities, contributing to supporting GBL activities.

3. METHOD

3.1. Research design

To answer the research question, we use the quantitative research design which is a methodological choice made to explore and clarify the latent factors that play an important role in organizing GBL activities in primary schools. Among many other techniques, the exploratory factor analysis (EFA) was utilized to decode the hidden structure within the responses collected from the survey. EFA is a multivariate statistical technique that allows researchers to identify and extract latent factors or underlying structures that govern a large set of observed variables [25]. In addition, to enhance the robustness and reliability of the factors discovered through EFA, the study also conducted confirmatory factor analysis (CFA). CFA serves as a validation step, assessing the suitability of the proposed factor model to the observed data [25]. To ensure the two experiments were carried out independently, we first shuffled the initial data, then split them into two parts: one part for performing EFA and the other part for CFA.

3.2. Sample and data collection

The focus of this study is teachers who are directly teaching at the primary level. The scope of the study encompasses primary school teachers working in diverse geographical areas of Vietnam, including cities, towns, rural areas, and mountainous regions, where the author team members reside and maintain contact networks. To effectively approach the survey participants, the study employed the purposive sampling technique. This technique enables researchers to select subjects with characteristics that align with the research objectives, thereby enhancing the ability to collect valuable information. In this context, an online survey, designed and managed through the Google Forms platform, was used as the primary means to collect data from participants. Prior to the official conduct of the survey, all invited participants were provided with detailed and complete information about the primary purpose of the study, the nature of the data to be collected, the confidentiality measures during data storage and analysis, as well as the freedom to withdraw from the study at any time without any consequences. The data collection process was conducted over three months, from March 2025 to May 2025. The survey instrument consisted of two clearly structured parts:

- Part 1: collects general information about the respondents through four questions regarding their workplace, working area, years of teaching experience, and professional qualifications, in order to establish the context for the subsequent responses.
- Part 2: consists of 24 questions designed to explore in depth primary school teachers' perceptions of their readiness to organize learning through play.

These questions were presented on a five-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree), allowing respondents to indicate their level of agreement with each statement. These questions were not entirely new, but were adapted and developed based on existing studies [26]–[28], and were reviewed and evaluated for their appropriateness to the specific context of the current study in Vietnam. To ensure data consistency and quality, a listwise elimination method was applied, whereby any observed variables containing at least one missing value or observed variables with only one response option were eliminated from the analysis. Before the survey was officially sent to the participants, it underwent rigorous internal reliability testing and validation by three reputable and experienced experts in

the field of primary education to ensure that the instrument accurately measured what the researchers intended and that the participants clearly understood the intended purpose.

3.3. Analysis of data

The survey collected 639 responses from the participants. After the data cleaning process, 18 (2.8%) data items were removed because they did not meet the validity criteria, leaving 621 (97.2%) data items for analysis, the first 311 data items for EFA analysis, and the last 310 data items for CFA analysis. Regarding sample size, classic studies in the field [29], recommend a minimum ratio of 5:1 between the number of observations and the number of variables. In the current study, this ratio was above 10:1 (311:24), indicating that the sample size was appropriate and met the requirements for the reliability of the results.

Using the EFA method to test the existence of correlations between variables, our study employed the first index, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, to partially represent the strength of these correlations. Some previous studies have suggested that a KMO level close to 1.0 is satisfactory, while values below 0.5 are considered unsatisfactory [25], [30]. The second index used is Bartlett's test of Sphericity, which determines whether there are significant correlations between observed variables. This test tests the hypothesis that the correlation matrix between variables is a unit matrix (there is no significant relationship between variables). If the p-value (sig.) < 0.05 , the results show that the variables are correlated strongly enough to perform factor analysis, thereby confirming the suitability of the data for the EFA method [31]. The data analysis method, using IBM SPSS (v25.0), was primarily employed to extract influencing factors, combined with the Varimax rotation technique, to optimize the factor structure and enhance data interpretation. With 24 variables to be studied, it is feasible to have 4 to 7 factors as expected [31].

The use of criteria such as Kaiser, scree plot, and explained variance ratio helps ensure that the extracted factors accurately reflect the latent structure of the data set. After completing EFA, the study continued to conduct CFA to test the validity and reliability of the extracted factors. CFA was performed to assess construct validity, reliability, and the overall goodness-of-fit of the model. Convergent validity was evaluated using standardized factor loadings, average variance extracted (AVE), and composite reliability (CR). Factor loadings greater than 0.50 were considered acceptable. With $AVE > 0.5$ and $CR > 0.70$ indicate adequate convergent validity and satisfactory internal consistency of the constructs.

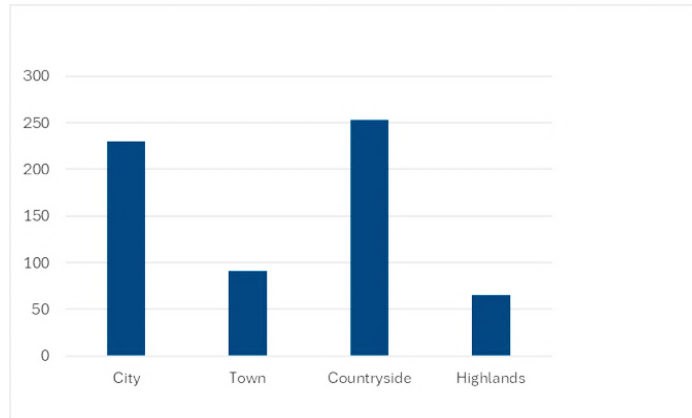
Some measures of the degree of fit between the experimental data and the measurement model in this study include: Chi-square divided by degrees of freedom (CMIN/DF), overall fit index (GFI), adjusted goodness of fit index (AGFI), normed fit index (NFI), comparative fit index (CFI), root mean square error of approximation (RMSEA) and PCLOSE. Of which, CMIN/DF is considered a good fit if ≤ 3 and acceptable if ≤ 5 . GFI, AGFI, NFI, and CFI with values ≥ 0.95 are considered an excellent fit, and a good fit is ≥ 0.9 [32]. RMSEA with values ≤ 0.01 is excellent, ≤ 0.05 is good, and ≤ 0.08 is average. A PCLOSE index with a value of ≥ 0.05 indicates an excellent fit, while a PCLOSE ≥ 0.01 reflects an acceptable fit [31]. CFA analysis in this study was conducted using IBM Amos software version 20.0, which accurately and reliably tests the measurement model structure.

To address the potential occurrence of common method bias, we ensured respondent anonymity to reduce evaluation apprehension. Harman's single-factor test was conducted, and the results indicated that no single factor accounted for the majority of the variance. This suggests that common method bias was not a significant concern in this study.

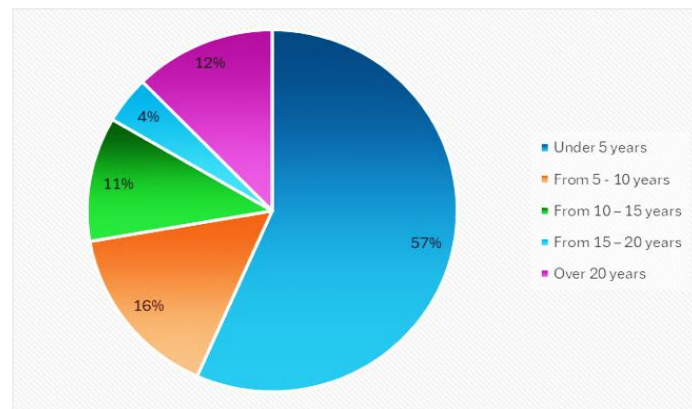
4. RESULTS

4.1. Descriptive analysis

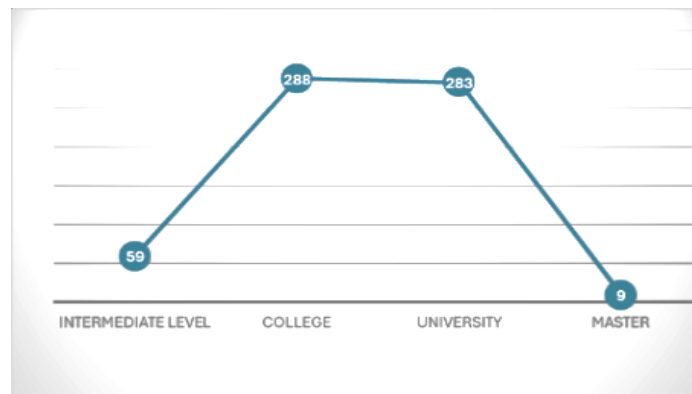
During the analysis, an observed variable, Q17, was removed due to its high cross-loading coefficient (≥ 0.3) to ensure the clarity of the factor structure. This left 23 remaining variables for the subsequent analysis. Figure 1 presents information about the survey participants, including their work locations, years of teaching experience, and professional qualifications. In Figure 1(a), it is evident that the majority of respondents are concentrated in rural areas (253 individuals, or 39.6%) and urban areas (230 individuals, or 36%). This is followed by those in towns (91 individuals, or 14.2%) and highlands (65 individuals, or 10.2%). Figure 1(b) illustrates the distribution of years of teaching experience among respondents. Most teachers (57%) have less than 5 years of experience, while 16% have taught in primary schools for 5 to 10 years. The remaining teachers are distributed among the categories of 10-15 years (11%), 15-20 years (4%), and over 20 years (12%). Figure 1(c) shows the professional qualifications of the interviewed teachers. The most common qualification is a college degree, held by 288 individuals (45.1%), followed closely by a university degree, which is held by 283 individuals (44.3%). Fewer respondents have intermediate level qualifications (59 individuals, or 9.2%), and the least represented are those with a master's degree (at least nine individuals, or 1.4%).



(a)



(b)



(c)

Figure 1. General information about participants (N=639) by (a) work locations, (b) years of teaching experience, and (c) professional qualifications

Table 1 reports the mean, standard deviation, skewness, and kurtosis of the observed variables. As shown in Table 1, the mean values range from 3.04 to 3.62, and no variable shows excessive variation. This indicates a relatively high level of agreement among the responses from the survey participants. The standard deviation ranges from .748 to .956, the skewness ranges from -0.499 to 0.296, and the convexity values range from -.670 to 0.657, indicating that the data distribution is relatively concentrated and has a shape close to a normal distribution, suitable for further research. As shown in Table 2, the results of KMO and Bartlett's tests showed that the KMO index reached an acceptable level (0.747), indicating the adequacy of the sample to perform factor analysis. On the other hand, Bartlett's test was significant $\chi^2(253)=2478.291, p<0.000$.

Table 1. Mean, standard deviation, skewness and kurtosis of the collected survey data

Variable	Mean	Standard deviation	Skewness	Kurtosis
Q1	3.16	.791	.296	.085
Q2	3.04	.801	-.195	-.173
Q3	3.23	.809	-.227	.243
Q4	3.26	.850	.099	-.399
Q5	3.40	.784	.046	.211
Q6	3.62	.840	-.499	.294
Q7	3.39	.807	-.027	-.155
Q8	3.05	.844	.084	-.091
Q9	3.34	.894	-.262	-.160
Q10	3.19	.813	.169	-.389
Q11	3.38	.794	-.096	.059
Q12	3.42	.811	.100	-.284
Q13	3.26	.748	-.096	.144
Q14	3.45	.817	-.351	.657
Q15	3.47	.911	-.221	.211
Q16	3.46	.852	-.104	.112
Q18	3.23	.798	-.104	.135
Q19	3.17	.851	.039	-.048
Q20	3.36	.882	-.177	-.373
Q21	3.42	.956	.004	-.670
Q22	3.39	.791	-.280	.190
Q23	3.37	.750	.141	-.019
Q24	3.16	.791	-.029	.155

Table 2. KMO and Bartlett test

KMO measure of sampling adequacy.		0.747
Bartlett's test of Sphericity	Approx. Chi-square	2478.291
	df	253
	Sig.	.000

4.2. Exploratory factor analysis

The extracted factors, along with their eigenvalues, explained variances, and cumulative variances, are summarized in Table 3. Following the Kaiser criterion, only factors with eigenvalues greater than 1 were retained in the model. The analysis of 23 observed variables revealed that seven factors significantly influenced the organization of GBL activities. These seven factors accounted for 68.995% of the variance in data collected from 311 primary school teachers. Specifically, factors 1 through 7 contributed 18.438%, 10.704%, 9.294%, 8.559%, 8.348%, 7.016%, and 6.636% to the explained variances, respectively.

Table 3. Results of factor analysis

Component	Total	Initial eigenvalue		Total variance explained by loadings		
		% of variance	% Cumulative	Total	% of variance	% Cumulative
1	4.241	18.438	18.438	4.241	18.438	18.438
2	2.462	10.704	29.142	2.462	10.704	29.142
3	2.138	9.294	38.436	2.138	9.294	38.436
4	1.969	8.559	46.995	1.969	8.559	46.995
5	1.920	8.348	55.343	1.920	8.348	55.343
6	1.614	7.016	62.359	1.614	7.016	62.359
7	1.526	6.636	68.995	1.526	6.636	68.995
8	.680	2.957	71.952			
9	.639	2.780	74.732			
10	.618	2.687	77.419			

The scree plot in Figure 2 illustrates the variation of the eigenvalues, showing that seven factors can be retained in the model. The eigenvalue of the eighth factor (.680) is lower than the original criterion value of 1.0, so it is not retained [25]. However, it is worth noting that an eigenvalue close to one may also be considered acceptable. After evaluating all the criteria, we concluded that retaining the seven factors is appropriate for the analysis. The remaining factors may provide opportunities for further research in the future.

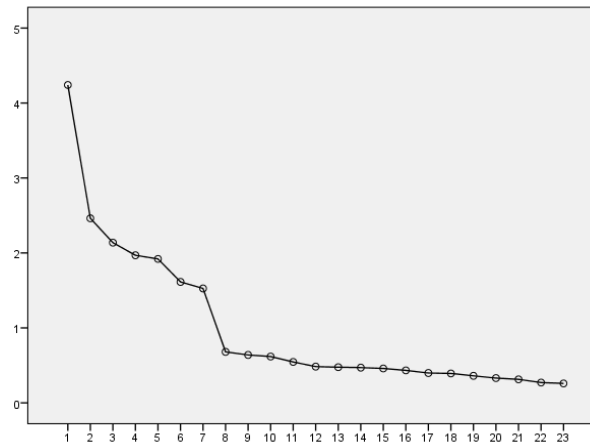


Figure 2. Scree plot

Table 4 presents the factor loadings, which range from 0.728 to 0.882. According to Hair *et al.* [31], it is suggested that for samples of 200 or more, factor loadings of 0.40 or higher are considered significant. Therefore, all observed variables in this study were retained. Additionally, Table 4 confirms that all seven factors meet the established criteria, with each factor having at least three observed variables that have factor loadings exceeding 0.40.

Table 4. Rotated varimax component analysis matrix

Variable	Component						
	1	2	3	4	5	6	7
Q18	.836						
Q19	.830						
Q20	.818						
Q21	.752						
Q10		.811					
Q13		.789					
Q11		.789					
Q12		.771					
Q16			.869				
Q15			.824				
Q14			.785				
Q2				.805			
Q1				.805			
Q3				.802			
Q4					.826		
Q6					.824		
Q5					.812		
Q7						.835	
Q9						.803	
Q8						.796	
Q23							.840
Q24							.822
Q22							.777

The results of the EFA, which includes the Cronbach's alpha coefficient and the factor loadings of the observed variables, are presented in Table 5. According to Hair *et al.* [31], a Cronbach's alpha value of at least 0.7 indicates acceptable reliability for each factor. Factor 1 is labeled "confirmation," as all its items affirm the effectiveness and quality of the teaching method through play. Factor 2, named "environment," encompasses items related to facilities, classrooms, parents, and colleagues. Factor 3 focuses on interaction and student activities, hence it is called "students." Factor 4 is referred to as "belief," reflecting teachers' confidence in the validity of GBL activities. Factor 5, named "motivation," highlights the reasons that inspire teachers to organize learning activities through play. Factor 6, designated as "awareness," includes three items that express teachers' concerns about developing students' abilities and fostering positive emotions. Finally, factor 7 consists of three items related to the skills that primary school teachers can use to facilitate GBL activities; thus, it is named "competence."

Table 5. Final results for EFA

Variable	Item	Loadings
Factor 1. Confirmation (Cronbach's alpha=0.849)		
Q18	My experience in organizing learning activities through play exceeded my expectations	.836
Q19	The learning outcomes through play for students were better than I expected	.830
Q20	Using the teaching method through play improves the quality of learning	.818
Q21	Using the teaching method through play increases students' interest in learning and confidence	.752
Factor 2. Environment (Cronbach's alpha=0.820)		
Q10	I always feel comfortable in my class.	.811
Q13	Parents always cooperate with me when organizing play-based learning activities.	.789
Q11	I always have opportunities to discuss with colleagues at my school about experiences in organizing games.	.789
Q12	Teaching materials and equipment are sufficient for me to improve the organization of games in the classroom.	.771
Factor 3. Students (Cronbach's alpha=0.788)		
Q16	My students really enjoy interactive learning with their peers.	.869
Q15	Students often provide clear feedback on the results of their peers' group activities.	.824
Q14	Students really enjoy being encouraged and motivated by me in their learning	.785
Factor 4. Belief (Cronbach's alpha=0.753)		
Q2	I always trust in the effectiveness of educational games in teaching.	.805
Q1	I believe in the benefits of educational games when implementing the general education curriculum.	.805
Q3	I am always ready to plan and organize play-based learning activities.	.802
Factor 5. Motivation (Cronbach's alpha=0.769)		
Q4	I frequently organize play-based learning because my students enjoy it greatly.	.826
Q6	Organizing play-based learning is very important to me because my students understand more quickly.	.824
Q5	Organizing play-based learning gives me a sense of accomplishment.	.812
Factor 6. Awareness (Cronbach's alpha=0.761)		
Q7	I believe that learning through play creates positive emotions for students.	.835
Q9	I believe that learning through play provides many opportunities for students to develop their competencies.	.803
Q8	I think it is necessary to regularly inspire students in teaching.	.796
Factor 7. Competence (Cronbach's alpha=0.756)		
Q23	I think I have the ability to organize educational games for students.	.840
Q24	I think I have sufficient knowledge to organize educational games for students.	.822
Q22	I think I can inspire students through organizing play-based learning activities.	.777

4.3. Confirmatory factor analysis

Table 6 shows the reliability and validity of the scales used in the CFA analysis. Looking at Table 6, we can see that the Cronbach's alpha values are all >0.7 and the CR of all factors are also ≥ 0.7 , the AVE of the factors are all ≥ 0.5 , proving that the structure has good reliability and is acceptable. Table 7 summarizes the fit indices of the CFA model. The results from the table show that $CMIN/DF=1.686$ is an excellent index. Similarly, GFI has a value of .910, which is higher than the acceptable criterion ($\geq .90$). The AGFI and NFI indices are considered acceptable with values of .929 and .927, respectively. CFI=.939 is higher than the threshold of the acceptable criterion. RMSEA=.047 is also an acceptable criterion ($\leq .05$). Finally, PCLOSE=.705 is much larger than the threshold value ($\geq .05$), so this is an excellent fit index.

Table 6. Cronbach's alpha, structural reliability, and AVE of the seven factors

Factor	Items	Cronbach's alpha	CR	AVE
Confirmation	4	.808	.796	.505
Environment	4	.818	.796	.505
Students	3	.767	.796	.505
Belief	3	.800	.732	.564
Motivation	3	.766	.740	.510
Awareness	3	.732	.796	.505
Competence	3	.753	.756	.511

Table 7. Fit indices of the CFA model

No	Measure	Estimate	Threshold	Interpretation
1	CMIN/DF	1.686	<3	Excellent
2	GFI	.910	$\geq .90$	Acceptable
3	AGFI	.929	$\geq .90$	Acceptable
4	NFI	.927	$\geq .90$	Excellent
5	CFI	.939	$\geq .90$	Acceptable
6	RMSEA	.047	$\leq .05$	Acceptable
7	PCLOSE	.705	$\geq .05$	Excellent

Figure 3 presents a model of the factors affecting the organization of GBL activities in primary schools, accompanied by relevant statistical indicators. According to Hair *et al.* [31], the standardized factor loading coefficient needs to be ≥ 0.5 to be accepted, and ≥ 0.7 is good. All factor loadings in Figure 3 are in the range of 0.68-1.09, ensuring the model has good convergence. Only variable Q6, with a coefficient of 0.68, has a coefficient lower than 0.7, but it is still acceptable. This result is consistent with EFA.

The curved arrows in Figure 3 represent the correlation between factors. According to Kline [33], if the correlation coefficient is greater than or equal to 0.85, there may be a multicollinearity problem between the factors. However, the correlation coefficients in the figure range from 0.00 to 0.17, indicating that the factors do not have multicollinearity.

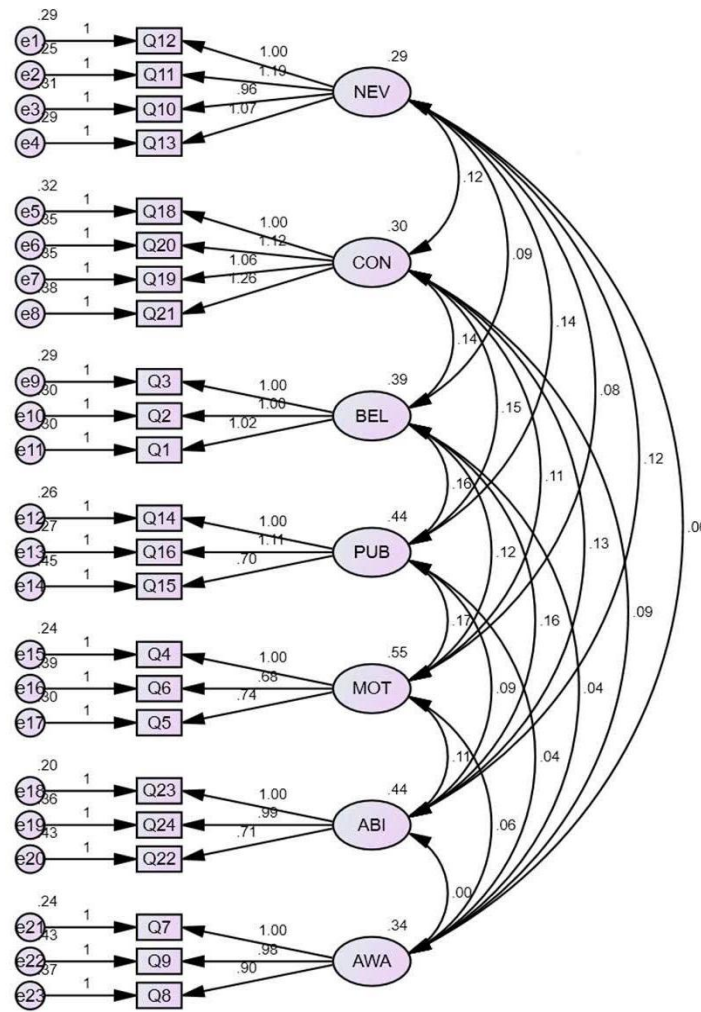


Figure 3. Seven factors influencing the organization of GBL activities in primary schools

5. DISCUSSION

This study investigated the factor structure of 23 observed variables from primary school teachers using EFA and CFA. The results from the EFA showed that the sample size of 311 teachers was appropriate, as evidenced by the KMO index exceeding the threshold of 0.50, allowing for further analysis. The EFA analysis yielded a solution comprising seven main factors, and this model demonstrated the ability to explain over 67% of the total variance in the data, indicating a significant level of fit. The research results identified seven main factors affecting the organization of GBL activities of primary school teachers, including confirmation, environment, students, beliefs, motivation, awareness, and competence. The results of the CFA showed that the model fit indices met the standards, indicating validity and high reliability of these factors.

The confirmation factor indicates that teachers recognize the effectiveness of GBL in improving students' learning outcomes, engagement, and classroom experiences. This finding supports previous studies [8], [21], [34], that highlight the educational benefits of GBL in primary education. The environment factor emphasizes the importance of supportive conditions such as parental involvement, collaboration with colleagues, classroom facilities, and technological resources [35]. Meanwhile, the students factor highlights the role of student engagement, cooperation, and interaction in successful GBL implementation [6], [12]. In addition, teachers' belief, motivation, and awareness significantly influence their willingness to adopt GBL, supporting findings from [7], [36], [37]. Finally, competence reflects teachers' pedagogical skills and creativity in implementing GBL, which has been identified as a critical determinant of successful game-based instruction [38]. These findings suggest that improving teachers' professional competence, strengthening institutional support, and promoting positive perceptions of GBL are essential for effectively integrating GBL in primary education.

In addition to the results consistent with some previous studies on the organization of GBL activities in primary schools, this study also has some differences. First, this study has identified a model of seven factors that simultaneously affect the organization of GBL activities in primary schools, instead of addressing each component individually, policy makers and educators on GBL in primary schools can focus on discussing these seven areas. Additionally, multivariate linear regression or cluster analysis can be used to enhance the investigation further. Second, this study used the CFA method to test the reliability and validity of the factors, which has not been systematically implemented by many studies in the field of primary education in Vietnam. Third, future researchers can utilize these seven factors to explore other proposed areas, such as refining GBL organization methods or evaluating student learning outcomes through GBL.

6. CONCLUSION

This study aimed to investigate the underlying latent factors through the analysis of a dataset of 23 survey questions. The results of the EFA analysis revealed that the data contained seven latent factors, which accounted for more than 68.995% of the variance; the remaining variance was attributed to other factors. These latent factors were named confirmation, teaching environment, students, beliefs, motivation, awareness, and competence. The CFA analysis validated the seven-factor model, with all measurement indices meeting acceptable and excellent thresholds, confirming that the measurement model demonstrates high reliability and validity. These factors align with findings from previous studies. This provides insights into GBL, allowing policymakers and educators in primary schools to focus their discussions on these seven domains rather than examining individual indicators.

Although this study has yielded some remarkable results regarding the organization of GBL activities among primary school teachers and future researchers, it is still limited by certain constraints. First, the research data sample consists of 621 primary school teachers from a limited number of locations in Vietnam, so it may be necessary to conduct studies with a broader scope of locations to draw more generalizable conclusions. Second, this study mainly focuses on identifying and testing influencing factors. To obtain an overall assessment of the organization of GBL, additional statistical techniques such as cluster analysis, qualitative analysis, and multivariate linear regression are necessary to evaluate the level of influence of each factor on the organization of GBL activities in primary schools.

This study offers several recommendations that can guide new research directions for interested researchers and scholars. The first is to raise awareness, motivation, confidence, and capacity to organize GBL activities in primary schools. On the school side, the research results can be used to improve the teaching environment, facilities, and develop policies to support the organization of GBL activities in primary schools, as well as focus on teacher training activities. For policymakers, these research results can serve as the basis for proposing training programs, developing teaching materials, and implementing measures to encourage teachers to incorporate GBL in teaching subjects in primary schools. In addition, future studies can utilize these factors to explore and gain a deeper understanding of other aspects, such as teaching programs, adjusting teaching methods, and student learning outcomes.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

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Vi : Visualization

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [CTDN], upon reasonable request.




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