The Identification Problem-Solving Abilities Based on Gender: Implementation Teaching Science Throught Guided Discovery Model’s in Bangkalan District

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Abstract. The aimed of this research was to identify differences of student’s problem-solving abilities in junior high school in Bangkalan district based on gender. Problem-solving ability is measured by paper and pencil test using the Polya’s indicator. The research design with one group pretest-posttest design. Data analysing with paired T-test. The paired t-test show that \( t_{\text{count}} < t_{\text{table}} = -1.051 < -2.021 < 1.051 \). It can be concluded that the problem-solving abilities of female students is better than male students. In addition, teaching science with a problem-solving approach will provide learning experiences to improve pupil’s ability.

1. Introduction
Learning Science is a process development learning, where students are active in observing, investigating and experimenting [1]. Furthermore, learning science has three main parts, namely the attitudes, processes, or methods and product [2]. Moreover, in natural science learning, students are invited to be directly involved in the learning process in the environment to develop their knowledge, this is in line with the theory of constructivism [3]. Teachers are teaching how to build their understanding based on experience.

Constructivism theory views students continually checking new information that is contrary to the old rules and improving the old rules if they are no longer appropriate [3]. Constructivism theory emphasizes that learning is not just memorizing, but reconstructing or building new knowledge and skills through the facts or propositions they experience in their lives, in the learning process, students must get emphasis, actively develop their knowledge, and be a responsible answer to learning outcomes [4].

Besides, students are encouraged to build their own questions. In this process, the students are taught how to process student’s reflective thinking that is used to solve the problem [5]. The problem-solving process is part of the thinking process [6]. Thinking skills are needed by everyone to succeed in their lives [7]. Moreover, problem-solving based on cognitive processes that are the result of searching for ways to get out of difficulty and ways to get around obstacles [8]. Problem-solving is part of the thinking process (Mayer, 1983). Problem-solving is the basic skill needed by students today [9].

In its development, problem solving abilities have different levels in each student. The point of view in giving assessment to each student will be different. Female students will be more careful in solving problems, when compared to male students [10]. Furthermore, there are several types of development
that are evident in the cognitive style of compilation of older children, usually becoming independent, at least until teenage birth. As adults, the movement changes to become more dependent on the field. In addition, some research results also show that boys prefer to be field independent than girls [11]. The difference between male and female students' abilities is caused by several factors, namely a) equal learning opportunities between male and female students; b) cultural dimensions in society; and c) Different ways of thinking of female students with men [12]. Therefore, special strategies are needed in developing problems. Gender differences were evident in success patterns and in strategy use on conventional and unconventional problems. Specifically, female students were more likely than male students to correctly solve conventional problems; male students were more likely than female students to correctly solve unconventional problems using logical estimation or insight [10].

Learning problem-solving is learning to use scientific methods or thinking systematically. Also, the problem-solving process involves the ability to reflect [5]. However, the process needs to be taught with a systematic learning model. The learning process of discovery becomes an alternative to teaching problem-solving skills. In Polya’s there are contain four indicators. It can lead students to develop the problem-solving ability.

The problem-solving process trained to students following the problem-solving cycle. It includes problem identification, problem definition, strategy formulation, an organization of information, allocation of resources, monitoring, and evaluation (see figure 1) [4]. Each stage in the cycle will help them find ideas for problem-solving. Therefore, the ability to solve problems will help students to solve problems not only in the academic field but also in real life [13]. Because the problem-solving ability is an efficient way to get the goal. Other hands, the problem-solving ability is necessary activity of human to solve the problems. Problems can be divided in two categories, includes well-structured problem and ill-structured problem [14]. Therefore, problem-solving cycle can help students or teacher to train the problem-solving ability.

![Figure 1: The Problem-Solving Cycle](image)

Discovery learning is a learning method that encourages students to find principles for themselves [2]. Discovery learning is a learning method that emphasizes student-centered learning experiences [5]. From the experience of the students find their own ideas and degrade the meaning by themselves [15]. The method of discovery learning consists of three phases, namely: (1) exploration, is the initial phase where during this phase the teacher plays an indirect role, the teacher asks questions and helps students individually or in small groups. Students in this case act as active learners [15]. (2) concept recognition, during this phase, the teacher assumes a traditional rule, information relating to the extraction of the student experience. (3) Application of the concept, in this phase the teacher filed a new situation or a problem that can be solved by excavation experience and an introduction of the idea, as well as the exploration phase, students use various types of activities [15].
Discovery learning has three types, Guided Discovery Learning; Less Structure-Guided Discovery and Discovery without guidance [2]. First, type guided discovery learning, the teacher submits problem formulation and methods that can be used by students to solve problems, and then students are encouraged to solve the problem based on the method given by the teacher. Second, the type of guided discovery less structure, the teacher only submits the problem formulation without providing a problem-solving approach, and then the student is assigned to formulate the problem-solving method by giving the teacher approval. Third, free discovery, students themselves who submit the formulation of the problem, create problem-solving methods and use these methods to solve the issues. Finally, the use of guided discovery is used to build students’ problem-solving abilities in junior high school students. Because according to Piaget’s Cognitive development theory, middle school students tend to want guidance rather than being released.

This guided discovery approach involves students in investigations, in investigative activities that lead them to draw valid conclusions, acquire skills and understand concepts, put forward some of the things that use of guided discovery learning: work, excite, educate, practical, and have advantages [14]. Besides, guided discovery learning makes student motivation change from extrinsic to intrinsic motivation, can teach students how to find something, information obtained is quickly understood and easily remembered by students, students can build their positive concepts, and according to previous research this learning is active.

In this study, aims to observe differences in problem-solving abilities in male students with women. Problem-solving skills taught through guided discovery models combined with the problem-solving cycle of Sternberg are expected to map as far as students’ problem-solving abilities in Bangkalan district. So, why should be distinguished between male and female students? Some studies show that male students tend to use strategies that are simpler than women [16]. Furthermore, boys have a different learning style than girls [14,16]. Thus, there will be training that can encourage similar problem-solving abilities in men and women. So, the achievement of abilities in the teaching and learning process becomes better. In the context of education, a teacher trainer can be defined as one who is concerned for learning at a minor level for the particular job to improve the skills [17].

2. Methods

This research is a quasi-experimental study with one group pretest-posttest design. Sample is using from three junior high schools in Bangkalan Regency in 3 different sub-districts (see Table 1).

| SMPN 1   | SMPN 1 | SMPN 1 | N  |
|----------|--------|--------|----|
| Bangkalan| Kwanyar| Kamal  |    |
| Male     | 17     | 14     | 16 | 47 |
| Female   | 15     | 16     | 16 | 47 |
| Total    | 32     | 30     | 32 | 94 |

The instrument of problem solving ability uses a written test using indicators from the pattern which are translated into ten indicators (see Table 2).

| Polya indicator          | Problem Indicator | Problem Code |
|--------------------------|-------------------|--------------|
| Understanding Problems   | Indicator 1       | 1            |
|                          | Indicator 3       | 3            |
|                          | Indicator 5       | 5            |
| Planning the Settlement  | Indicator 2       | 2            |
|                          | Indicator 6       | 6            |
Polya indicator | Problem Indicator | Problem Code
---|---|---
Implement Problem Solving | Indicator 7 | 7
Indicator 4 | 4
Indicator 8 | 8
Evaluate | Indicator 9 | 9
Indicator 10 | 10

The data analysis process uses descriptive statistics and paired t-tests by comparing the ability to solve male and female students' problems. The t-test is done using the SPSS 18.0 program.

3. Result and Discussion
The results of the study indicate that there are differences between the ability to solve problems of male students with female students. This difference caused by the learning model used. Female students prefer to be given guidance compared to male students. Male students tend to work individually [16]. Descriptive statistical results can be seen in Table 3.

| Table 3: Descriptive statistic |
|---|---|---|---|
| N | Mean | SD | SE |
| Male | 47 | 69.73 | 10.62 | 1.54884 |
| Female | 47 | 72.19 | 10.03 | 1.46265 |
| Total | 94 | 70.96 | |

Based on Table 3, the problem-solving ability of female students has an average of 72.19 with standard deviation 10.03. While male students with an average of 69.73 with a standard deviation of 10.62. This shows that there is a difference between the two genders. A different test is done using SPSS with the result of $-t_{\text{count}} < t_{\text{table}} < t_{\text{count}} = -1.051 < 2.021 < 1.051$ with a significance of 0.001 (see Table 4). This shows a significant difference.

| Table 4: T-Test |
|---|---|---|---|---|---|
| Paired Differences | Mean | Std. Deviation | Std. Error | Mean | Lower | Upper | df | Sig. (2-tailed) |
| Pair 1 PS_M - PS_F | -2.46638 | 16.08837 | 2.34673 | -7.19010 | 2.25734 | -1.051 | 46 | .001 |

This difference is not only caused by differences in learning styles of male students or female students [16]. However, the learning motivation of female students tends to be higher than female students [14]. This is seen during the learning process in the classroom.
Also, the tendency of female students to seek self-recognition for higher success also influences problem-solving abilities [14]. Even so, male students are more capable of problem-solving planning skills than female students.

![Figure 2: Graphic score problem-solving between male and female](image)

Ambiguity in defining problems is still found in the classroom. Boys have different perspectives from girls [16]. Boys tend to have issues with simple problems. Patterns on girls are more complex than boy. Whereas, girls have a tendency to be more careful in interpreting problems.

Nevertheless, learning with guided discovery is very helpful for students in training problem-solving skills. Besides, problem-solving cycle of Sternberg can able to guide students in problem-solving ability. Scaffolding for students is needed to achieve the desired knowledge of students [3].

Figure 2, shows that female students tend to get better grades than men. It indicates that academically female students are better than men. Which states that there are significant differences between male students and female students [11]. His difference also based on the ability of the brain's performance ability. The gender differences at early elementary school stage and varied with age [13].

This process can illustrate that differences in abilities will appear at different ages. Age maturity in women is faster than men [3]. That, differences in abilities will look at different periods. Age maturity in women is faster than men [3]. So, it is necessary to give different treatment at different ages to train an ability or skill. Thus, teachers will be younger to train their students and achievement of capabilities will be balanced between male students and female students. In addition, the participation of parents in motivating students in learning will help students achieve the expected skills.

4. Conclusion

Based on the results of the study, it can be concluded that the ability to solve problems for female students is better than male students in guided discovery learning models.

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