The Discovery Learning Impact to Student's Scientific Attitude Based on Intrapersonal and Interpersonal Intelligence

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Abstract. Purpose. So many inventions are essential for meaningful life and progress of society. One of teacher's task to prepare how students face future is grow up their scientific attitude based on each potency. This research investigates the Discovery learning impact on students scientific approach based on intrapersonal and interpersonal intelligence. Methodology. Quasi-experimental research design was used in determining treatment to 45 students in the third grade of elementary school. The experimental group (n=22) is Discovery learning class and Control group (n=23) is a conventional class with direct instruction learning. The treatment of the course was chosen randomly. Data collection techniques use observation for scientific attitude during science learning while questionnaires for students' intrapersonal and interpersonal intelligence. The intrapersonal and interpersonal intelligence questionnaires scores are high and low categorized. The data of the research were analyzed using Kruskal Wallis nonparametric test. Findings. The experimental groups' scientific attitude were significantly higher than the control group's. There was significant difference in scientific attitude between high and low category interpersonal intelligence, however no significant difference for intrapersonal intelligence variable. This means that Discovery learning model and interpersonal intelligence affect students' scientific attitudes, where in Discovery was learning and high interpersonal intelligence influence better than others. Interaction test among independent variables on scientific view results that all interactions have significant differences. Significance. Teacher chooses the learning models must be suited with learning material and students characteristics such as the potential of students' intelligence so that learning can take place effectively to achieve learning purpose that related to the nature of science in the form of scientific attitude. Scientific attitude can be grown by the right treatment learning, especially in elementary school.

Keywords: discovery learning, intrapersonal intelligence, scientific attitude

1 Introduction

Scientific invention is essential for meaningful life and progress of society. It means that students must be prepared to face many challenges in the future. Teacher in the school must design the best learning situation creatively to grow up their student's scientific attitude based on each potency. Why the scientific view? According to [1], "Scientific attitude is a logical way of thinking clearly, reasonably without any disturbance or prejudice. Scientific attitude means not accepting any such fact which does not have any proof." The growing progress of

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social media in the world, the dissemination of diverse information very quickly becomes a benefit as well as the human challenge to utilize appropriately. Fake news or hoax can be an obstruction to our progress. We should develop an attitude which is quite scientific and logical. People with an excellent scientific opinion not easily swayed and accustomed to find out about everything. They act dominantly with honesty, curiosity, open-minded, dan skepticism. Harlen [2] states about scientific attitude indicator are 1) Curiosity, 2) Objective attitude toward facts, 3) Critical thinking, 4) Invention and creativity attitude, 5) Open-mindedness and cooperation, 6) Attitude of perseverance and 7) Sensitive to the environment.

The research that has been done by (Farooq, M and Islam 2012) scientific attitude using conventional learning is shallow especially on honest opinion, logical thinking, curiosity, confidence, discipline, thoroughness, and cooperation. Science learning at the elementary school level becomes very important, considering the initial concept planting is at that level and will be deepened to the next level. Scientific attitude especially in studying elementary school science is beneficial for students that can form a positive opinion and values in students such as high confidence, accuracy, discipline, honesty, and do not know despair. This attitude and positive value as a provision to overcome the problems in everyday life. The development of scientific approach is also useful for building student character. This is in line with the new paradigm of education, the goal of learning is not just changing behavior but shaping the character and mental attitude oriented to the global mindset [3]

Our system of schooling provides many opportunities for a teacher to create an environment where learning takes place, one of which the selection of learning models that suitable the characteristics of students and learning material. The teacher must move from a textual approach to a process of strengthening the use of a scientific method. [4] stated that teaching students with the notion of discovering, critical thinking, questioning, and problem-solving skills is one of the main principles of science and technology teaching. Thus, science and technology teaching curriculum should accordingly be developed to educate science-literate students who can inquire and solve problems they face. Today, it is believed that learning models following the constructivist approach in which the students learn more effectively by constructing their knowledge, should be used. One of these models is discovery learning. According to constructivists, instructional methodologies like discovery learning help students to internalize and not merely memorize new knowledge. Discovery learning is often cited as the best educational practice. Syntax or phase of Discovery learning is stimulation, problem statement, data collection, data processing, verification, and generalization.

Partnership for 21st Century Skills states that there are three essential skills required for the 21st-century students, that are creativity and innovation, critical thinking and problem solving, and communication and collaboration [5]. They are not new; teachers use and teach these skills for a long time. However, these skills explained through the work of Gardner and his theory of multiple intelligences. [6] intelligence is defined as the ability to process information that is activated in a cultural context for problem-solving or creating products which are worthy in a culture. He introduced eight different bits of intelligence, including verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalistic [7]. Intrapersonal and interpersonal intelligence are an essential skill required for 21st-century students. Through individual intrapersonal intelligence, an individual can identify him/herself by understanding the purposes, goals, and will of his or her life. On the other hand, through intrapersonal intelligence one can locate oneself by understanding one's own needs, aspirations and requirements, while a person with

interpersonal intelligence is more confident when expressing ideas and opinions, self-reliant and smart in presenting views and opinions.

State that intrapersonal intelligence means sensitive to feelings, desires, and fears. Besides, children are also aware of the advantages and weaknesses themselves and able to plan and goals. Sonawat & Gogri [8] Individuals who are smart in intrapersonal have several indicators of intelligence, that is: a) Regularly devote their own time to meditating, pondering and thinking about problems, b) Have or often attend counseling events or seminars of personality development to understand themselves better, c) Be able to face setbacks, failures, obstacles with courage, d) Have a hobby or an interest and pleasure kept for themselves, e) Have essential goals for life, which are thought through continuously, f) Have a realistic view of the strengths and weaknesses of self obtained from the feedback of other sources, g) Prefer to spend the weekend alone in private places and away from the crowds, h) Consider himself a person who wants reliable and independent thinking, i) Have a diary to express feelings, emotions and write personal experiences, and j) Have the desire to work alone, self-employed.

Interpersonal intelligence is the ability to perceive and make distinctions in the moods, intentions, motivations, and feelings of other people. The 21st-century students need to learn through interaction with other people, and they have many friends and empathy for others [5]. They have the skill to sense feelings, intentions, and motivations. Although manipulative at times, they are great organizers. They make an effort to reach groups consensus and encourage co-operation. Both verbal (e.g., speaking) and non-verbal language (e.g., eye contact, body language) are used to open communication channels with others. The characteristics of interpersonal intelligence [9] are as follows: a) Easy to get along and liked his friends, b) Having two or more close friends, c) Dare to be a leader, d) Likes to teach other friends about something, d) Become a member of a group, club, or the like, e) Having a high attention to others, f) Nice to socialize with peers, g) Have a good sense of empathy towards others, h) Likes to help friends.

There were several research studies which emphasized to determine intelligence types and the impact of a subject according to multiple intelligence theory on students' academic achievement, retention of knowledge, and attitude [10]. Therefore, this study was conducted to determine the effect of discovery learning model on scientific opinion as compared with conventional (direct instruction) learning model based on student's intrapersonal and interpersonal intelligence.

2 Objectives

This study sought to explore the effect of using discovery learning model compared with conventional (direct instruction) learning to student scientific attitude in terms of their potential intrapersonal and interpersonal intelligence. More specifically, this study was aimed at achieving the following objectives: (i) To study the differences of students scientific attitude in the experimental group (discovery learning) and the control group (conventional/ direct instruction learning); (ii) To study the differences of students scientific attitude in intrapersonal intelligence; (iii) To explore the differences of students scientific position in interpersonal intelligence; (iv) To study the interaction of learning model and intrapersonal intelligence to scientific position; (v) To study the interaction of learning model and interpersonal intelligence to scientific attitude; (vi) To study the interaction of intrapersonal

and interpersonal intelligence to scientific opinion; (vii) To study the interaction of learning model, intrapersonal and interpersonal intelligence to scientific attitude

3 Method

3.1 Participants and sampling

Quasi-experimental research design was used in learning treatment to 45 students in the third grade of elementary school. The treatment of learning was done in science lessons with materials about energy and its changes. They are divided into two class with different treatment. The experimental group (n=22) is discovery learning class and Control group (n=23) is a conventional class with direct instruction learning. Cluster random sampling technique was used here. The treatment of the class was chosen randomly because based on the Annava Test to pretest of both classes showed that no significant difference before treatment ($p > 0,05$).

3.2 Instrument

Data collection techniques are observation for scientific attitude variable during the science learning and questionnaires for students' intrapersonal and interpersonal intelligence. Instrument validation of the observation sheet through peer sharing and expert judgment. Point of observation sheet are developed by six scientific attitude indicator: 1) Curiosity, 2) Objective attitude toward facts, 3) Critical thinking, 4) Invention and creativity attitude, 5) Open-mindedness and cooperation, 6) Persevering attitude and sensitive to the environment. The intrapersonal and interpersonal intelligence questionnaire is developed based on each indicator with a Likert scale that has four option to be chosen. It trough tryout instrument then the validity analyzed using Pearson product-moment correlation ($r >$ r table 0,291) and reliability with Alpha Cronbach ($r11 = 0,686$ for intrapersonal and $r11 = 0,726$ for interpersonal) show that the questionnaire is valid and reliable. The intrapersonal and interpersonal intelligence questionnaires scores are high and low categorized according to the average of data.

4 Results and Discussion

4.1 Data description

The value of observing students' scientific attitudes at each learning meeting summed and then made a percentage to get a score of scientific attitudes. A description of the scientific attitudes percentage score of the two groups (experimental and control classes) the following diagram in **Figure 1**.

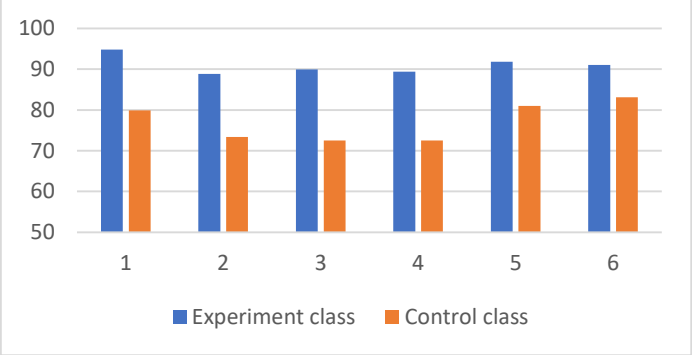

Fig. 1. Scientific attitude diagram

There are six scientific attitude indicator. Based on the diagram can be seen the percentage score of every aspect of observation of students' scientific attitude of experiment and control class. The science lessons with materials about energy and its changes in experiment class with discovery learning model give higher average value than conventional learning. Descriptions of scientific attitudes from both classes show that there is a distinctly different scientific attitude from each class. The experimental class has the highest score on aspect 1: curiosity, while the control class on aspect 6: persevering attitude and sensitive to the environment. It becomes one of discovery learning advantages that can answer the demands of the principle of learning that says that "From learners are being told become to find out". Student curiosity will be further honed and developed through this learning model. The fact that science activities build on children's wonder and questions and their interest on the surrounding world [11] because basically, children have a curiosity that encourages them to learn to understand the world around them. Sanna Jarvela (OECD, 2008) states that curiosity and creativity are essential for the nature of learning and education aims. A good teacher should encourage students to learn through their interest not only by command and task.
Scientific attitude score description of each research variable that are learning model (treatment), intrapersonal, and interpersonal intelligence can be shown in **Table 1**.

Table 1. Descriptives of scientific attitude

	Learning Model		Intrapersonal Category		Interpersonal Category	
	Discovery	Conventional	High	Low	High	Low
Mean	91,30	77,18	86,36	81,95	88,04	79,85
Std. deviation	3,07	6,13	8,87	7,74	8,18	6,85
Minimum	85	70	71	70	70	71
Maximum	99	92	99	92	99	91
N	23	22	25	20	25	20

4.2 Data analysis

The data were analyzed using Kruskall Wallis nonparametric test which the result shown in **Table 2**.

Table 2. Nonparametric Kruskall Wallis test result on scientific attitude

Variable	Chi Square	p (sig.)	Meaning
Learning model	28,746	0,000	There are significant difference
Intrapersonal intelligence	3,399	0,065	There are no significant difference
Interpersonal intelligence	11,724	0,001	There are significant difference
Model* Intrapersonal	29,477	0,000	There is interaction between variables
Model* Interpersonal	30,258	0,000	There is interaction between variables
Intrapersonal* Interpersonal	12,664	0,005	There is interaction between variables
Model* Intrapersonal* Interpersonal	31,772	0,000	There is interaction among variables

Based on nonparametric test results in **Table 2**, can be concluded that there are significant differences (sig <0.05) students' scientific attitude scores in terms of the independent variables of learning models and interpersonal intelligence. This means that the learning model and interpersonal intelligence have a significant influence on students' scientific attitude. Discovery learning has a better effect than the conventional model; the average score of the scientific attitude of experiment class is 91,3, which is bigger than the control class is 77,18. Similarly, high interpersonal intelligence is better than others, where a high interpersonal group has an average scientific attitude 88,04 compared 79,85 for the low category. While intrapersonal intelligence (sig> 0,05) there is no significant difference.

Discovery learning model more emphasis on direct experience and giving priority to the process rather than learning outcomes [12] It proved closely related to the learning process, one of which is the student's scientific attitude that can be observed during several times the learning process has increased rather than in the conventional model. Teachers can encourage the development of interpersonal intelligence by designing lesson plans that include group activities, seminars, and dialogues [5]. This discovery model involves discussion and activities in groups so it can contribute directly to related interpersonal potential, which affects student scientific attitude. In healthy environments and conditions; one intelligence is not usually developed independently from the other (Gardner, 1993, cited in Sellars, 2008, p. 80). It means that one intelligence isn't the only dominant, but other factors affect.

Interaction test results between independent variables on scientific attitude state that all interactions have significant differences. There is the interaction of learning model and intrapersonal intelligence, learning model and interpersonal intelligence, intrapersonal and interpersonal intelligence; learning model, intrapersonal and interpersonal intelligence to scientific attitude. Interaction here means that two or more variable independent (learning model, intrapersonal, and interpersonal intelligence) in this study have linkages to affect scientific attitude. (McGrath and Noble cited in Sellars, 2008) There is an important role that interaction with others plays in developing intrapersonal intelligence and do not infer that students with strong intrapersonal intelligence prefer to undertake solitary learning tasks.

5 Conclusion

The findings of this study imply that teachers should choose a science learning model that can improve learning outcomes as well as develop students' scientific attitudes. The election must also be adjusted to the characteristics or potential students, one of the potential intelligence. The result of this study has supported that learning model and intelligence have

an interrelationship in influencing student's scientific attitude. Scientific attitude can be one of the provisions of students facing the challenges of the future.

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References

[1] S. Candrasekaran, M. Sc, M. Ed, and M. Phil, "Developing Scientific Attitude , Critical Thinking and Creative Intelligence of Higher Secondary School Biology Students by Applying Synectics Techniques," vol. 3, pp. 1–8, 2014.
[2] S. F. dan Z. K. Prasetyo, *Pembelajaran Sains*. Yogyakarta: Ombak, 2014.
[3] D. D.E Nurjanah, "Pengaruh Penerapan Metode Experimenting And Discussion (ED) dalam Pembelajaran Terhadap Hasil Belajar Fisika dan Sikap Ilmiah Siswa SMP," *WePFi*, vol. 1, no. 3, 2013.
[4] A. G. Balım, "The Effects of Discovery Learning on Students ' Success and Inquiry Learning Skills," no. 35, pp. 1–20, 2009.
[5] V. Advani and M. H. G, "Effect of Interpersonal Intelligence Based Teaching Strategies on Students Academic Achievement," vol. 3, no. 4, 2016.
[6] H. Gardner, *The disciplined mind: What all students should understand*. New York: Simon & Schuster, 1999.
[7] H. Gardner and T. Hatch, "Intelligences Multiple," *Educ. Res.*, vol. 18, no. 8, pp. 4–10, 1989.
[8] M. Y. Ibrahim, *Pembelajaran Berbasis Kecerdasan Jamak (Multiple Intelligences)*. Jakarta: Prenadamedia Group, 2016.
[9] Yustisia, *75 Rahasia Anak Cerdas.* Yogyakarta: Ar-Ruzz Media, 2013.
[10] Sibel, "The effects of multiple intelligence theory based teaching on students' achievement and retention of knowledge (Example of the enzyme subject)," *Int. J. New trends Educ. their Implic.*, vol. 4, no. 3, 2013.
[11] S. Broström, "Science in Early Childhood Education," vol. 4, no. 2, pp. 107–124, 2015.
[12] Sujarwo, *Model-model Pembelajaran Suatu Strategi Mengajar*. Yogyakarta: CV. Venus Gold Pres, 2014.
[13] M. Sellars, "Intelligence for the 21st Century: A Discussion of Intrapersonal and Emotional Intelligences," vol. 15, no. 2, 2008.