

The Development of a Blended Instructional Model Using the Inquiry Process with Digital Games to Enhance Analytical Thinking Skills for Primary Students

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Abstract

Analytical thinking skills were an essential learning process for primary students. The research objectives were to 1) study the current condition, problems, and good practices regarding teaching and learning. 2) develop a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for elementary school. 3) study the results of using the instructional model. The research and development process was divided into 3 phases. Phase 1; study the current conditions, problems, and good practices regarding teaching and learning, the sample group included 377 teachers and 11 teachers. Phase 2; develop a blended instructional model, the sample consisted of 7 and 7 experts. Phase 3; study the results of using the instructional model the sample consisted of 34 grade 6 students. The data were analyzed by basic statistics and hypothesis testing statistics. The research found that 1) The current condition and overall problems were moderate level. The good practices included blended learning methods, the inquiry process, and instructional media with digital games. 2) The blended instructional model using an inquiry process along with a digital game included 4 core components: principles, objectives, management of teaching-learning processes, and measurement and evaluation. Seven experts evaluated and certified this instructional model that was appropriate in all aspects at a high level. 3) The results of using the instructional model found that (1) the analytical thinking skills of students who studied using the instructional model overall post-test were significantly higher than pre-test at the .05. (2) Measuring students' learning achievement overall score post-test was significantly higher than pre-test at the .05. (3) Students' post-test scores of the experimental were significantly higher than the control group at the .05. (4) Students' post-test scores of the experimental were significantly higher than the control group at the .05.

Keywords: analytical thinking skills, blended learning, digital games, elementary school, inquiry process, instructional model

1. Introduction

Analytical thinking involves the process of breaking down information into smaller components, identifying relationships between each part and other factors, and considering the overall structure (Montaku et al., 2012; Astriani et al., 2017). The ability to differentiate, organize, and attribute is integral to the analysis process (Astrini et al., 2017). Analytical thinking is the classification of something/a matter to find elements and relationships between those elements and help understand that matter (Wongyai, 2019). Characterizing analytical thinking skills as a mental process employed to determine problem solutions, differentiate, organize, and attribute were three indicators of analytical thinking skills (Ad'hiya & Laksono, 2018; Farizi et al., 2023; Heliawati et al., 2021; Wirdiyatusyifa et al., 2021). Analytical thinking skills have emerged as essential competencies in the 21st century (Prawita et al., 2019). Playing a crucial role in human development across social, technological, and educational domains (Ramadani et al., 2021). The National Institute of Educational Testing (2020) stated that the analytical thinking skills of learners should be developed in order to be comprehensive and consistent with the learners' abilities because analytical thinking skills are an important skill for all learners. Teachers should organize learning to strengthen the analytical thinking skills of students. Continuously study through organizing integrated learning

activities to develop analytical thinking in 5 steps which were followed by all sequencing steps. The National Basic Educational Test (O-NET) showed scores results of students in Grade 6, and most of them found that scores of student's analytical thinking skills in science subjects were still at a low level. Therefore, it is necessary to develop teaching and learning in science subjects for students to have higher scores.

The inquiry process is a learning management model that is based on the theory of knowledge creation as constructivism. It is a process where learners must search, explore, examine, and research in various ways until the students understand and learn meaningfully. It can be created as the learner's knowledge and stored as information in the brain for a long time. It also can be used when faced with any situation (Institute for the Promotion of Teaching Science and Technology, 2007). There are dividing the steps into 5 steps: 1) creating interest (Engagement) 2) exploring and searching (Exploration) 3) explaining and conclusions (Explanation) 4) expanding knowledge (Elaboration) and 5) evaluating (Evaluation) (Institute for the Promotion of Teaching Science and Technology, 2003). The concept of using games in education emerged at the end of the 20th century. At that time, most teachers preferred to use the teaching method of transferring knowledge to students, namely lecturing to provide knowledge directly. This teaching method greatly affects the quality of teaching, makes students ineffective, and makes students feel bored with learning, described that teaching involves transferring knowledge directly from teachers. As a result, only 20–25 percent of students are successful in their studies. Commented that the children did not want to study because of the work assigned to them by the teachers. The teacher's teaching method cannot be stimulated to feel like learning, teaching problems raise the idea of combining the world of fun and the world of learning together by using games. The basis of the game was a learning activity for students that made students change their attitude. Studying is a difficult task and becomes fun which is considered the first step in using games in teaching (Prensky, 2001; Rodkroh, 2021).

A digital game is a game that players can play with a computer online or offline (Bunt-Kokhuis et al., 2005). A digital game is a program or interactive electronic media, a type of game that allows the player to have only one or more people use digital devices such as computers, and mobile phones as devices for playing and creating experiences. It is intended for entertainment or may be used for teaching purposes, and it has competition rules and objectives that players must overcome to reach (Beth, 2006). It is also used to enhance thinking skills in many ways (Gee, 2004). Consistent with the Egenfeldt-Nielsen study (2005), it was found that students who played games tried to understand the basics and concepts in the game, including things hidden in the game. This would help the learners to have a learning process by using blended learning. Na Songkhla (2018) explained a teaching arrangement that consists of online learning and classroom meetings. The activity combines meetings between students and teachers with the use of technological elements that allow learners to control their own time, place, and learning path. Blended learning design consists of 3 characteristics: 1) a combination of teaching materials, 2) a combination of teaching methods, and 3) a combination of face-to-face teaching and online teaching. Teaching management in content that teachers can provide content easily for students to learn on their own from the web. Students can learn difficult content in a traditional classroom via the web which allows students with different abilities to achieve equal learning success.

Instructional models are thought tools that people use to search for answers, knowledge, and understanding of all phenomena. Normally, in researching any subject, questions need to be answered. In the research process, a hypothesis or set of hypotheses is created which is the expected answer in advance. These assumptions are usually derived from previous knowledge or findings, maybe from experience, or maybe from various theories and principles. A hypothesis is a statement that indicates the relationship between elements or variables that matter/problem situation. It would remain only a tool for seeking answers until it has been tested. If the hypothesis is true, then the statement can be used to predict or explain that phenomenon. The model is the same as the hypothesis that a person may create from thoughts, experiences, metaphors, or various theories and principles but the model is not a theory (Khaemmanee, 2023). The instructional model has important elements as follows: 1) There is a theoretical philosophy, theories, principles, concepts, or beliefs that are the basis or principles of that instructional model. 2) There is a description and explanation of the conditions or characteristics of teaching and learning that are consistent with the adhered principles. 3) There is a system that is an arrangement. The elements and relationships of the elements of the system can lead students to the goals of the system or process. 4) There is an explanation or information about teaching methods and various teaching techniques that would help the teaching and learning process achieve maximum efficiency (Khaemmanee, 2010).

By studying the problems, concepts, and theories mentioned above. It needs to be developed and solved as well as enhancing the analytical thinking skills of students and to be consistent with the above concept and importance. This research focuses on studying and developing the instructional model. There are teaching and learning design principles that match the content, objectives, teaching process, measurement, and evaluation and are consistent

with responsiveness to enhance students' analytical thinking skills and students' academic achievement.

2. Method

2.1 Research Objectives

- to study the current condition, problems, and good practices regarding and learning that enhance analytical thinking skills in science for primary students.
- to develop a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for primary students.
- to study the effect results of the blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for primary students.

2.2 Research Hypothesis

- Students who learned with the blended instructional model had post-test scores on analytical thinking skills measures higher than pre-test.
- Students who learned with the blended instructional model had post-test scores on academic achievement tests higher than pre-test.
- Students in the experimental group who learned with the blended instructional model had higher post-test scores on analytical thinking skills measures than students in the control group.
- Students in the experimental group who learned with the blended instructional model had higher post-test scores on the academic achievement test than students in the control group.

2.3 Research Methods

Research and development were used in this research that were conducted in 3 phases as follows.

Phase 1: Study of the current condition problems and good practices regarding teaching and learning that enhance analytical thinking skills for primary students. It's divided into 5 steps: 1) study documents, principles, concepts, theories, and related research to analyze and synthesize the elements of the instructional model 2) question teachers' opinions about the current condition, problems of organizing teaching and learning that enhances analytical thinking skills in science for primary students. The inquiry was collected from a sample of 377 people who were teachers during science for students at the primary school level under the Office of the Basic Education Commission. Multi-stage random sampling was selected. 3) interview science teachers about good practices in teaching and learning that enhance analytical thinking skills in science for primary students. In an interview, the sample group consisted of 11 people who were teachers of science for primary students, under the Office of the Basic Education Commission, specialized in teaching science. Random cluster sampling was selected for a sample group. 4) create (draft) a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills in science for primary students. 5) prepare a manual for using the instructional model.

Research Instruments

- The opinion questionnaire for teachers who have been teaching science to students at the primary school. The questionnaire consisted of 4-point rating scale questions using the Likert scale (Thomas et al., 1998). The consistency between the questions and the objectives and content by 3 experts, it was found that all questions could be used with an IOC value of 0.80–1.00.
- The interview for science teachers. It was a semi-structured interview concerning teaching and learning that enhanced analytical thinking skills in science for students at the primary school. Science subjects for primary students. The consistency between the questions and the objectives and content by 3 experts, it was found that all questions could be used with an IOC value of 0.80–1.00.

Data Collection and Data Analysis

- Phase 1: The sample group was selected to collect data. Then, separate the sample according to affiliation, and educational area level and proceed with data collection. The coordinator collected data through questionnaires and interview forms. The results of the questionnaire responses were analyzed by percentage, mean (\bar{X}), and standard deviation (S.D.) The results of the interview responses were analyzed by descriptive discussion and percentages.

Phase 2: Development of a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for primary students. There were 2 steps as follows:

- 1) Evaluate the suitability of the (draft) instructional model and were experts in Educational Technology and Communications, curriculum, Teaching of Science, and Measurement and Evaluation. Experts were obtained by specific methods based on qualifications according to specified criteria. 2) Evaluate and specify the instructional

model by 7 experts. Evaluate and specify the instructional model who were experts in Educational Technology and Communications, curriculum, Teaching of Science, and Measurement and Evaluation. The qualified experts graduated with a doctoral degree and have teaching or working experience of more than 5 years or an authors of academic textbooks or research whose work is accepted in the academic part. Qualified experts are obtained by specific methods according to qualifications and specified criteria.

Research Instruments

- The questionnaire to evaluate and certify the instructional model. The questionnaire consists of 5-point rating scale questions using the Likert type (Tairuakham, 2012). The consistency between the questions and the objectives and content by 7 experts, it was found that all questions could be used with an IOC value of 0.80–1.00.

Data Collection and Data Analysis

- Data were collected by the questionnaire to evaluate the appropriateness of the (draft) instructional model. Coordinators collected data with 7 experts via mail and online meetings according to appointments. Then improved (drafted) the instructional model and contacted and coordinated with 7 experts to evaluate and certify the instructional model via mail and online meetings according to appointments. Data were analyzed by percentage, mean (\bar{X}) and standard deviation (S.D.).

Phase 3: Study the results of using the instructional model using the inquiry process with digital games to enhance analytical thinking skills in science for students in primary school. This instructional model was conducted with grade 6 students, semester 2, academic year 2022 of Chaturaphak Phiman School, Chaturaphak Phiman District under the jurisdiction of Roi Et Primary Educational Service Area Office. A purposive Sample was selected by purposive sampling. Then a sample was randomized from grade 6 students in all 3 classrooms. There were 2 groups which were the experimental group and another control group. The experimental group was 34 students and the control group was 31 students. The content was science for grade 6 level which consisted of topic 1: Astronomical Phenomena, topic 2: The Eclipse, topic 3: Advances in Space Technology, and topic 4: Space Technology. The experimental time was 20 hours.

Research Instruments

- The teaching plan with a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for primary students who were grade 6 students. The time was 20 hours, 11 plans. The teaching plans were checked for quality by 4 experts. They evaluated the appropriateness of the learning management plan by a 5-level rating scale based on the Likert method (Tairuakham, 2012). It was found that, overall, the determination of the elements of the learning management plan has the highest level ($\bar{X}= 4.29$, $SD = 0.17$). And the overall composition of the learning management plan has the highest level ($\bar{X}= 4.32$, $SD = 0.03$).
- The test to measure students' analytical thinking skills pre-post learning. Multiple choice test with 4 options, The consistency between the questions and the objectives and content by 4 experts. There were 40 questions that could be used with an IOC value of 0.80–1.00. This test was a try-out with 33 students who studied in grade 6 and not in the sample. This set of exams had a difficulty level (P) between 0.44–0.91 and discrimination power (B) between 0.20–0.91. The confidence value using Cronbach's method (Srisa-at, 2010). The whole set has a reliability value of 0.88.
- The test to measure academic achievement pre-post learning. It is a multiple-choice test with 4 options. The consistency between the questions and the objectives and content by 4 experts. There were 40 questions that could be used with an IOC value of 0.60–1.00. This test was a try-out with 33 students who studied in grade 6 and not in the sample. This set of exams had a difficulty level (P) between 0.33–0.85 and discrimination power (B) between 0.44–0.89. The confidence value using Cronbach's method (Srisa-at, 2010) The whole set has a reliability value of 0.85.

Data Collection and Data Analysis

- Data were collected in the following steps: 1) preparation stage 2) experimentation and data collection stage 3) data collection and further data analysis. The scores of measuring analytical thinking skills and academic achievement measurement were analyzed by the mean (\bar{X}), standard deviation (S.D.), and percentage. The comparison of the results of the pre-study and post-study by hypothesis t-test dependent. It was analyzed by comparing post-study scores between the experimental group and the control group by testing the hypothesis t-test independently.

2.4 Ethical Considerations

This research study was approved by Mahasarakham University Ethics Committee for Research Involving Human Subjects (No. 313/2020, issued on 25 December 2020). All data were kept confidential.

3. Results

3.1 Study Result of the Current Condition, Problems, and Good Practices Regarding Teaching and Learning that Enhance Analytical Thinking Skills in Primary School

Current conditions regarding teaching and learning that enhance analytical thinking skills. It was found that overall in all 3 aspects, The average was at a high level. In terms of 1) teaching methods, 2) teaching media, and 3) measurement and evaluation. It was found that the averages for all 3 aspects were at a high level, including; 1) teaching methods (\bar{X} = 3.41, SD = 0.01), 2) teaching media (\bar{X} = 3.42, SD = 0.01), 3) measurement, and evaluation (\bar{X} = 3.45, SD = 0.01).

Problems concerning teaching and learning that enhance analytical thinking skills. It was found that the averages for all 3 aspects were at a high level. In terms of 1) teaching methods, 2) teaching media, and 3) measurement and evaluation. It was found that the averages for all 3 aspects were at a high level, including; 1) teaching methods (\bar{X} = 3.25, SD = 0.05), 2) teaching media (\bar{X} = 3.17, SD = 0.06), 3) measurement, and evaluation (\bar{X} = 3.33, SD = 0.07).

Good practices regarding teaching and learning that enhance analytical thinking skills include blended teaching methods, the inquiry process, and teaching media with digital games.

3.2 Development Results of a Blended Instructional Model Using the Inquiry Process with Digital Games to Enhance Analytical Thinking Skills for Primary Students

The blended instructional model uses an inquiry process with digital games to enhance the analytical thinking skills of primary students as in the Figure 1 below.

The instructional model consisted of 4 components as follows; 1) principles of the teaching model, objectives of the teaching model, teaching and learning process, and measurement and evaluation 2) a blended teaching method that included face-to-face teaching and online learning. 3) the inquiry process teaching method with 5 steps including step 1: Create interest, step 2: Explore and research, step 3: Explain and conclude, step 4: Expand knowledge, and step 5: Evaluate 4) Teaching media were 9 types of digital games that including; (1) balloon popping games, (2) matching games, (3) true or false games, (4) crossword games, (5) puzzle words games, (6) quiz games, (7) missing word games, (8) maze chase games, (9) dating games, 5) Measurement and evaluation that included measuring analytical thinking skills and measuring academic achievement.

The results of the evaluation and certification of this blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for the primary student by 7 experts. Overall, every aspect is appropriate at a high level (\bar{X} = 4.30, SD = 0.09).

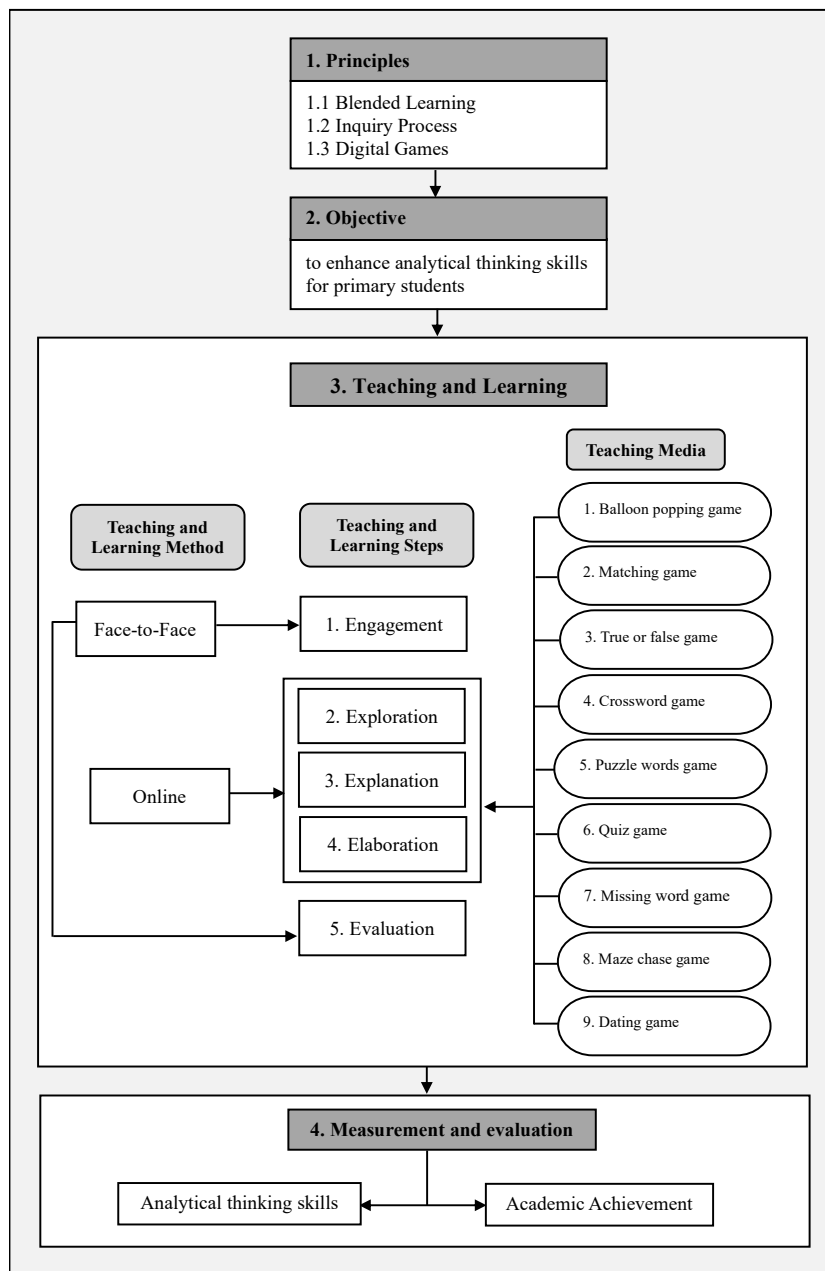


Figure 1. The blended instructional model using inquiry process with digital games to enhance analytical thinking skills for primary students

3.3 Study the Effect Results of Using a Blended Instructional Model Using Inquiry Process with Digital Games to Enhance Analytical Thinking Skills for Primary Students

1) Results of comparing the average scores measuring analytical thinking skills of students who studied using a blended instructional model between pre-test and post-test as in Table 1.

Table 1. The results of comparing the average scores measuring the analytical thinking skills of students who studied using a blended instructional model between pre-test and post-test in the experimental group

Scores	n	\bar{X}	SD	df	t	sig
Pre-test	34	12.20	1.80	33	14.79	.000 *
Post-test	34	19.11	3.28			

Note. * Statistically significant at the .05 level.

Table 1, shows the comparing results of the average scores that measure analytical thinking skills between the pre-test and post-test in the experimental group. It found that students who learned this blended instructional model had average scores post-test that were significantly higher than those pre-test at the .05 level.

2) Results of comparing the average scores on the learning achievement test who studied using this blended instructional model between the pre-test and post-test as in Table 2.

Table 2. The results of comparing the average scores on the learning achievement test who studied this blended instructional model between the pre-test and post-test in the experimental group

Scores	n	\bar{X}	SD	df	t	sig
Pre-test	34	11.85	3.01	33	19.32	.000 *
Post-test	34	20.76	4.36			

Note. * Statistically significant at the .05 level.

Table 2, shows the results of comparing the average scores on the learning achievement test of students who studied using this blended instructional model between the pre-test and post-test in the experimental group that were higher than those pre-test at the .05 level.

3) Results of comparing the average scores measuring analytical thinking skills of students who studied this blended instructional model between the pre-test and post-test in the experimental group and the control group students who studied normally as in Table 3.

Table 3. The comparison between the average analytical thinking skills scores of students in the experimental group and the control group students

Scores	Experimental group			Control group			t	sig
	n	\bar{X}	SD	n	\bar{X}	SD		
Pre-test	34	12.20	1.80	31	11.70	1.75	1.12	.855*
Post-test	34	19.11	3.28	31	13.45	1.80	8.50	.002*

Note. * Statistically significant at the .05 level.

Table 3, shows the results of comparing the average scores measuring analytical thinking skills of students who studied this blended instructional model between the pre-test and post-test in the experimental group and the control group students who studied normally. It found that students' pre-test scores of the experimental group and the control group were not different. Regarding students' post-test scores of the experimental group and the control group. It found that students' post-test scores of the experimental were significantly higher than those of the control group at the .05

4) The results of comparing the average learning achievement scores of students who studied this blended instructional model between the pre-test and post-test in the experimental group and the control group students who studied normally as in Table 4.

Table 4. The comparison between the average learning achievement scores of students in the experimental group and control group students

Scores	Experimental group			Control group			t	sig
	n	\bar{X}	SD	n	\bar{X}	SD		
Pre-test	34	11.85	3.01	31	11.58	1.80	0.43	.018*
Post-test	34	20.76	4.36	31	13.41	1.89	8.64	.000 *

Note. * Statistically significant at the .05 level.

Table 4, shows the results of comparing the learning achievement scores of students who studied this blended instructional model between the pre-test and post-test in the experimental group and the control group students who studied normally. It found that students' pre-test scores of the experimental and control groups were not different. Regarding students' post-test scores of the experimental group and the control group. It found that students' post-test scores of the experimental were significantly higher than those of the control group at the .05.

4. Discussion

1) Study results of current conditions, problems, and good practices regarding teaching and learning that enhance analytical thinking skills in science for primary students.

Current conditions regarding teaching and learning that enhance analytical thinking skills. The overall was at a moderate level. The current conditions of teaching management are not diversified enough, teachers lack the media to stimulate learning. They should have modern and developed teaching media to encourage learners to think, act, practice, and evaluate learners according to the actual situation. Therefore, the development of media and how to use technology to manage teaching are required to be more participatory. IPST (2017) determined that the guidelines for organizing learning activities of science courses focus on the development of all skills, including reading, investigation, practical training, experimental operation, information retrieval, and discussion to develop student's knowledge, skills, scientific process, and follow-up work. Knowledge, thinking ability, reading and problem-solving ability, and how to apply them to daily life, and further effective study. The researcher takes this as the research objective, proceeds forward studying the present situation of teaching management to cultivate scientific analytical thinking ability in elementary school, and proceeds forward the teaching management to develop scientific analytical thinking ability in primary school. The problem of teaching science that was organized teaching at the primary level is always in the traditional way and emphasizes students learning in the classroom. The lack of media and accessories for teaching and learning makes studying limited in time and contains difficult content to study on their own. Teacher guidance is required and he focuses on content rather than skills. As Butsikhot (2019), Koonlaboot et al. (2018), and Jelena Minic et al. (2023) studied the problems and needs of blended teaching and learning and found that teachers should adjust the learning process to the suitable needs of learners by allowing learners to learn. Learn via both the website and study in a classroom with a teacher, and it may allow students to present their work or submit work via social media. Learners can determine the content they want to learn by themselves based on the encountered problems. It may be necessary to add new technology for teaching and developing students' thinking.

Good practices regarding teaching and learning that enhance analytical thinking skills included blended teaching methods, the inquiry process, and teaching media with digital games. Experts interviewed found that the guidelines included: (1) Blended teaching methods. Percy (2010), Johnson et al. (2015), Pannim (2016), and Promkhruea (2018) researched the development of a blended instructional model and found that the blended teaching-learning method has received positive feedback from both students and teachers. It can develop learners to solve problems' ability on their own. The problems existing in science teaching in primary schools, the traditional teaching management is to emphasize students' learning in the classroom, lack of media and auxiliary equipment for teaching assembly, limited teaching time, difficult self-study of learning content, and the need for teachers' guidance. (2) The inquiry process has 5 steps: ① interest generation step, ② survey and search step, ③ explanation and conclusion step, ④ knowledge expansion step, and ⑤ evaluation step. As Ali (2014) and Rattanawan (2022) also studied the level of achievement in science learning with inquiry-based learning of students and found that students in the group who studied with inquiry-based methods had achievements. Academic performance is significantly higher than students who study using the normal method at the .05 level. (3) Teaching media with digital games. As Rodkroh (2021) studied the results of educational digital games to enhance knowledge of digital intelligence for primary students and found that ① the knowledge of digital intelligence of elementary school students before and after studying with educational digital games was significantly different at the .05 level. ② Students' satisfaction with educational digital games. Overall, it is at a high level, and in line with Petkov (2011) who conducted a study on using serious games to stimulate the desire to learn about history in secondary school students, it was found that games can stimulate students to be more interested in learning through stories and gameplay systems.

2) Development results of a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for primary students. Results of the evaluation of certification of this blended instructional model by 14 experts. Overall, every aspect was appropriate at a high level. This is because the blended instructional model has been developed in a systematic, step-by-step process. Each step is related to each other. This blended instructional model has developed based on concept systematic theories, and related research to be based as information for developing a blended teaching model using problems as a basis together with digital games and determine the elements. It is comprehensive and suitable to enhance analytical thinking skills for students at the primary school. This blended instructional model has also developed from the research data in the first step concerning current conditions and teaching conditions that enhance analytical thinking, good practices regarding teaching and learning that enhance analytical thinking skills included blended teaching methods, the inquiry process, and teaching media with digital games that each component is related. As Khaemmanee (2021) described

the process of developing the instructional model in conclusion: The development of the instructional model starts with the study of theoretical concepts, current conditions, and problems related to teaching and learning. Then, apply the concepts obtained from the data analysis to determine the principles and details of important elements of the instructional model, namely philosophy, concepts, theories, or various beliefs. Showing the relationship to produce results for the students according to the aims of the teaching. The important elements include principles, objectives, content, teaching activities, and evaluation measures that have been organized to have relationships and systematically support each other. It is to help students learn according to the specified objectives. As Termsinsuk (2015), Iamanupong (2016) and Changphet (2019), Nurrijal1 (2023) also researched the development of a blended instructional model. They found that the instructional model has 5 components: ① principles, and concepts, ② objectives, ③ content, ④ teaching and learning process, and ⑤ measurement and evaluation. There were 6 steps in organizing teaching and learning activities: ① the problem identification step ② the data collection and concepts related to the problem step, ③ the designing a solution step, ④ the planning and implementing the solution step, ⑤ the testing, evaluating, and improving the solution step, and ⑥ the presenting the solution and the results of the problem step. In each step, technology was used to support learning.

3) Study the effect results of using a blended instructional model using the inquiry process with digital games to enhance analytical thinking skills for primary students. The results of measuring analytical thinking and learning achievement of students who studied this blended instructional model between pre-test and post-test in the experimental group. It found that both analytical thinking skills and learning achievement post-test were significantly higher than those pre-test at the .05 level. This is because the instructional model is conducted through a design process and systemic operation. This instructional model has a clear sequence of steps and coherent elements. In addition, teaching methods are used to write learning plans, that help students be interested and enthusiastic in learning. Students learn the inquiry process, analytical thinking, and clear planning, including the use of digital games to make students develop analytical thinking skills. As Majiet (2016), Phromkruea (2017), Sathuphan (2018), Pimwan (2020), Yingyom (2022), and Wongwai (2023) also have researched the development of teaching models that enhance skills. It was found that students' analytical thinking average scores of analytical thinking ability after studying were significantly higher than before studying at the .05 level and academic achievement scores after studying were significantly higher than before studying at the .05 level.

5. Conclusion

The research results found that a blended instructional model using the inquiry process with digital games enhances analytical thinking skills for primary students. It can effectively enhance the analytical thinking skills of students. Learning is organized with games to create variety and increase efficiency in developing students' abilities. Methods for organizing learning with digital games can be further improved to be more diverse and learning methods with games are encouraged to be used in the learning of science subjects as well as other subjects in the science subject group. It needs to develop students' analytical thinking abilities.

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Authors' contributions

Tawalai, N.: Conceptualization, data acquisition, drafting the manuscript, Data analysis, translation of the manuscript, and editing/reviewing. Seechaliao, T.: Editing/reviewing, supervision, and critical revision of manuscript.

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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