STUDENTS' METAPHORICAL THINKING SKILLS IN STATISTIC METHOD SUBJECT DURING COVID-19 PANDEMIC

by Adi Wibawa

STUDENTS' METAPHORICAL THINKING SKILLS IN STATISTIC METHOD SUBJECT DURING COVID-19 PANDEMIC

I Putu Ade Andre Payadnya[1*], Kadek Adi Wibawa[2]

[1*,2] Universitas Mahasaraswati Denpasar, Denpasar, Indonesia
Corresponding author.
E-mail: adeandre@unmas.ac.id [1*)]
            adiwibawa@unmas.ac.id [2)]

Abstract

The purpose of this study was to analyze students' metaphorical thinking skills in the statistic method subject during COVID-19 Pandemic using three stages of metaphorical thinking. This research was conducted from March to May 2020. Subjects in this study were 20 students of class IIB of Mathematics Education Study Program Mahasaraswati University Denpasar. This study uses descriptive analysis techniques. Data collected through tests, interviews, observations, and documentation. The results showed that students' metaphorical thinking skills in online learning during COVID-19 Pandemic was still very low where only 20% of students answered correctly at the grounding metaphors stage, 25% at the linking metaphors stage, and only 25% at the redefinitional metaphors stage. Students tend to be confused when required to associate statistical concepts with everyday phenomena and discover the characteristics of the concepts. Online learning due to COVID-19 Pandemic also causes the suit of students to do group discussion as well as the decrease in student motivation primarily in solving metaphorical thinking questions. Some solutions that can be taken to overcome this problem are: 1) Using interactive learning, 2) Using Project-Based learning (PBL), 3) Discussing current trends in learning, 4) Demonstrating assertiveness, and establishing learning rules.

Keywords: COVID-19 pandemic; descriptive analysis; metaphorical thinking skills; statistic method.

Abstrak

Tujuan penelitian ini adalah untuk menganalisis kemampuan berpikir metaforis siswa pada mata kuliah metode Statistika selama Pandemi COVID-19 dengan menggunakan tiga tahapan berpikir metaforis. Penelitian ini dilaksanakan pada bulan Maret sampai Mei 2020. Subjek dalam penelitian ini adalah 11 siswa kelas IIB Program Studi Pendidikan Matematika Universitas Mahasaraswati Denpasar. Penelitian ini menggunakan teknik analisis deskriptif. Pengumpulan data dilakukan melalui tes, wawancara, observasi, dan dokumentasi. Hasil penelitian menunjukkan bahwa kemampuan berpikir metaforis siswa dalam pembelajaran online saat Pandemi COVID-19 masih sangat rendah dimana hanya 20% siswa yang menjawab benar pada tahap *grounding metaphor*, 25% pada tahap *linking metaphor*, dan hanya 25% pada tahap *redefinitional metaphor*. Siswa cenderung bingung ketika diharuskan mengaitkan konsep statistika dengan fenomena sehari-hari dan menemukan ciri-ciri konsep tersebut. Pembelajaran online akibat pandemi COVID-19 juga menyebabkan kesesuaian siswa untuk melakukan diskusi kelompok serta penurunan motivasi siswa terutama dalam menyelesaikan soal-soal berpikir metaforis. Beberapa solusi yang dapat diambil untuk mengatasi masalah tersebut adalah: 1) Menggunakan pembelajaran interaktif, 2) Menggunakan Pembelajaran Berbasis Proyek (PjBL), 3) Membahas tren pembelajaran saat ini, 4) Menunjukkan ketegasan, dan menetapkan aturan pembelajaran.

Kata kunci: Analisis deskriptif; kemampuan berpikir metaforis; metode statistika; pandemi COVID-19.

INTRODUCTION

The success of modern mathematics learning is highly dependent on students' high order thinking skills. High order thinking skills is a process of thinking of students in a higher cognitive level that is developed from various cognitive concepts and methods and learning taxonomies such as the method of problem-solving, bloom taxonomy, and the taxonomy of learning, teaching, and assessment (Saputra, 2016). High order thinking skills include problem-solving abilities, creative thinking skills, critical thinking, argumentative abilities, and decision-making abilities.

High order thinking skills are divided into several thinking competencies that illustrate students' skills in analysing and understanding concepts and problems and also to develop the curriculum (Fanani & Kediri, 2013). High order thinking skills also one of the components that very significant to improve the learning quality. One of the thinking competencies that is an important part of high order thinking skills is metaphorical thinking skills.

Metaphorical thinking is very closely related to high order thinking skills (Nurhikmayati, 2016). This is because metaphorical thinking focuses on developing advanced thinking skills to connect mathematical concepts and real phenomena that exist around students (Carreira, 2001). Metaphorical thinking uses metaphors as a basic concept in thinking. As a result, some mathematical concepts learned based on students' experiences can easily build a mathematical model with an accurate interpretation (Hendriana, 2012: 6).

Metaphorical thinking is the ability to model mathematical situations that are interpreted from a semantic perspective using metaphors. According to Holyoak & Thagard (Hendriana, 2012), metaphor begins with a concept that is known to students to other concepts that are not yet known or are being studied by students. Meanwhile, according to Hendriana, et al (2016), the concept of thinking that emphasizes the ability to connect mathematical ideas and phenomena that exist are metaphorical thinking.

Metaphorical thinking through three stages, including (1) grounding metaphors is the basis for understanding mathematical ideas that are connected with everyday experience (2) linking metaphors: building a link between two things namely choosing, asserting, giving freedom, and organizing charac-teristics from the main topic supported by additional topics in the form of metaphoric statements (3) redefinitional metaphors: redefining these metaphors and choosing those that best fit the topic (Mardiyanti et al, 2018).

Metaphorical thinking skills are very important in mathematics subjects specifically subjects that require high conceptual understanding, critical thinking, and deep analysis. One of mathematics these subject is Statistic Method. The statistic method introduces students to the basics of research statistic which will become a compulsory science for students in conducting research and completing their final assignments. In learning statistic methods, it is very important for students to not only memorize the formula but also understand the concept thoroughly (Payadnya & Atmaja, 2020). This can be done by modelling the concept into students' logical understanding that is associated with real phenomena.

The sudden wave of online learning caused by the Covid-19

Pandemic has changed the face of education in Indonesia and is causing unpreparedness from both teachers and students. Farida et al (2020) state that online learning causes students to be difficult to cause a decrease in student understanding because of the difficulties faced by students to adapt to accessing learning content properly.

Learning activity in Pandemic of COVID-19 situation requires an educational element to sustain online learning. The current condition urges innovation and adaptation related to the use of available technology to support the learning process (Ahmed et al., 2020). Learning statistical methods oriented to metaphorical thinking skills that are usually done face-to-face must be affected by this change, causing a major change in the thinking ability of students who are accustomed to follow learning directly and take advantage of direct social interaction with teachers and other students.

Knowing students' thinking skills in Statistic Method materials during a pandemic is very important for the success of learning mathematics. Some studies are still not specific in this regard. For example, research by Tama, et al (2019) which analyzed students' metaphorical thinking skills but was not carried out during the Covid-19 Pandemic and not specified in Statistic Method subject so that the changes that occurred could not be answered. In addition, research by Nastiti, et al (2020) conducted an analysis and obtained the low ability of students in one aspect of HOTS during the pandemic. Unfortunately, the aspect of HOTS discussed is critical thinking skills so that metaphorical thinking skills that have different characteristics have not been revealed. This study will overcome these shortcomings by deeply analyzing students' thinking skills in statistical methods during a pandemic which is the basis for appropriate learning in improving overall thinking skills during a pandemic.

The purpose of this study is to investigate how students 'metaphorical thinking skills in the subject of statistical methods use a three-stage reference to metaphorical thinking in the online learning period due to the COVID-19 Pandemic and look for any impacts on the students' metaphorical thinking skills. The results of this study will be used as a reference for educators in the morning to be able to arrange appropriate online learning during the COVID-19 Pandemic period to improve students' metaphorical thinking skills.

METHODS

This research uses qualitative research methods that aim to show more careful the metaphorical thinking skills of students in the Statistics Method subject during Covid-19 Pandemic. The qualitative approach was chosen with the aim of analyze more carefully about students' metaphorical thinking skills. In addition, with a qualitative approach, researchers can communicate directly with respondents to find out various errors and obstacles faced by students.

The type of research that will be conducted is descriptive qualitative research. This research is described to collect information about students' higher order thinking skills through three stages of metaphorical thinking, namely: grounding metaphor, linking metaphor, and redefinitional metaphor.

This research was conducted at the Mathematics Education Study Program, Mahasaraswati University, Denpasar. The subjects in this study were 20 students of Class IIB

Mathematics Education Study Program Mahasaraswati University Denpasar. The study period is from April to May academic year of 2019/2020. The determination of subject and time is adjusted based on the needs of the aims and objectives of this study.

Research procedures are stages of activities designed by researchers that will be applied when carrying out research. The steps used in this research procedure are as follows:

1. Determine the problem by making observations in Class IIIB of the Mathematics Education Study Program, Mahasaraswati University Denpasar.
2. Determine the steps of analysis and the theoretical basis needed to conduct the analysis.
3. Determine the research population to be selected, namely the population of Class IIB students of the Mathematics Education Study Program, Mahasaraswati University Denpasar.
4. Determine the research sample in the form of 11 students from a predetermined population.
5. Determine the analytical procedure to be used in analyzing student errors.
6. Prepare research instruments in the form of essay questions based on three stages of metaphorical thinking to analyze students' metaphorical thinking skills.
7. Consult the research instrument with the research team.
8. Conducting instrument trials to find out the validity and reliability of the instrument.
9. Carry out research by providing questions in the form of descriptions on the research sample.
10. Checking students' answers and analyzing students' mistakes based on three stages of metaphorical thinking.

11. Conducting interviews with students who have been selected to find out the causes of errors made by students in working on questions.
12. Comparing the results of student answers in working on questions with the results of student interviews.
13. Draw conclusions from the results of data analysis that has been carried out.

Data sources are sources from which data can be obtained. In this study, researchers used primary data sources and secondary data sources. In this study, researchers obtained primary data from the results of students' answers in working on students' descriptions and interviews. Meanwhile, researchers obtained secondary data from literature, websites and documents in the form of students' math scores in the previous semester.

In this study, several data collection techniques were used, namely as follows:

1. Test Instruments

Giving this test aims to obtain data and observation material regarding student errors in solving statistical method questions. The questions used in this study are in the form of descriptions.

2. Interview

The interview used in this study is an unstructured interview by compiling an interview guide that only contains an outline that will be asked. This guide requires more creativity from the interviewer, even the results of interviews with this type of guide depend more on the interviewer. This interview aims to determine the factors that cause obstacles or difficulties experienced by students.

The data analysis technique used in this reserach is 1ualitative descriptive with the following stages.

1. Data Reduction

Data reduction is a form of analysis that sharpens, categorizes, directs, discards unnecessary data, and organizes data in such a way that final conclusions can be drawn and verified. This activity leads to the process of selecting, focusing, simplifying, and abstracting the raw data written in field notes. The stages of data reduction in this study are:

a. Correcting the results of student work which is then ranked to determine students who will be used as research subjects.

b. The results of student work which are the subject of research which are raw data are transformed into notes as material for interviews.

c. The results of the interviews that have been carried out are simplified into a good and neat language arrangement, then translated into notes.

2. Data Presentation

Data presentation is a structured collection of information that provides the possibility of drawing conclusions and taking action. At this stage the data in the form of student work are arranged according to the object of research.

3. Drawing Conclusions or Verification

Verification is part of a complete configuration activity so that it is able to answer research questions and research objectives. Comparing the results of student work and the results of interviews, conclusions can be drawn regarding the location and causes of student errors in working on description problems on the subject of straight-line equations.

4. Data Validity Check

In this study, checking the validity of the data using triangulation techniques. Triangulation technique is an examination of the validity of data that utilizes something other than the data for checking purposes or as a comparison against the data. In this study, the type of triangulation used is source triangulation, which is to compare and check back the degree of trustworthiness of information obtained through different times and tools in qualitative methods. The source triangulation stage carried out in this study was to compare the results of student work with the results of interviews.

RESULTS AND DISCUSSIONS

Results

The results obtained in this study indicate the lack of metaphorical thinking skills possessed by students in terms of the three stages of metaphorical thinking in statistical concepts. The statistical material used in this study is Data Normality and Variance Homogeneity. This can be seen from the following Table 1.

Table 1. Summary of results of student answers

Stages	Number of Students Answering Correctly	Number of Students Answering Wrong	Correct Percentage
Grounding Metaphors	4	16	20%
Linking Metaphors	5	15	25%
Redefinitional Metaphors	5	15	25%

From the Table 1, it can be seen that the students' metaphorical thinking skills is still less in the three stages assessed. In the Grounding Metaphors stage, only 4 students out of 20 students answered correctly, or about 20% of all students. While in the Linking Metaphors stage only 5 students out of 20 students answered correctly, or about 25% of all students. In the Redefinitional Metaphor stage only 4 students out of 20 students answered correctly, or about 25% of all students.

From the data it is clear that students' metaphorical thinking skills during the Pandemic generally are still very lacking. There are only a few who answered correctly by using innate reasoning that was not formed in appropriate learning. Meanwhile, students who answered incorrectly mostly lacked in reasoning and thinking skills to analyze problems and connect with appropriate concepts.

Discussions

At each stage of metaphorical thinking, there are weaknesses or shortcomings of students in demonstrating the ability to think at a higher level. The following is a discussion of the analysis of student answers at each stage.

1) Grounding Metaphor

At this stage, students are presented with metaphors that have been prepared previously and students are asked to understand these metaphors and explain the statistical concepts that are under these metaphors. One example of the problem is:

"There are forests that only grow one type of plant or can be said to have only one variation. Each plant has the same characteristics because it comes from the same species, but each tree is a different individual. Examples of these forests are pine forests or pine forests. What concepts fit into this metaphor? Explain."

The metaphors presented refer to the concept of homogeneity of variance. However, most students cannot understand the concepts referred to and give incorrect answers. Many students gave answers that the concept referred to was an average concept because the forest covered with the same tree meant that it could be said that the average tree in the forest was the same. Examples such as pine forests are on average overgrown with pine trees. The Figure 2 shows one of the student's answers in grounding metaphor stage.
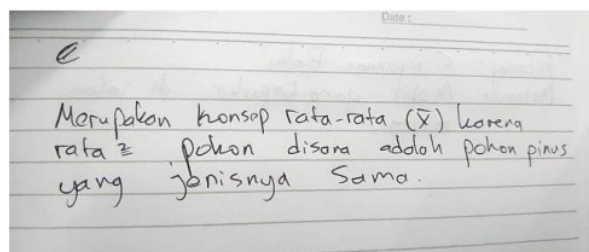

Figure 2. Examples of student answers in the grounding metaphor stage

The student's answer in Figure 2 shows that students are not in-depth in understanding the concept, so that when connected with metaphors students only use the equivalent words that are deemed appropriate or inherent in their

thinking. This shows the lack of meta-phorical thinking abilities possessed by students. In addition to this, some students have succeeded in answering the homogeneity of variance without giving a detailed explanation of the concept's relationship with the metaphor.

2) Linking Metaphor

At this stage, students are given two concepts and metaphors which they must pair with each other accordingly. However, many students mistakenly pair concepts with metaphors, and some even pair upside down. The Figure 3 shows one of the student's answers in linking metaphor stage.
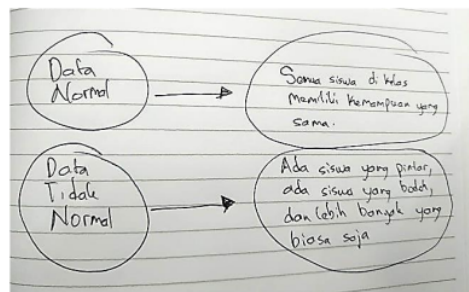

Figure 3. Example of Student Answers in the Linking Metaphor Stage

From the student's answer in Figure 3, it is clear that there is a lack of students' ability to think in understanding concepts and relating them to real-world phenomena presented in metaphors. The concept of "normally distributed data" is paired with the metaphor "all students in the class have the same ability to be at the intermediate level". Meanwhile, the concept of "data not normally distributed" is paired with the metaphor "there are high-ability students, low-ability students, and many capable students in the classroom". This is wrong because the definition of normally distributed data itself is that in the data there are high, low levels, and most of them are in middle-level data as shown also in the normal curve, but students think normal means neither high nor low.

3) Redefinitional Metaphors

At this stage, students are given a concept and asked to write metaphors that are following the concept. However, most students only write cases or story problems from the concepts given. This is of course not appropriate because even though in some cases it seems the same, metaphorical thinking is a different matter from the story. In metaphorical thinking, students must be able to make metaphors that have the same characteristics and concepts with the material even in different domains (Kiliç, 2010). Metaphorical thinking itself is not a concept, but a way to understand concepts through similes that are simpler, familiar, and easy for students to understand. The Figure 4 shows one of the student's answers in redefinitional metaphor stage.
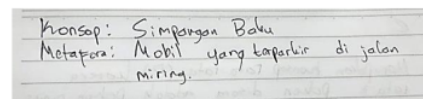

Figure 4. Example of student answers in the redefinitional metaphor stage

Apart from the many shortcomings, there are also students' answers that are almost right but are still constrained by the lack of detailed explanation given about the relationship of concepts to metaphors. From the results of interviews conducted with 5 student representatives, most claimed to have difficulty understanding the metaphorical thinking skills test presented online. They stated that the absence of group formation and discussion made it difficult for them to exchange ideas with colleagues in working on problems. They said line learning that was carried out in the middle of the COVID-19 Pandemic limited cooperative discussion that they could do with other students to avoid the process of sharing and exchanging opinions in solving problems. This is contradictory to the concept of constructivism learning which emphasizes the process of students working together in constructing their knowledge.

The rest also claimed to have decreased learning motivation during the online learning period. This is due to the lack of a learning atmosphere that students feel while learning from home. This results in the lack of enthusiasm of students in doing the test metaphorical thinking skills presented so that students' answers are not optimal.

From the discussions that have been presented, it can be seen that there is a lack of students' metaphorical thinking skills due to online learning in the era of educational disruption. Students seem less able to understand the concepts and problems presented correctly. In accordance with the opinion of Newman and Wehlage (Widodo, 2013:162) with high-order thinking skills students will be able to clearly distinguish ideas or ideas, argue well, be able to solve problems, be able to construct explanations, be able to hypothesize and understand things. complex becomes clearer. So, the lack of students' ability to understand concepts and ideas and the intent of the problems presented is an indicator of the lack of students' higher-order thinking skills in the term of metaphorical thinking.

In addition to the lack of understanding, the researchers also revealed that there was a decrease in students' motivation and activeness in learning. This is in line with Cahyani, et al (2020) who found that students' learning motivation decreased during online learning and only a few students participated and were active in learning. This decrease in motivation will also result in a decrease in students' higher order thinking skills which will also reduce the quality of learning. This is because motivation and activity are one of the determining factors for learning success (Emda, 2018).

In addition to negative things, there were also positive impacts of online learning in the era of educational disruption. This can be seen from the results of interviews which show that students tend to find it easier to obtain information in learning. In accordance with the opinion of Herliandry, et al (2020), online learning accustoms students to collect and manage information related to the given task without the limitations of space and time. This is a good development because the ease of access to information will familiarize students to seek and collect their own knowledge so that they can also practice higher order thinking skills more freely.

From the discussion above, it can be seen that students' mataphorical thinking skills during the Covid-19

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pandemic are relatively low. Most of the students are unable to understand and find the right solutions and steps in solving metaphorical thinking problems. Students oftenly wrong in giving answers so that many answers deviate from the answer key. This is in line with research by Tama, et al (2019) which found that in answering questions on metaphorical thinking students tend to be less able to provide the right steps. However, reserach by Tama, et al (2019) that had been conducted before the pandemic also found that even though there were many wrong answers, the level of students' metaphorical thinking skills still tended to be moderate, while in this study the level of students' metaphorical thinking skills was low. This shows that there is a negative impact caused by learning during the pandemic on students' metaphorical thinking skills.

This study has the advantage of a detailed and specific description of students' metaphorical thinking skills during the COVID-19 pandemic, especially in the subject of Statistical Methods. However, this research is still limited to students at the level of the research subject used, so to get more valid results, research subjects must be developed to reach all grade

This study will provide an overview of students' metaphorical thinking skills in the subject of Matode Statistics during the COVID-19 Pandemic, so that the results of this study can contribute in the form of knowledge for mathematics educators to be able to develop appropriate statistical methods learning during the pandemic so that students can improve his mataphorical thinking skills.

The low metaphorical thinking skills of students in online learning during the COVID-19 Pandemic period

should be a concern in mathematics education. This causes teachers and lecturers to be smart in preparing effective and interactive online-based learning. Some solutions that can be taken by mathematics educators to still be able to improve students' metaphorical thinking skills are:

1) Using interactive learning. Interactive included here is learning that can attract interest and increase student motivation. As is well known, online learning due to the COVID-19 Pandemic gives many temptations to students. Learning that is not directly supervised by the teacher will make students free and can do other activities so they are less interested in participating in learning. This causes the teacher to design learning that is not monotonous, teachers should not only do the learning by lecture method only. The provision of learning videos, animations, and the use of interactive e-learning are solutions that can be used.

2) Using Project-Based learning (PjBL). PjBL can direct students to be active in learning not just to listen to the teacher's explanation. The project provided can stimulate students' thinking abilities and provide fun activities for students, coupled with internet facilities that are freely accessed by students, PBL can direct students to utilize their internet facilities efficiently and positively.

3) Discussing current trends in learning. By creating contemporary learning, students will be able to be more interested and serious in learning. Students who are on average young are certainly very updated with current issues such as the Pandemic COVID-19. Linking learning with current issues will increase students'

motivation and mathematical thinking that are very dependent on the contextual domain. One example is making questions related to the COVID-19 Pandemic.

4) Demonstrates assertiveness and sets learning rules. Lack of student motivation in online learning due to the COVID-19 pandemic which has caused a lack of students' metaphorical thinking skills, one of which is caused by the difficulty in providing supervision to students when learning online. This situation can be improved by giving strict rules to students in participating in online learning so that the rest do not underestimate online learning and can feel if the teacher is always watching and paying attention to learning that takes place.

CONCLUSION AND SUGGESTION

From the tests, interviews, and observations made, several conclusions were obtained which showed the lack of students' metaphorical thinking skills in the subject of statistical methods during the Pandemic COVID-19 period where only 20% students make the correct answer in grounding metaphors, 20% linking metaphors, and 20% in redefinitional metaphors. From the analysis, several problems occur, such as: 1) Students are less able to understand the statistical concepts presented in-depth so they are not able to translate the meaning of the concept, 2) Students are less able to link the concepts of statistical methods with the concepts of everyday life, 3) Students are not able to distinguish story questions from metaphorical thinking questions, 4) Students have difficulty discussing when learning online due to the Pandemic COVID-19, and 5) Students experience motivation when

solving statistical problems oriented to metaphorical thinking skills due to online learning. In addition, there are also positive impacts felt by students where students feel freer by utilizing the internet and other technologies during online learning.

For further research, it is hoped that they will be able to analyze students' metaphorical thinking abilities at various school levels. It is very important to get more detailed data about students' metaphorical thinking skills. In addition, a combination of various instruments can also be used as a valid and efficient measuring tool to measure students' metaphorical thinking skills.

ACKNOWLEDGEMENTS

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