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RESEARCH ARTICLE

Scaffolding Based on Problems in Graph Theory Learning

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ABSTRACT

Scaffolding is assistance provided so students can solve problems or understand concepts that can not be solved independently. When students are considered capable of completing their tasks independently, the assistance is eliminated. In this study, scaffolding was carried out by giving problems about graph theory. Problems given are closed and open contextual problems. The selection of this problem can be seen by students' understanding of graph theory. The results of this study, this problem-based scaffolding can help students who experience difficulties in the problem of graph theory. Students are enthusiastic because through this problem, they can explore and connect blood donation problems and regional tourism with the concept of graph.

1. INTRODUCTION

Graph theory is a branch of mathematics that is very useful in everyday life. Hasmawati (2015) states that the Graf theory is widely developed and has many applications in various fields of science such as in the fields of Chemistry, Physics, Electrical Engineering, Communication Sciences, Genetics and others. Therefore, it is important to study this Graph Theory so that we can use this knowledge to help us make the right decisions in solving problems. Some of the benefits of graph theory are for optimal scheduling problems and how to send secret messages (Dafik, 2015).

Because of the importance of Graph Theory, the material of this theory is included in one of the subjects taught in college. However, there are still many students who find it difficult to study graph theory. Rahayu & Nugraheni (2010) explained that students find it difficult to understand graph theory material in a strong and comprehensive manner.

Mardiani (2017) stated that some of the conceptual errors of graph theory emerged, such as: writing errors in the names of historical figures of graph theory, writing errors in understanding point concepts, degrees of points, and sides, errors in remembering information and others.

According to the interview with the Graf Theory lecturers, many students have difficulty with this course. This can be seen from the student exam results, almost more than 70% of students get less grades. When confirmed to students, they had difficulties because they felt abstract graph theory.The following is an example of the findings of researchers in the field related to student difficulties in the concept of graph theory.

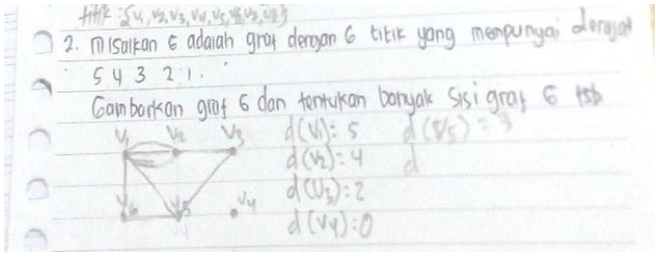

Figure 1. Student's difficulty 1

In Figure 1 it appears that students have difficulty describing graphs with 6 points that have degrees 5, 4, 3, 2, and 1.

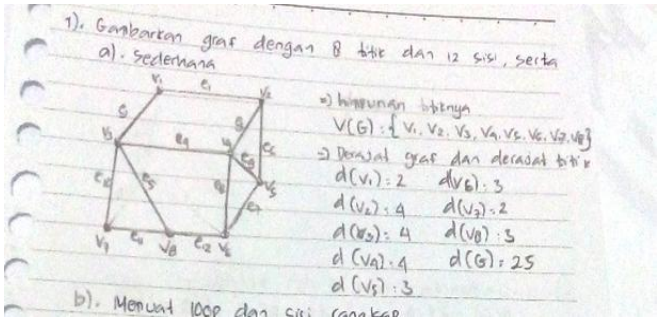

Figure 2. Student's difficulty 2

In Figure 2, its can be seen that students have difficulty determining the degree of each point of graph G.

Based on a short interview, students have difficulty understanding the material of graph theory because it is abstract. Therefore, scaffolding will be conducted in this study by providing real problems related to graph theory.

Scaffolding is a technique for providing structured learning support that is done so that students can work independently (Sudrajad, 2013; Amelia, 2018; Putriani, 2018). If students feel they have been able to overcome their difficulties, then the assistance is eliminated. McKenzie (1999) proposes eight characteristics of scaffolding learning, namely giving clear instructions, clarifying goals, giving assignments to students, showing students useful learning resources, reducing uncertainty, surprises, and disappointments, delivering students to work efficiently, creating momentum. While scaffolding is categorized into 3 levels, namely level 1, assistance in the form of preparation for the learning environment carried out by the teacher; level 2, assistance in the form of direct interaction between the teacher and students; level 3, assistance in the form of interaction between teachers and students for the development of contextual thinking (Anghileri, 2006; Fonna, 2018, Rahayu, 2018; Sapta, 2018; Setiawaty, 2018).

The provision of scaffolding in this course is problem based. Herman (2007) states that problem-based learning contributes to the formation of positive student dispositions towards mathematics. The problem used in this study is both closed and open contextual problems. With contextual problem solving, students will be stimulated to develop psychological potential related to the thinking process. The problem of contextual mathematics is a mathematical problem related to the context as defined (Usmadi, 2018; Trianto, 2007; Thahir, 2018; Mursalin, 2018).

2. RESEARCH METHODS

This study describes the form of scaffolding in problem-based learning graph theory. Problems given relate to everyday life. In this study two different problems were given, the first was about blood group problems and the second was regional tourism problems. However, in this article only one problem is presented, namely the blood group problem as presented below.

Blood Type Problems

There are four types of blood types namely blood types A, B, AB, and O. Blood type O can be donated to all blood types. Blood types A and B can be donated to their own blood type or blood type AB, while blood type AB can receive blood from all blood types. Make a directed graph that describes the situation. In the first problem, students were asked to draw a directed graph representing the Blood Type problem.

3. RESULTS AND DISCUSSION

Based on the results of work on problem 1 about blood type, it was seen how students applied graph theory in real life. The following are some of the results of the work of the student blood type problem.

3.1 Student's work results 1 by S1

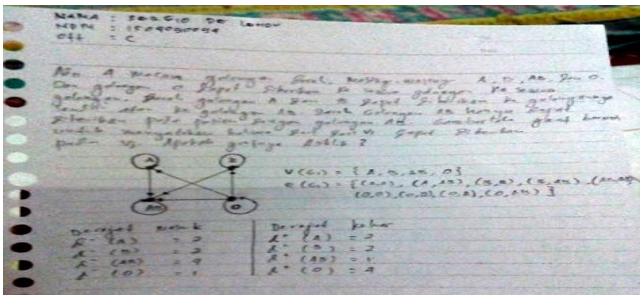

Figure 3. Student's work results 1 by S1

Based on the picture above, it appears that S1 can connect his knowledge about the concept of directed graphs to blood types problems. This can be seen when S1 is able to identify various types of blood groups as a vertexs and relationship of blood type donation between blood groups as a directed edges.

3.2 Student's work results 1 by S2

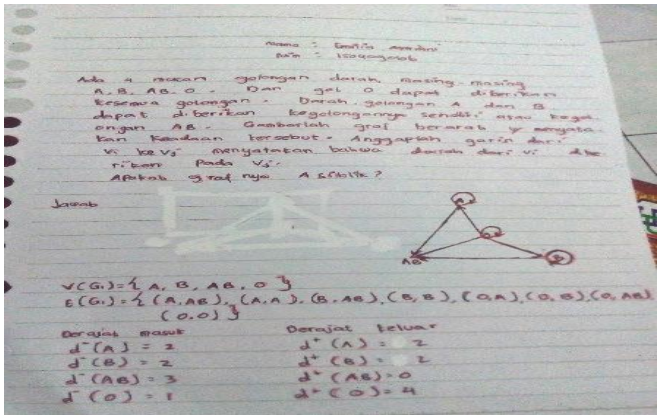

Figure 4. Student's work results 1 by S2

Based on the picture above it appears that S2 can also relate his knowledge about the concept of directed graphs to blood type problems. This can be seen when the S2 is able to identify various blood groups as the point and relationship of blood type donation between blood groups as a directed line. However, the S2 does not describe the directed edge from AB to AB. This causes the S2 to be incorrect in mentioning the degree of entry and the degree of exit from point AB. Based on the interview, it was found that S2 actually understood the concept of degree point graphs, it's just that when the master's work was inaccurate, it didn't describe the donation of blood type AB to AB.

3.3 Student's work results 1 by S3

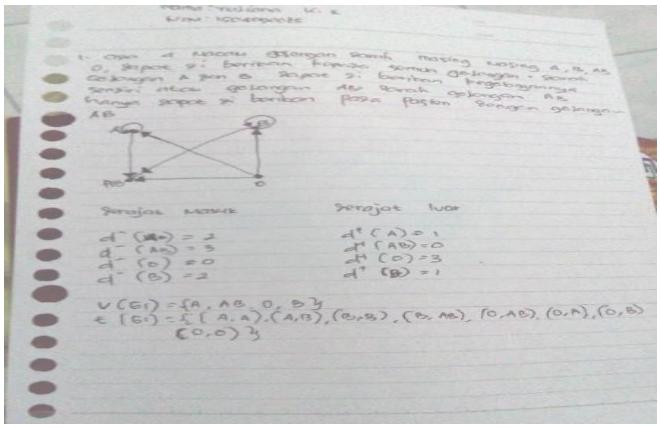

Figure 5. Student's work results 1 by S3

Based on the picture above it appears that S3 is not able to connect his knowledge of the concept of directed graph to blood type problems. It can be seen that the S3 has not written the set of the edges graph exactly. S3 is wrong in mentioning the degree of point. Based on the interview, it was found that the S3 was not thorough in reading the problem given, namely blood type AB can accept all blood types. S3 does not understand the concept of the degree of the graph. After this problem-based scaffolding with questions and answers during interviews, the S3 finally understood the concept of vertexs degrees.

4. CONCLUSIONS

Based on the results of the research given it can be seen that:

1. This problem-based scaffolding helps overcome student difficulties with graph theory, it can be seen that some students are able to relate the knowledge of graph theory with blood group problems.
2. Contextual problems are able to support mathematics learning and motivate students to improve thinking skills (Widjaja, 2013).

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