Implementation of Inquiry-Based Learning in Science Influences on Conceptual Understanding in Terms of Self-Efficacy of School Students

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ABSTRACT
The study aimed to examine the differences in the effect of the Inquiry Based-Learning model compared to the direct learning model on understanding concepts in Science in terms of elementary school students' self-efficacy. Research method with ANOVA design experiment. This research was conducted at Pondok Benda Elementary School, South Tangerang, Banten. The sample consisted of 4th- grade elementary school students (Number=111, ages 10-11 years). Data analysis technique of two-way variance and continued with the Tukey test for a significance level of $\alpha = 0.05$. To test the normality of the data using the Lilliefors test and to test the homogeneity of the data using the Bartlett results.

Keywords: Inquiry -Based learning, Science, meaningful understanding, self-efficacy

1. INTRODUCTION

Learning approaches and strategies that support the development of conceptual understanding. This pedagogy supports concept-based teaching related to inquiry-based learning with authentic learning, dialogic discussion and flexible integrated assessment, especially in science learning [1]. Inquiry-based learning creates learning that is meaningful, deep understanding, and challenging. Practice learning by involving students directly to be able to provide important ideas and ideas on issues, and problems in real-life contexts. Critical and scientific thinking skills and their application in science learning are very important at the Elementary School Education level [2]. Conceptual understanding-based curriculum design focuses on students' learning experiences that are adapted to their understanding of concepts. This influences the development of attitudes and mentality in terms of students' self-efficacy toward beliefs about how something works based on previous experience and learning.

Inquiry-based learning practices (Inquiry-based learning) by connecting previous knowledge or prior knowledge of students in applying new knowledge and contextual understanding. Learn to understand patterns and examples to strengthen students' conceptual understanding knowledge, especially in science learning. Concept-Based Teaching and Learning (CBTL) is learning that focuses on conceptual understanding rather than just teaching facts it aims to introduce concept-based learning that supports understanding, ideas, transfer of knowledge, and critical thinking skills, and is reflective of the investigation of material scope in science [1]. The characteristics of the learning process affect the attitudes toward science learning at the elementary age level, both students and teachers [3]. Understanding the concept in learning adds depth to the investigation and thoroughness of students' thinking in exploring. As we know conventional learning focuses on two competencies, namely knowledge and skills. In contrast to concept-based learning in science, the characteristics of the curriculum design do not limit the breadth of knowledge and experience. In this case, students can access study material investigations following with the limits of inquiry material (lines of inquiry) and focus on learning objectives (learning outcomes) in elementary school- level science learning in certain phases [4]. Building a deep conceptual understanding of more complex knowledge ideas by applying transdisciplinary or interdisciplinary learning to science learning.

Inquiry-based learning is an active learning approach in which discovery, research, and investigation are applied to learning experiences, learning resources, and activities designed to support the research process [5]. In other words, inquiry-based learning is a learning approach that encourages students to generate and test their hypotheses and allows the use of the scientific method [6]. Question-based learning approaches as well as learning include a student-centered and open classroom environment. Learning activities [7] where the learning process allows students to integrate the information they learn in everyday life [8]. In this process, students are empowered to become independent and close learning individuals [9]. Besides that, inquiry-based learning supports the development of skills such as critical thinking [10] problem -solving, decision- making, [11] and analytical thinking. Inquiry-based learning aims to arouse students' curiosity and interest [12]. In summary, inquiry-based learning leads to significant improvements in cognitive, affective, and skill dimensions.

Unlike the case with the expository learning model in the classroom, especially science learning, which requires scientific investigations, investigations that are motivated by problems and involve students' critical thinking in depth in accordance with the understanding of learning concepts. The expository learning model is direct learning to carry out investigations with learning characteristics that focus on knowledge facts, teacher-centered, less interactive, lecturing in nature, and less innovative in involving learning media. This affects the low positive attitude of students in the learning process. Less active learning processes and lack of student access to solving problems, drilling, lecturing, and doing repetition [13] are general descriptions of the characteristics of the expository learning model.

Table 1. Differences in the Characteristics of the Expository Learning Model and the Inquiry Learning Model

No.	Description	Expository Learning Model	Inquiry learning model
1.	Theoretical perspective	Cognitive Behaviorism	Cognitive constructivism
2.	teacher's role	Dominant/control role	Guiding and facilitating
3.	Knowledge	Limited level of knowledge	Develop knowledge
4.	Skills	Limited skills/lack of involving students	Develop skills/engage students
5.	Confidence	Low self-confidence	High level of confidence
6.	Motivation	Low motivation	High motivation
7.	performance	Low performance/direct teaching	High- performance/inquiry teaching
8.	Learning Results	Low learning outcomes	High learning outcomes

The table shows different characteristics to support understanding of concepts in science learning which aims to increase self-efficacy at the elementary school education level. As the age development is still experience and concrete understanding. In accordance with constructivist cognitive thinking, one of them is the 5E' learning approach (Engage, Explore, Explain, Elaborate, and Evaluate) [14] namely science learning experiences to increase students' self-efficacy. Thus a deep understanding of concepts can increase high student self-efficacy by treating inquiry-based learning models. Conversely, the expository learning model with a less in-depth understanding of concepts affects students who have low efficacy [15].

Understanding the concept is information about the benefits that students will get after following the learning process. These benefits can be applied by students in everyday life. The characteristic form of understanding is meaningful: humans organize to solve problems and achieve goals. The indicators of understanding the concept corresponding to the revised Bloom's taxonomy level with good categories, namely interpreting, giving examples, classifying, drawing inferences, comparing, and explaining. Inquiry-based instructional learning [16] is a learning model that has active learning characteristics, students can ask questions, can make decisions, authentic learning, subject-based (intracurricular) or cross-disciplinary (interdisciplinary) learning materials according to student learning investigations [17].

Improving process skills can be developed through direct experience as a process of learning experience. Inquiry learning can provide an instructional framework that helps to ensure students develop a wider range of intellectual and scientific process skills [18]. The inquiry learning method can significantly improve learning and process skills in students [19]. The forms of inquiry-based implementation models are very diverse, one of which is outlined in the article [20] by using literacy strategies [21] to improve science learning with 5E instruction steps which can help to independently choose books that are appropriate for each phase of learning. As mentioned that questions and problems are the centers of investigative investigations. Students continuously investigate questions and repeatedly explore opportunities and experiences in the construction of science learning. The science books that are presented are more authentic and interesting than traditional textbooks, this book is equipped with hints on questions and research problems.

Assessment of students' understanding of science concepts in providing ideas and ideas,one example of a student using a science note entry book. Students use learning modules with quizzes at the end of each module which will be cumulative in summative assessments as a form of application of science concepts stated in [22] Investigation. This allows teachers to build inquiry with different levels of guidance so that students have the opportunity to choose the appropriate level at each stage of development and learning style [23]. Therefore, the investigation is a learning process with an emphasis on critical thinking and analysis processes to seek and find answers to the problems raised and focused on knowledge, skills, and attitude development based on active cognition students learn to explore independently [24]

Research shows that inquiry learning has the potential to increase engagement, interest and motivation in science [25]. The application of the inquiry learning model is not only a type of learning model, but exists as a type of learning model that depends on the participation of students and teachers. In other words, this learning model is stated [26] in the student-centered inquiry learning model student-cantered. This model depends on the learner, and the teacher's role as a facilitator in directing learning. So that students gain experience with an inquiry approach, focus on questions, use more open, unstructured problems, and reduce the intensity of direct or explicit guidance. Therefore,

Teaching success is a complex inquiry and various factors interact with each other and have an impact on its success, including student, teacher, and school factors [27]. Inquiry-based learning is not just an academic matter, it involves self-regulation, open and critical inquiry in order to achieve optimal goals and progress not only individually, but also comprehensively [28]. To achieve success in learning, self-efficacy is one of the internal factors in a person that can lead to a strong belief that he is able to achieve certain results. Self-efficacy is a factor that greatly influences motivation and achievement, self-efficacy is related or may not be related to real self-efficacy.

Further development of understanding of self-efficacy[29] as self-assessment about the ability to organize and take the necessary actions in dealing with situations. In other words, self-efficacy is self-confidence, every student's belief in doing tasks competently [30]. As well as establishing himself significantly to self-regulate and be able to behave instructional. The implication of implementing teacher self-efficacy can create a dynamic and student-centered learning environment so that taking can form student agency.

According to Bandura [31] there are two aspects, namely personal progress, and expected results with the thought that certain behaviors will lead to certain results. According to Bandura [32], individual development can be improved in the following 4 ways; mastery experience, experience, learning environment, physiology and emotional states. Experience is authentic evidence of one's success, in practice the teacher can provide a useful model for both experienced and pre-service teachers who both gain confidence and are able to try out in learning activities. Environmental support in learning helps students to be able to re-evaluate their competence. In supporting student agencies to be able to succeed in assigned tasks that are in accordance with the expected and sustainable learning outcomes.

a) View challenging problems as tasks that must be mastered
b) Develop deeper interest in the activities in which they participate
c) Form a stronger sense of commitment to their interests and activities
d) Recover quickly from setbacks and disappointments
e) Many studies have linked student academic achievement

Influence self-efficacy on the understanding of learning concepts and student learning outcomes are influenced by students' initial perceptions of themselves, in learning activities students visualize positive or negative scenarios about problem solving activities in science learning which will then adapt. The more complicated the problem, the higher the competence in solving problems, for students with low efficacy, they can provide competence in real world problems with high self-efficacy. Because students with low and high self-efficacy will differ in the impact of ways of thinking in finding and exploring solutions [34].

Self-efficacy is an "important personal variable when combined with specific goals and an understanding of achievement will determine future behavior". In this case, self-efficacy is very influential on a person's success through the achievements he gets. Self-efficacy is the student's belief in his own ability to carry out a task given by the teacher successfully including aspects of magnitude (level of task difficulty), strength (strength) and generality (view in general about the breadth of the field of behavior). Indicators for magnitude (task difficulty level) include: 1). Confidence in being able to carry out difficult tasks, 2). Confidence in the ability to try harder to achieve success. Indicators for strength (strength) include 1). Firm stance, 2). Able to develop self-potential and indicators for generality (view in general about the breadth of the field of behavior includes 1). Accept the challenge and 2). Accepting new things. Self-efficacy was assessed by respondents on a questionnaire test made by researchers to capture data on self-efficacy instrument variables.

Thus, researchers and educators identify the positive influence of inquiry-based learning (IBL) on science learning students both at the affective and cognitive levels. Authentic inquiry skills are expected of students where able; to identif problems, ask research questions, design and conduct investigations, formulate, communicate, and conduct hypotheses, design models, and communicate. This is regardless of how the inquiry learning model was conceptualized over the past 50 years. However, research consistently shows that inquiry-based learning in the classroom has affects on conceptual understanding rather than expository.

One example of the learning achievements of a 4th- grade elementary school in science subjects with the scope of material about energy. The focus of the research is on energy sources, energy changes, and energy utilization and processing in everyday life. This study aims to determine the conceptual understanding of students who are treated with the Inquiry-Based Learning model compared to a group of students who are treated with the expository model and its effect on student self-efficacy (students' learning confidence in doing certain tasks). Based on research on "Effective Inquiry Learning Approaches in Understanding Concepts" that in order to build a correct understanding of concepts, students can make associations between their previous concepts. Scientifically correct explanations require a learning environment that encourages students to ask questions, form hypotheses, and collect data. In this case, the inquiry approach is very useful for supporting learning [35], the challenge currently being faced is stated that [36] science learning in Indonesia tends to focus on memorizing facts or lesson concepts whereas, the teacher dominates all processes. The teacher explains all the material while the students take notes on every important material from the teacher. In addition, several studies have revealed that conventional or direct lecture-based learning has some drawbacks. Thus, the need to change the learning paradigm from direct/conventional learning to creative and innovative learning. Conventional learning can be overcome if the teaching and learning process focuses on processes, especially skills in learning science. Syntax identification of both expository and inquiry learning models can be seen in the following table:

Table 2. Syntax of the Expository Learning Model with the Inquiry Learning Model in Science Learning

	Expository Learning Model[14]	**Inquiry Learning Model**[37]
Phase 1	• The teacher explains the learning structure (learning objectives and learning activities) on the topic of energy sources.	**Orientation,** students are able to: • The introduction to the topic of energy sources is complemented by exploratory activities based on questions and students' prior knowledge.
Phase 2	• The teacher shows the material to students sourced from the textbook or PPT presented.	**conceptualization,** students are able to: • Asking trigger questions from the teacher as a hypothesis. Problem identification based on questions. • Conduct investigations/exploration of the Web, or exploration of learning environments. • Make predictions, hypotheses, and brainstorm solutions in drawing general conclusions from hypotheses.
Phase 3	• The teacher asks students to make a summary of learning material about energy sources from the prepared teaching materials. Next, the teacher asked students to write keywords in their notebooks.	**Investigation,** students are able to: • Exploring, observing, experimenting, interpreting data, and analyzing the concept of energy change through various forms of application. • Plan methods/means, design experiments, and develop action plans based on question investigations. • Determining the right learning environment is one of the learning resources. The stages of observation, collecting evidence, and in-depth investigation. • Analyze result data, explain and evaluate information. Next, Compile data and determine solutions.
Phase 4	• The teacher poses questions as an assessment stage and asks students to answer them.	**Conclusion,** students are able to: • Drawing conclusions and determining the decision of the investigation.
Phase 5	• Students continue to the next stage of learning.	**Discussion,** students are able to:

Expository Learning Model[14]	Inquiry Learning Model[37]
	• Communicating and reflecting on the results of the evaluation of investigations based on evidence and phenomena. • Discussions can be carried out by sharing, debating, elaborating results through presentations. • Determine learning outcomes which then return to investigation/investigation of new questions to solve problems. • Discussions can be carried out by sharing, debating, and elaborating results through presentations. Determine the learning outcomes and then return to the investigation/investigation of new questions to solve the problem.

Based on the table above, the two syntaxes of the learning model show that the inquiry learning model in science influences understanding concepts in terms of students' self-efficacy in conducting exploration, and ongoing investigation. It was stated in the article [38] that process skills in science have a very important role in training students to verify or construct science learning concepts through a scientific approach. In science teaching practice, the goal is for all students to understand the science concepts being studied. Every student can understand the concept of science and can explain its relationship in real life, not only understanding science. This is stated [39] with active learning as a learning practice that views science critically by asking questions as concrete evidence of whether students understand the knowledge being studied. Besides that, it is discussed in the inquiry learning model [40] that science education has been studied for many years, there are differences of opinion on the definition of asking and how it forms in the classroom. In the inquiry learning model is a form of active learning where students are given a sequence of tasks arranged with stages of the process of investigating, solving, understanding, and working individually or in groups. In this inquiry learning model, we see the process of each syntax/cycle in relation to how people learn. In general, the inquiry learning model framework is defined as follows: orientation, conceptualization.

2. METHOD

This research is using experimental method. Hypothesis testing uses a two-way analysis of variance (ANOVA). The data were processed by descriptive analysis and analysis of variance with SPSS 24. The independent variables were the inquiry method and the expository method. The subjects were divided into two classes, namely the experimental class and the control class. The total number of students who were the subject of the study was 41 people, which were divided into two classes (class A and class B), each consisting of 20 students in class A and 21 in class B. The method used was the experimental design method. Treatment By level 2 x 2. The variables in this study are the dependent variable (meaningful understanding), the independent variable (Learning Method), and the attribute variable (self-efficacy). The learning method (A) includes two forms: the inquiry learning method (A1) and the expository (A2) method. Self-efficacy (B) is classified as high (B1) or low (B2). There were four groups tested, namely the inquiry learning group with high self-efficacy (A1B1), the guided inquiry method group and students with high self-efficacy (A2B1), the inquiry group and students with low self-efficacy. (A1B2), and the inquiry group and students with low self-efficacy (A2B2). The following is a treatment table design with learning designed as follows:

Table 1. Design Treatment by level

Self-efficacy (B)	Learning Method (A)	
	Inquiry (A1)	**Expository (A2)**
Height (B1)	A1B1	A2B1
Low (B2)	A1B2	A2B2

The research sample consisted of all elementary school students in Pamulang sub-district. The sample was selected using a random sampling technique. Two classes are used as sampling sources for this research. the researcher tried the inquiry method and the expository method, the subjects were divided into two classes, namely the experimental class and the control class. The experimental class (Class IV A) was taught using the inquiry method and the control class (Class IV C) was taught using the expository method, while the variable attributes were classified into high and low self-efficacy. This method is used to test whether there is an effect by giving different treatments to each experimental group.

The normality test was carried out to test the significance of normality (Liliefors) as a whole. The test results show that the variables of conceptual understanding and self-efficacy have a significance value of > 0.05, namely 0.372 and 0.452. Therefore, research data can be expressed in a normal distribution. The results can be seen in table 2 below:

Table 2. Testing Normality

		Self- efficacy	**Meaningful Understanding**
N		14	14
Normal Parameters, b	Means	78.07	74.29
	Std. Deviation	11,750	14.123
Most Extreme Differences	absolute,		230,245
	positive,		226,245
	Negative	-, 230	-, 157
Kolmogorov-Smirnov		Z,859,	915
asymp. Sig.(2-tailed),			452,372
a. Test distribution is Normal.			
b. Calculated from data.			

The homogeneity of variance test was carried out on the conceptual understanding and efficacy variables. These variables must fulfill the assumption that the variance is homogeneous so that tests can be carried out on each treatment. The homogeneity of the data was tested using the Bartlett test with the results of the Barlett test at α = 0.05. The results of homogeneity calculations can be seen in Table 3 below:

Table 3. Test Results for Homogeneity Data

Variables	**X2count**	**X2tables (α = 0.05)**	**Conclusion**
A1 A2	0.317	3.84	Homogeneous
A1B1 A1B2 A2B1 A2B2	0.963	7.82	Homogeneous

The results of the X test show that the calculated X value is smaller than the X table value so it can be concluded that the group data examined from the sample variance is homogeneous.Validity test using content validity and construct validity. Construct validity was tested by expert judgment. Content validity was analyzed with reference to the elementary school curriculum. The multiple- choice questionnaire uses a formula based on biserial point dichotomy. The validity of each questionnaire was determined by comparing the correlation coefficient (r-value) with the biserial correlation number (r-table) based on a 5% significance level, as follows: 1) if r-item > r-table and α = 0.05, then the item is considered valid; 2) if r-item≤ r-table and α = 0.05, then the item is considered invalid. Based on these calculations, 20 multiple choice test questions have r-phi values > 0, and a significant level of α = 0.05. Testing the validity of the essay test based on the product moment formula shows that the entire test (7 questions) has a value of r value > r-table (0, 355) and a significance level α = 0.05. To determine the reliability of the instrument used the Hoyt formula.

3. RESULTS AND DISCUSSION

This research was conducted to test the hypothesis. The first hypothesis determines the difference between inquiry and expository methods. The second hypothesis is the interaction between learning methods. The third hypothesis was carried out to find out the difference in the meaningful understanding of students who used the inquiry method and the expository learning method for students who had high self-efficacy. Testing the fourth hypothesis is to determine differences in students' understanding of concepts using the inquiry method and the expository method of students who have low self-efficacy. The following is a summary of the results of hypothesis testing calculations which can be seen in Table 4:

Table 4. Summary of Test ANOVA

Source	Type II Sum of Squares	Df	MeanSquare	F	Sig.
Corrected Model	3431.250A	3	1143,750	46866,	000
Intercepts	155,258,036	1,	155,258,036	6361793	000
A,	3322321	1	3322321	136,134	000
B,	893	1,		893,037,	850
A*B		1	108036	4,427	108036
Error	585,714	24	24,405		
Total	159,275,000	28			
Corrected Total	4016964	27			
a. R Squared =.854 (Adjusted R Squared =.836)					

3.1. The results of the ANOVA analysis based on table 4 above can be described as follows:

3.1.1. The meaningful understanding of students who study with the Inquiry learning method for students who have low self-efficacy

Based on Table 1 above, the F-count is 136.134, which is greater than the F-table. At the real level $\alpha = 0.05$ (F count > F table = 136.134 > 4.26). At level $\alpha = 0.01$ (F count > F table = 136.134 > 7.82). That is, there is a very significant difference in the average score of understanding the concept between students who study with the inquiry learning method and students who learn with the expository method. The results of the analysis of the average score of understanding the concept show that students who learn using the inquiry method are higher than the expository method.

3.1.2. Interaction learning methods and self-efficacy and meaningful understanding

Based on Table 2, it is obtained that the F-count is 4.427 which is greater than the F-table. At the real level $\alpha = 0.05$ (F-count > F-table = 4.427 > 4.26). At level $\alpha = 0.01$ (F count > F table = 4.427 > 7.82). That is, there is a very significant influence interaction between learning methods and self-efficacy on students' understanding of concepts. The average understanding of the concept in the inquiry method has a high self-efficacy of 87.14 and a low self-efficacy of 61.42. For the average understanding of the concept in the expository learning method which has a high self-efficacy of 83.57 and the average of which has low self-efficacy of 65.71. This shows that to group students' understanding of concepts with the inquiry method and self-efficacy in meaningful understanding, the scores of conceptual understanding tend to be higher.

3.1.3. Differences in understanding the concept of students who have high self-efficacy, namely learning with the inquiry method and learning with the expository method

Dunnet's t-test results show that t-0 = 8.115, p-value = 0.000 / 2 = 0 < t-tab = 0.05 or H0 is rejected. That is, the average score of students' understanding of the concept of learning with the inquiry method is higher than the expository method because of high self-efficacy. Testing the third hypothesis proved to be true. Thus it can be concluded that the conceptual understanding of the group of students who studied with the inquiry method was higher than the group of students who studied with the expository method for students who had high self-efficacy. Thus, the learning method that is suitable for students who have high self-efficacy is the inquiry learning method.

3.1.4. Differences in conceptual understanding of students who have low self-efficacy in learning with the inquiry learning method and the expository learning method.

Dunnet's t- test results show that t-0 = -8.386, p-value = 0.000/2 = 0 < t-tab = 0.05 or H0 is rejected. That is, the average score of students' understanding of the concept of learning with the inquiry method is not lower than the expository method for low self-efficacy. Testing the fourth hypothesis is proven. Understanding on the concepts of students who learn with the inquiry method is not lower than the group of students who learn with the expository method for students who have low self-efficacy. It can be concluded that there is no influence of inquiry and expository learning methods on conceptual understanding of students who have low self-efficacy. The results of the research and statistical analysis show that using the inquiry learning method is effective for both high and low self-efficacy. These findings indicate that overall there are differences in the results of students' understanding of concepts between groups of students who are taught by the inquiry learning method and the group of students who are taught by the expository learning method. The application of different learning methods also has consequences for interpersonal differences in students. In addition, differences in self-efficacy also have consequences for differences in students' meaningful understanding. The first hypothesis, this is because the Inquiry Method is a method that emphasizes the process of critical thinking and analysis to seek and find answers to the problems asked (Beni, 2012). The characteristics of high self-efficacy are needed so that students can follow the lesson well. Unlike the expository expository learning in almost all learning activities that require the guidance of a teacher. The whole system is geared towards a neat series of events in educational institutions. Investigative inquiry learning can have a positive impact on student achievement, because it provides opportunities for students to find new ideas or ways of thinking, clarify and justify their points of view, and build or improve ideas from one another by comparing various points of view.

4. CONCLUSION

Based on data analysis, this study concluded that first, students who used the inquiry learning method were higher than the expository ones. Second, there is an interaction effect between learning methods and self-efficacy on elementary school students' conceptual understanding which depends on the level of self-efficacy. Third, students who have high self-efficacy and are given the inquiry method have a higher conceptual understanding than expository.

AUTHOR'S CONTRIBUTION

The author's contribution to this study lies in the state of the art, where previous studies examined the active-learning model that involved the participation of elementary school students. The novelty of this study lies in the implementation of the inquiry-based learning model for understanding concepts in science learning to increase self-efficacy in elementary school students. The results of this study can be disseminated to teachers at the next level.

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