Using Predict – Observe - Explain Learning Approach Supplemented with Learning Log to Promote Conceptual Understanding of Changes in Substances among Grade 5 Students

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Abstract

The purpose of this research was to study and compare the conceptual understanding of changes in substances among Grade 5 students learning through predict – observe – explain learning approach supplemented with a learning log. This research is a quasi – experimental research design based on a one-group pretest – posttest design. The sample consisted of Grade 5 students from a medium-sized school in Loom Nam Mong school group, under Udon thani primary Education Service Area Office 4, during the 2024 academic year. The sample consisted of 18 students, with the classroom serving as the sampling unit, selected through cluster random sampling. The research instruments included: 1) the predict – observe – explain learning approach supplemented with learning log 5 lesson plans on change in substances, and 2) a conceptual understanding test on change in substances. Statistical analysis was conducted using mean, percentage, standard deviation and hypothesis testing used t-test for dependent sample. The results of research revealed that the post-test score was significantly higher than the pre-test score at the .01 level.

Keyword: POE learning; Learning log; Scientific conceptual

Introduction

Scientific concepts are essential for learning science as they enable students to build connections between knowledge and comprehension, and apply them to different situations. When students correctly understand scientific concepts, they will improve their critical thinking and problem-solving abilities, creating the foundation for future learning at higher levels or on more complex topics. If students misunderstand scientific concepts, the consequences may be confusion about the related content, inability to apply knowledge in real situations, and may affect learning in the long run (Sinatra, G. M., & Hofer, B. K., 2014).

Predict-Observe-Explain (POE) learning is an effective teaching process for promoting understanding of scientific concepts because it stimulates students to participate deeply in the learning process, emphasizing analytical thinking, reflecting on understanding, and correcting misunderstandings through steps; 1) Predicting allows students to articulate their initial understanding and ideas about a scientific phenomenon or situation. Writing or creating predictions helps to encourage students when they want to ensure that their initial understanding is correct, 2) Observation enables students to absorb knowledge through firsthand experiences, such as conducting an experiment or observing a demonstration. This procedure allows students to compare actual results to their predictions, which is a critical step that might encourage conceptual change, and 3) Explanation provides students with the opportunity to articulate the reasoning behind experimental findings or phenomena, applying scientific principles. This process enables students to think, examine, and reconcile previous knowledge with sound concepts (Hartelt, T., & Martens, H., 2024; Rebull, L. M., 2018). A learning log is a document or tool used to record information about a student's learning experiences, knowledge, understanding, or progress in education. This log may be in the form of handwritten notes, digital notes, or other media creations that reflect the student's learning. The log sheet enables students to assess their knowledge of the lecture or experience obtained, highlighting areas for improvement or further development (Kolb, 1984). Making notes on your learning helps in the development of critical thinking and summarizing abilities, which are important skills in the learning process (Brookfield, 2018).

According to the information presented above, it is clear that organizing learning that promotes understanding of scientific concepts at the primary level is essential because this is the age at which students start to develop scientific thinking, which can be used as an important basis for advanced learning in the future. Traditional education, which focuses solely on memorization or knowledge transfer, frequently fails to encourage students to think analytically and comprehend fully. The Predict-Observe-Explain (POE) learning model is an instructional approach that encourages student participation, in which students form hypotheses, observe experimental results, and relate knowledge to explain phenomena. This type of learning not only develops scientific process skills but also enhances a deeper understanding of scientific concepts. When POE learning is combined with learning logs, students are encouraged to reflect on their own ideas and check their understanding. Recording what they have learned enhances critical thinking and the correction of misconceptions, leading to more effective learning. Therefore, the researcher is interested in conducting research on “Managing learning by predicting, observing, and explaining, supplemented with learning logs to promote understanding of science concepts of primary school students” to support the creative learning process that promotes both conceptual

knowledge and important science skills and helps develop science teaching in primary school to be more effective.

Research Objective

In this research to study and compare about conceptual understanding on changes in substances of Grade 5 students before and after learning by the predict – observe – explain learning approach supplemented with learning log.

Conceptual Framework

The research conceptual framework is based on a on learning that emphasizes students to create their own knowledge. This process involves predicting events that will occur in a given situation, then observing the results from experiments or predicts according to the given situation, comparing and explaining the differences between what happened from the practice and what was predicted, and finding theories or reasons to support until it becomes their own knowledge, supplemented with a learning log, which is a record of what was learned, including content, experimental results, opinions, doubts or questions related to that lesson, to reflect what they have learned from that lesson.

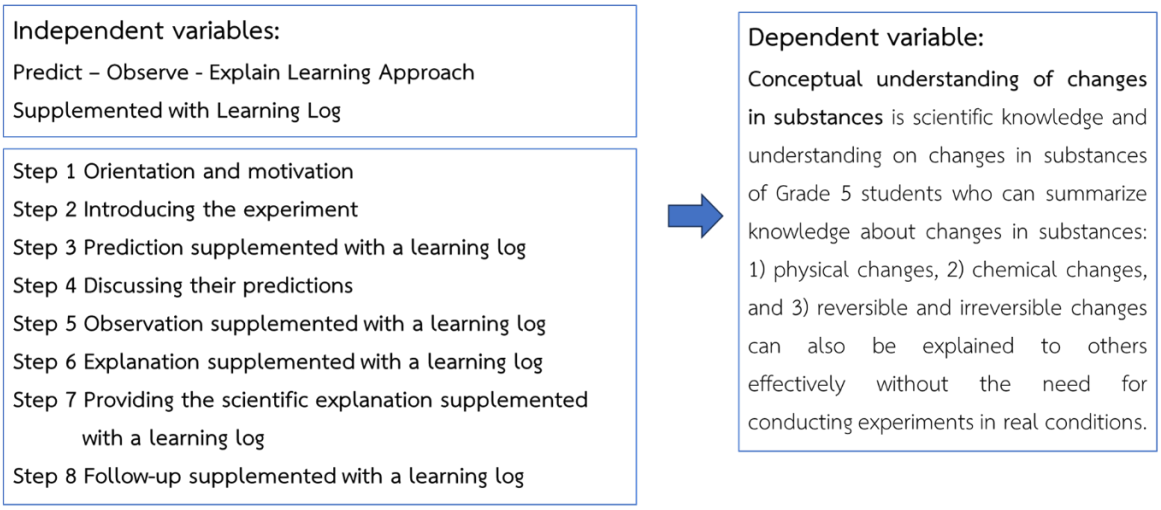

Fig.1 Conceptual Framework of Using Predict – Observe - Explain Learning Approach Supplemented with Learning Log to Promote Conceptual Understanding of Changes in Substances among Grade 5 Students

Research Methodology

1. Population and Samples: The sample group used in this research consisted of Grade 5 students, totaling 18 students from a classroom selected through cluster random sampling. The sample was drawn from a population of Grade 5 students from a medium-sized primary school in Loom Nam Mong group, Udon thani Primary Education Service Area Office

4, in the second semester of the 2024 academic year. The population consisted of four classrooms, comprising a total of 85 students.

2. Duration of time used in the research: The duration of time used in this research involved a teaching experiment 5 weeks, with each 3 hours of teaching. The total teaching hours amounted to 15 hours. This experiment was excluding the hours dedicated to pre-test and post-test assessments.

3. Research Design: This research was a pre-experimental design. Research design used is one group pretest and posttest design. (John & James, 2019)

4. Research Instruments:

4.1 The lesson plans based on the Predict–Observe–Explain learning approach supplemented with a learning log that included topics the changes in substances for 5th-Grade students The instructional materials comprised five lesson plans, each lasting three hours, for a total of 15 hours. The 5 lesson plans are as follows 1) Melting, vaporization, evaporation, condensation and solidification, 2) Sublimation and re-sublimation, 3) Dissolution, 4) Chemical change, and 5) Reversible and irreversible changes. The contents of this this research were developed using the indicators and core learning content with science learning group (revised edition B.E. 2560, A.D.2018) according to the Basic Education Core Curriculum B.E. 2551 (A.D. 2008). The lesson plans were qualified checking from 3 science educators' expert. The appropriateness of the learning activities, time, measurement, evaluation, and media used in the lesson plans were evaluated. The quality of the lesson plans was very good level ($\overline{x}$ =4.52). The lesson plans were tested with Grade 5th students who were not in the sample group to find the appropriateness of the activities, time, measurement and evaluation, and media. It was found that the lesson plans were suitable for the learning activities. The students were happy able to create knowledge, present in front of the class confidently, and wanted to learn more in this type of activity.

4.2 The 10-items conceptual understanding test of change in substance comprehension test is a 2-level scale, with Level 1 being a 4-choice multiple choice test and Level 2 providing reasons to support the answer in Level 1. Scoring was performed according to the scoring criteria of Costu, Ayas & Niaz (2019). The quality of the test was examined by the thesis advisor and the content validity was considered by the same science learning experts who assessed the quality of the learning lesson plan. Based on the test assessment data, the Item-Objective Congruence (IOC) index of the test ranged from 0.67 to 1. The conceptual understanding test that passes of the experts was given to 17 sixth-Grade students who had studied changes in substance to find the difficulty value (p) between 0.42 - 0.79, a discrimination value (r) between 0.42 - 0.75 and a reliability value (r_{tt}) of the whole test equal to 0.80.

6. Data Collection:

6.1 Pretest: Before staring the experimental research, the sample group has been applied a scale of conceptual understanding of change in substance as pretest by the 10-items conceptual understanding test of change in substance.

6.2 Experimental: The experimental were taught by 5 lesson plans on change in substance by using the Predict–Observe–Explain (POE) learning approach supplemented with learning log. The teacher was informed about the purpose of the study then using the lesson plans during the process teacher was observed, the interaction between teacher-students and students-students; participation and contribution of students into learning environment and teacher as well as the physical conditions and material availability of the classroom.

6.3 Posttest: After finished experimental the sample group have been applied a scale of posttest that the test same pretest. So, the study tools 5 weeks for the instruction, 2 weeks for the application of the pretest and the posttest.

7. Data Analysis: Compare conceptual understanding on changes in substances of Grade 5 students before and after learning by the Predict–Observe–Explain (POE) learning approach supplemented with learning log by taking the pre-test and post-test mean scores ($\bar{X}$), standard deviation (S.D) and percentage (%) and using t-test for dependent samples done for hypothesis testing.

8. Research Finding: The promotion of conceptual understanding of changes in substances of Grade 5 students before and after learning through the Predict–Observe–Explain (POE) learning approach supplemented with a learning log, research data of this scientific conceptual understanding can be summarized in Table 1 below:

Table 1 Research data of compare conceptual understanding on changes in substances of Grade 5 students before and after learning by the Predict–Observe–Explain (POE) learning approach supplemented with learning log.

N	Test	$\overline{X}$	S.D.	%	t-test	p
18	Pretest	6.61	2.52	22.04	22.90**	0.00
	Posttest	23.83	2.75	79.44		

**statistically significant at the .01 level.

According to Table 1, the pre-test score was 6.61 points (22.04%), while the post-test score increased to 23.83 points (79.44%). When comparing the pre-test and post-test scores, it was found that the post-test score was significantly higher than the pre-test score at the .01 level.

Research Discussion

Grade 5th students who learning by the Predict–Observe–Explain (POE) learning approach supplemented with a learning log could create conceptual understanding on changes in substances. The pre-test score was 6.61 points (22.04%), while the post-test score increased to 23.83 points (79.44%). When comparing the pre-test and post-test scores, it was found that the post-test score was significantly higher than the pre-test score at the .01 level.

Research Conclusion

Organizing learning activities in science classrooms using the Predict–Observe–Explain (POE) learning approach supplemented with a learning log resulted in grade 5th students obtaining a higher level of scientific conceptual understanding and having fun studying for the following reasons; 1) It is a learning management that promotes understanding through interactive learning activities. the Predict–Observe–Explain (POE) learning approach allows students to engage at every step, from developing a hypothesis to observing the results and reflecting to explain what happened, making it a very successful form of active learning, especially in a science environment. Making connections between existing knowledge and experimental findings allows students to better understand complicated concepts (Kowalski, F. V. (2024), 2) It generates curiosity through prediction and experimentation. The prediction process provides students with an opportunity to use their imagination and creativity, and to build expectations about the outcomes that will occur, while observation and experimentation create excitement and fun in learning. Doing things and seeing the actual results helps to make learning less boring and increases motivation to learn (Hewson, P. W., & Hewson, M. G. A., 2023), 3) Learning log is a tool that allows students to reflect on their understanding at each stage and allows teachers to closely monitor students' progress. Learning log writing enhances long-term memory and provides a summary of knowledge that students can review later (White & Gunstone, 1992) and 4) Supporting group learning and creating a fun atmosphere, this learning activity involves working together in small groups, which gives students the opportunity to exchange ideas and learn from their peers. This collaboration helps build social skills and creates a fun and friendly atmosphere in the classroom (Zohar, A., & Nemet, F., 2024).

Research suggestions

1. Suggestions for the use of study findings

1.1 Teachers should read the processes details, comprehend the learning activities, and fully prepare the media and equipment for learning that are acceptable for experimental activities. A Learning log should be created after learning to identify difficulties or track the evolution of students' behavior in order to improve the activity's effectiveness.

1.2 Teachers should encourage students to participate in activities with their classmates during the prediction, observation, and explanation stages, emphasizing the importance of explaining the reasons for their predictions and recording details from their observations of the experiment in order to explain the results and compare them with previous predictions so that students can create their own knowledge.

2. Suggestions for future research

The effects of the Predict–Observe–Explain (POE) learning approach supplemented with a learning log should be studied on other dependent variables such as scientific process skills, scientific explanation ability, and communication ability, etc.

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