The Students' Mathematics Learning Difficulties Analysis

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ARTICLE INFORMATION

ABSTRACT

Abstract: This study aims to describe, interpret, and analyze the PGSD UPY students' difficulties in learning mathematics 2. The research type is a descriptive qualitative research. The research subjects are students and a mathematics lecturer of PGSD UPY. The data were gathered through interviews, observations, documentations, and tests. The data validity test was done by using triangulation of sources and techniques. Proprietary interactive analysis models (Miles, Huberman, & Saldana, 2014) were used to analyzed the data. The results show that there are some difficulties experienced by students in learning numberic system especially for fractions. The pretest and post test results show that A1 and A2 students get low average score on fractions materials. The average score of the pretest for A1 is 66.11 while A2 is 62.35. The average core of the posttest for A1 is 67.22, while A2 is 63.52.

In a study, the material studied must be related to the knowledge possessed by students in forming cognitive structures. Meaningfulness in learning is intended so that students can use their understanding of what they have learned to solve real problems they face in the community. One of the subjects that is very closely related in everyday life is learning mathematics (Skemp, 1971; Suneetha, E., Rao., & Rao, 2011). This is based on the fact that mathematics is the basis of another science, which means that mathematics contributes to the birth of other sciences such as geology, biology, chemistry, physics, and other sciences. Suneetha et al., (2011) who said that mathematics is the key and path of all sciences. For example, in making a building, architects need mathematics to calculate the angle of a room.

In Indonesia the level of mathematics is still low. This is in accordance with the (OECD, 2020) PISA results which show that from 2018 students in Indonesia in reading, mathematics, and science are still very lacking, which is below the average of the Organization for Economic Cooperation and Development. The OECD noted that the Program for International Student Assessment (PISA) ranking for Indonesia based on the 2018 survey was in the lower order, especially for the value of mathematics competence, which was ranked 72 out of 78 countries (Mullis et al., 2012; OECD, 2019). It can be seen from time to time that mathematics is a learning that is less desirable and feared by students because it is difficult to understand. (Ardani, Setyaningrum, & Salsabila, 2018; Madanhire & Mbohwa, 2016) argues that for some students learning mathematics must be able to understand it with special abilities because it is felt to be difficult, abstract, and boring. (Booth, 2014; Widyastuti & Pujiastuti, 2014) stated that students who have difficulty in learning mathematics are influenced by a lack of understanding of concepts in the material being taught. Therefore, in learning mathematics, efforts need to be made to improve understanding of concepts in order to make students competent, learn more effectively, be confident, and understand.

From the results of Trends in International Mathematics and Science Studies 2015 (NCTM, 2015) (TIMSS), Indonesia is ranked 45th out of 50 countries which explains that Indonesia is still below the average in terms of obtaining math scores (Mullis et al., 2012). This is evident from the statement of (Ardani et al., 2018; Yilmaz, Altun, & Olkun, 2010) said that most students do not like learning mathematics because mathematics is boring. There are 20 students out of 33 students who feel bored with learning mathematics and there are 15 students from 33 students doing other activities in the mathematics learning process in class.

According to the PGSD mathematics lecturer at UPY, students do not yet have awareness and responsibility in learning so they need teaching experience from the students themselves, causing students to experience learning difficulties. Difficulties that occur in learning also do not come solely from the lecturer or the way he teaches. But it can also come from the students themselves. Learning mathematics is still something that is feared by students, so this is one of the causes of students still having difficulties in learning mathematics. (Ciltas & Tatar, 2011; Khiat, 2010) argues that mathematics learning has a goal, namely to actualize student learning at a high level. However, in reality students have difficulty in mathematics. (Barber & Mourshed, 2007; Brousseau, 2002: 86; Brown, 2008: 3; Cortina et al., 2014: 3) revealed that the epistemological obstacle factor or students' ability to understand certain mathematical topics that were not comprehensive, ontogenic obstacle or student's mental readiness to learn and didactical obstacle or lecturer's factor in presenting learning could be student barriers in learning. For students to appreciate and understand topics in mathematics, it is necessary to create opportunities to utilize their ability to connect important mathematical structures and to know the dimensions and depth of a topic (Rahman, 2010).

Learning difficulties are problems that occur in students in the process and learning outcomes. (Bell, 1981; Westwood, 2008) states that learning difficulties occur in obstacles that can limit results in a lesson plan or lecture, if a student is unable to answer most of the questions, then it is considered a personal threat rather than a teaching aid. An obstacle or difficulty is an irrational and unintentional error, such as having poor achievement in mathematics, lack of understanding of mathematical concepts, lack of mathematical skills and inefficiency in solving mathematical problems (Brousseau, 2002; Sugihartono, 2012; Tambychik & Meerah, 2010). In line with this opinion, (Smith et al., 2011) said that learning difficulties were used to describe students who did not respond to lectures. (Hallahan et al., 1985; Lenhard & Lenhard, 2013) say that learning difficulties are a general term for low academics and are one of the academic problems faced by students. There is another opinion from (Kirk, 1962) which states that the difficulty in learning mathematics is also called acalculia.

According to (Jordan & Levine, 2009) revealed that students who have learning difficulties have characteristics of weakness in interpreting symbols and numbers related to numbers, number relationships, and others. While (Kereh et al., 2013: 110) argue that every level from basic education to higher education can experience difficulties in learning mathematics. (Cooney et al., 1975; Lerner & Lerner, 2003) argue that learning difficulties in mathematics have certain characteristics, namely difficulties in processing information, language and reading, as well as math anxiety. Low principles, as well as difficulties experienced verbally. Hallahan et al., (1985) revealed that in learning difficulties there are factors that cause students to experience learning difficulties, namely factors that come from within the students themselves (biological/psychological factors) and factors that come from outside students, namely in the form of environmental and community conditions, education, family relationships, and so on. These factors ultimately cause learning difficulties experienced by students. (Burton, 2005) says that a student can be said to have learning difficulties if he shows certain failures in achieving his learning goals.

From some of the opinions above, it can be seen that learning difficulties are conditions where students cannot learn properly or students have difficulty or inability to understand concepts, have low learning achievements, and have obstacles in learning. In a learning process that does not always run smoothly, there must be problems experienced by students. However, this is also because the learning material delivered by the lecturer will be difficult for students to understand and understand. Permendikbud Nomor 22 tahun 2016 concerning the National Education System, namely learning is a process of interaction between students and educators and learning resources in a learning environment. (Fosnot, 1996; Suneetha et al., 2011) said that learning is a process to find something, rather than a process to collect something so that learning is a change in behavior. (Blitzer, 2019; Gattuso & Ottaviani, 2015) argues that the word mathematics comes from the Greek, namely mathematikos which means tending to learn, being curious, thinking openly, and being interested in the pursuit of lifelong knowledge. Mathematics is about logical and deductive reasoning, modeling, optimizing and proving those results logically, Mathematics learning in lectures occurs procedurally, allocating more space for computation than understanding. (Blitzer, 2019; Suneetha et al., 2011) reveal that the objectives of learning mathematics are different, namely to improve critical thinking and reasoning skills, improve problem solving skills, increase the level of accuracy and consistency, foster logical thinking skills, increase interest in mathematics, foster the ability to correlate mathematics learning with other learning.

METHOD

This research was conducted using a qualitative approach, and the type of this research is descriptive analytic. The qualitative approach in this study is useful to find out what learning difficulties are experienced by PGSD UPY students in mathematics 2. This research was conducted in February-May.

Sources of data in this study using primary and secondary data sources (Lofland & Lofland, 1984: 157). The research subjects in this study were mathematics lecturers 2 and PGSD students in grades A1 and A2. In this study to check the validity of the data by using triangulation techniques. The data triangulation technique in this research is in the form of source triangulation and technical triangulation. This study uses the proprietary interactive analysis model data analysis technique (Miles, Huberman, & Saldana, 2014). To clarify how this interactive model data analysis works, see the image below.
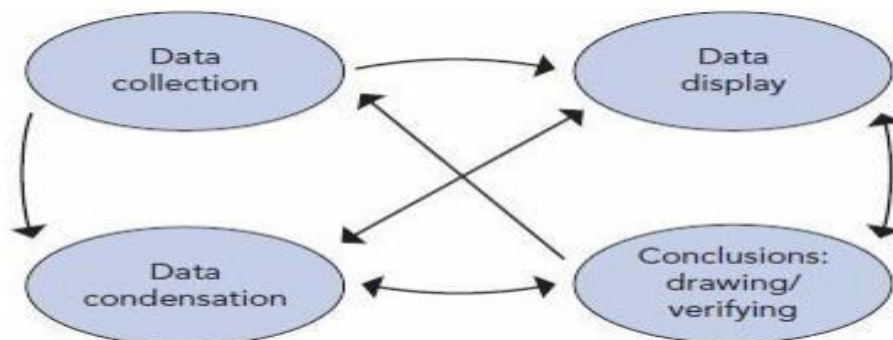

Figure 1. Data Analysis Components of the Interactive Analysis Model (Miles et al., 2014)

RESULTS

Based on the implementation in the field, there are several things that can be stated, including: The Mathematics 2 course studied in semester 2 is held every Wednesday. This course is held once a week with a weight of three credits.

Identifying Cases of Learning Difficulties
Localizing the difficulty

To localize the location of students' difficulties, the researchers used a diagnostic test in the form of multiple choice HOTS questions in Mathematics 2 course on the number system material, namely integers, prime numbers & composite numbers (FPB and KPK), the real number system, namely fractions, decimals and percents. each has 5 questions, so there are 20 number system questions for the pretest. For posttest also with the same amount. The location of student difficulties is obtained based on the final value of each material, the total correct number of each number and the total value. At first, the researcher will identify the types of student errors in the form of errors in reading and understanding the meaning of the questions, errors in understanding concepts, errors in using formulas or using notations and symbols, process errors, counting errors, and errors due to inaccuracy. However, based on the analysis on the student answer sheets, the researchers found the types of student errors for not writing the formula, errors for not writing the process, and errors for not answering the questions. Based on this, it was identified that there were nine types of errors made by students.
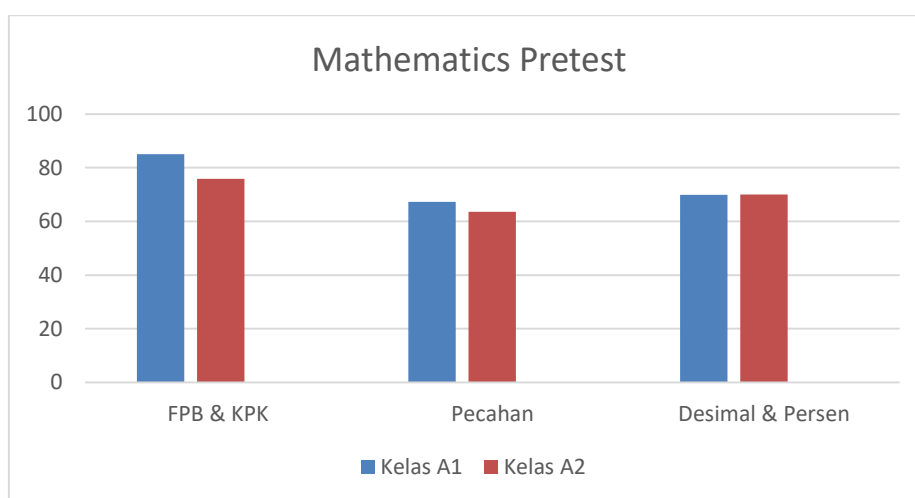

Figure 2. Diagram of Mathematics Pretest Results in Class A1 and A2

In the previous point, it has been known that the average pretest A1 in integers is 87.77, the average score for the FPB KPK is 87.22, the average value for fractions is 66.11, and the average value for decimal and percent is 67.78, while for the average value The average A2 class is 75.88 in integers, the average score for the KPK FPB is 74.11, the average for fractional values is 62.35, and the average value for decimals and percents is 67.05.
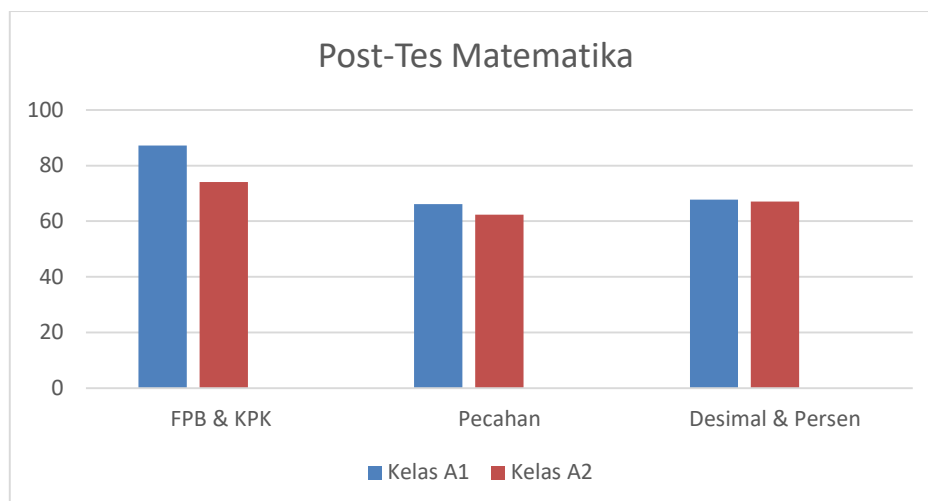
Figure 3. Diagram of Mathematics Posttest Results in Class A1 and A2

For the posttest A1 average value of 87.22, the average score for the FPB KPK is 85, the average for fractional values is 67.22, and the average value for decimals and percent is 69.94, while the posttest average value of A2 is 69.94. integer 79.41, the average score for the FPB KPK is 75.88, the average for fractional values is 63.52, and the average value for decimal and percent is 70. Judging from the score, the total value and the average value of the pretest and posttest can be concluded that students A1 and A2 have difficulty learning the material on a rational real number system, namely fractions.

Identifying Factors That Cause Learning Difficulties

The factors that cause difficulties in learning mathematics in the number system material for class A1 and A2 students were obtained through analysis of diagnostic test results and interviews with students and lecturers. Based on the analysis of student answers, many students did not understand the meaning of the questions. Many students have difficulty understanding concepts in working on the pretest and posttest questions. Difficulty understanding formulas and symbols. Many students have difficulty understanding and memorizing fraction formulas. Some students are still confused when they get multiple-choice HOTS questions but about stories in the real world. Students are still confused whether the problem must be done with addition, subtraction, division, or multiplication operations.

Many students experience the wrong process in working on pretest and posttest questions. The wrong process starts from students who do not understand the meaning of the question and do not understand the concept. This can be seen in the examples of student answers. Some students still do not understand the concept of fraction itself. From the results obtained, students doubt the answers they get because they still feel confused about the concept of fractions. It is also influenced by the inaccuracy of the students who did the pretest and posttest. These inaccuracies include not being careful in reading questions, not being careful in writing formulas, not being careful in writing processes and calculations.

Interviews with students and lecturers were conducted to support the analysis of the results of the pretest and posttest that had been carried out. Based on the results of interviews with lecturers and students, several factors were found that caused difficulties in learning mathematics in the number system material, including fractions. These factors include factors that cause difficulties in working on math problems on the number system material, namely the rational number system (fractions). In the fraction material, students admitted that sometimes it was difficult to understand the meaning of story problems, missed important information in the questions, and was confused about how to write mathematical sentences in answers. Errors in calculations are often done by students because they are confused with the problem solving process, many students find it difficult.

The inaccuracy experienced by students on average is because students are in a hurry to work on questions and tend to want to finish quickly, so students miss important information contained in the questions. The inaccuracy that is often done by students is also justified by the lecturer who states that students usually understand concepts and formulas, but are often less thorough so that they are wrong in solving problems. Based on the results of these interviews, it can be concluded that the causes of students' difficulties in working on test questions: students have difficulty understanding the meaning of the questions; lack of understanding of the concepts of distance, time, and speed; difficulty counting; and inaccuracy.

Other factors that cause difficulties in learning mathematics that come from the internal side of students are based on interviews with mathematics lecturers in classes A1 and A2 who said that the intellectual abilities of students in class A2 were on average, but some were quite low. At least there are some students according to the mathematics lecturer 2 who are considered to have learning difficulties and have below average intellectual abilities. This was mentioned by the lecturer in the interview.

Overall, each student has a different learning attitude. However, the learning attitude of students with learning disabilities is indeed less disciplined. The statement was mentioned by the lecturer when the researcher conducted the interview. In class A1 only one student was late to enter the class and all students were in uniform and wearing loafers, while for class A2 all male students were often late and not in uniform and there were even some students who still wore sports shoes. Students who lack discipline in studying and even often skip class. The student's lack of learning attitude is also supported by the results of interviews with students who have learning difficulties. Other than that,

In classroom learning, the lecturer mentioned that students can only concentrate during the morning hours, approximately 3 hours of the initial lesson. As for the students, many do not realize how long they can concentrate, some say 1 hour, some say 30 minutes, some say that it is difficult for them to concentrate because they get bored quickly in studying. Students are difficult to memorize, so to memorize formulas or subject matter must be repeated so that they are memorized. Some students admitted that it was very difficult for him to memorize formulas, other students admitted that he liked to memorize the most.

However, not only that, the lecturer's unclear explanation was acknowledged by some students with learning difficulties when interviewed. Some students prefer other friends, parents to explain material that has not been understood. In the interview, the lecturer mentioned that sometimes the material presented was not necessarily understood by all students, but as a lecturer, of course, he had tried his best to explain the material as well as possible so that all understood. However, due to limited time, not all students can be checked one by one. Moreover, not all students dared to admit that they did not understand the material presented. As for the classroom environment in Mathematics 2, it is very good, but the lecturers and students are disturbed by the glass walls in the mathematics laboratory.

DISCUSSION
Identifying Cases of Difficulty Learning Mathematics
Localizing the difficulty

To localize the location of students' difficulties, the researchers used a diagnostic test in the form of multiple choice HOTS questions in Mathematics 2 course on the number system material, namely integers, prime numbers & composite numbers (FPB and KPK), the real number system, namely fractions, decimals and percents. each has 5 questions, so there are 20 number system questions for the pretest. For posttest also with the same amount. The location of student difficulties is obtained based on the final value of each material, the total correct number of each number and the total value. At first, the researcher will identify the types of student errors in the form of errors in reading and understanding the meaning of the questions, errors in understanding concepts, errors in using formulas or using notations and symbols, process errors, counting errors, and errors due to inaccuracy. However, based on the analysis on the student answer sheets, the researchers found the types of student errors for not writing the formula, errors for not writing the process, and errors for not answering the questions. Based on this, it was identified that there were nine types of errors made by students. (Gulo, 2008: 59-60; Stern et al., 2017) who argues that the level of concept understanding can be seen from the level of ability. These abilities can be seen from the lowest to the highest. The lowest is translation, which is the ability to change a symbol into another form or symbol without changing the meaning of the symbol. Interpretation, which explains the meaning contained in a symbol both verbally and non-verbally. This ability includes comparing, contrasting, explaining in detail, or contrasting with other things. The last is extrapolation, which is looking at patterns or paying attention to the tendency of a situation, so that it can draw logical conclusions. Other than that, (Mwakapenda, 2004: 28) which reveals that understanding is the most important ability used to achieve a learning goal. Students who are able to understand concepts can solve problems in everyday life and associate new knowledge with previously acquired knowledge.

Judging from the score, the total value and the average value of the pretest and posttest, it can be concluded that students A1 and A2 have difficulty learning about the rational real number system material, namely fractions. This is in accordance with the opinion of the results of the study (Ciosek & Samborska, 2016: 10) concluding that fractions are a very difficult topic. The findings show that there are many student errors which indicate a lack of understanding of students' concepts on fractions. This is in line with the findings (Stigler, Givvin, & Thompson, 2010: 4) which show that fractions are very difficult for students to understand.

Identifying Factors That Cause Learning Difficulties

The factors that cause difficulties in learning mathematics in the number system material for class A1 and A2 students were obtained through analysis of test results and interviews with students and lecturers. An explanation of the factors that cause difficulties in learning mathematics in the fractional number system material can be seen in the following explanation. a. Causes of difficulties based on analysis of diagnostic test results

Based on the analysis of student answers, many students did not understand the meaning of the questions. Lecturers also help students understand how these fractional numbers are applied in daily problem solving activities (D'Augustine & Smith, 1992). For example, the answers of students A1 and A2 on questions no. 3 and 4, only a few students were able to complete the pretest and posttest questions. Many students still often ask about the essence and questions of the fractional questions obtained.

Difficulty understanding concepts

Many students have difficulty understanding concepts in working on the pretest and posttest questions. The low understanding of the concept of fractions based on the findings of (Siegler, Thompson, & Schneider, 2011) is caused by students learning by memorizing procedural rules, without understanding the concepts that correspond to fractions, so that many operational rules are not understood. This makes the assumption that fractions are mathematical representations. The findings of (Siegler et al., 2011) show that individual differences in understanding of fractions are closely related to mathematics achievement in general. Rose & Arline (2008: 3) said that students who can understand mathematical concepts if: (1) recognize labels, provide examples or not examples of concepts; (2) using diagrams, lines, pictures, and being able to manipulate and understand them; (3) integrating, distinguishing, and comparing concepts; (4) using and interpreting symbols; (5) interpreting the relationship of assumptions in mathematics. This is supported by the findings of (Torbeyns et al., 2014) that students' understanding of fractions is positively related to student mathematics achievement in general. In other words, if students have understood the concept of fractions, then mathematical concepts other than fractions can also be understood. (Geller et al., 2017) show that students with weak understanding tend to focus on concrete things, stronger students tend to use concepts to explain their answers while students with high understanding tend to use more general concepts. (5) interpreting the relationship of assumptions in mathematics. This is supported by the findings of Torbeyns et al., (2014: 5) that students' understanding of fractions is positively related to student mathematics achievement in general. In other words, if students have understood the concept of fractions, then mathematical concepts other than fractions can also be understood. Geller et al., (2017: 122) show that students with weak understanding tend to focus on concrete things, stronger students tend to use concepts to explain their answers while students with high understanding tend to use more general concepts.

Difficulty understanding formulas and symbols

Many students have difficulty understanding and memorizing fraction formulas. Some students are still confused when they get multiple-choice HOTS questions but about stories in the real world. Students are still confused whether the problem must be done with addition, subtraction, division, or multiplication operations. Students find it difficult to distinguish fractional arithmetic operations. Adding fractions must pay attention that the denominators are the same (Musser, Burger, & Peterson, 2011). In subtracting fractions, if the denominators are the same, the leading numerator is subtracted from the back numerator, while the denominator remains (Musser, Burger, & Peterson, 2011). Meanwhile, multiplying fractions is done by multiplying the denominator with the denominator, and the numerator with the numerator (Greenberg, 1996).

Difficulty processing/calculation skills

Many students experience the wrong process in working on the pretest and posttest questions. The wrong process starts from students who do not understand the meaning of the question and do not understand the concept. This can be seen in the examples of student answers. Novak & Renzo (2013) argue that a fraction is a quotient or a representation of parts of a number. This reinforces the concept of fractions as division. So in this case the fraction is a process of arithmetic operations.

Carelessness or carelessness

The inaccuracy made by students was carried out by all students who did the pretest and posttest. These inaccuracies include not being careful in reading questions, not being careful in writing formulas, not being careful in writing processes and calculations. An example of a student's answer showing inaccuracy can be seen in the answer to number 4 posttest. Concept understanding is not only limited to the ability to provide examples, as well as understanding and formulas, but rather the existence of interrelationships between concepts (Nitko & Brookhart, 2011; Yoong, 1987).

The factors that cause difficulties in learning mathematics that come from the internal side of students are as follows

Students' intellectual ability

Based on interviews with mathematics lecturers in classes A1 and A2, they said that the intellectual abilities of students in class A2 were on average, but some were quite low. Gulo (2008) who argues that the level of concept understanding can be seen from the level of ability. These abilities can be seen from the lowest to the highest. The lowest is translation, which is the ability to change a symbol into another form or symbol without changing the meaning of the symbol. Interpretation, which explains the meaning contained in a symbol both verbally and nonverbally. This ability includes comparing, contrasting, explaining in detail, or contrasting with other things. The last is extrapolation, which is seeing the pattern or paying attention to the tendency of a situation. so that it can draw logical conclusions. At least there are some students according to the mathematics 2 lecturer who are considered to have learning difficulties and have below average intellectual abilities. This was mentioned by the lecturer in the interview.

Student learning attitude

Overall, each student has a different learning attitude. Neill (2005) is a combination of self-esteem and self-efficacy. So, self-efficacy is part of the attitude that arises in the consciousness of each person. However, the learning attitude of students with learning difficulties is indeed less disciplined. The statement was mentioned by the lecturer when the researcher conducted the interview. In class A1 only one student was late to enter the class and all students were in uniform and wearing loafers, while for class A2 all male students were often late and not in uniform and there were even some students who still wore sports shoes. Students who lack discipline in studying and even often skip class.

Motivation to learn

Based on interviews with class lecturers, it was shown that the learning motivation of students in grades A2 and A1 was low and some were moderate or average. Some students admitted that they did not feel sad even though their grades were bad, and did not try to improve in order to get better grades. This shows that these students do not have a strong learning motivation to improve their achievements. Williams & Williams (2010) concluded that motivation in self-efficacy significantly influences student achievement. There is a two-way interaction between self-efficacy and student academic achievement. There is a reciprocal relationship between the two, where they influence each other. As found by (Kang et al., 2015) explains that there is a reciprocal relationship between self-efficacy and student academic achievement. The findings show that self-efficacy has a greater influence on students' academic achievement than vice versa. (d) Concentration of learning

In classroom learning, the lecturer mentioned that students can only concentrate during the morning hours, approximately 3 hours of the initial lesson. This is in accordance with the opinion of (Souviney, 1994) who defines mathematical concepts as basic patterns that connect a collection of objects or actions with each other. Vulperhorst et al., (2018) also said that interest in learning mathematics can be built from a situation of personal interest, which is then referred to as focus, attention, and influence. Rautiainen et al., (2018) added that students who pay attention to lessons and are actively involved in lessons indicate that these students have a high interest in learning, especially in learning mathematics. So in learning must focus. As for the students, many do not realize how long they can concentrate, some say 1 hour, some say 30 minutes, some say that it is difficult for them to concentrate because they get bored quickly in studying.

Ability to remember

The class lecturer mentioned that some students had difficulty memorizing, so to memorize formulas or subject matter they had to be repeated to memorize them. (Gagne, 1988; Vygotsky, 1978) reveals that students as learning subjects will create their own cognitive structures, but it is very difficult to know the processes that occur in the memory of a learner. Experience will be gained by interacting with the outside world, both through training and learning (Sulaiman et al., 2011). Some students admitted that it was very difficult for him to memorize formulas, some other students admitted that he liked to memorize the most.

The factors that cause difficulties in learning mathematics that come from the external side of students are as follows

Clarity of the lecturer in explaining the material

The lecturer's unclear explanation was acknowledged by some students with learning difficulties when interviewed. This is in accordance with the opinion of (D'Augustine & Smith, 1992) that mathematics learning can be improved if changes are made not only in the curriculum, but also in the way mathematics is taught to students. Some students prefer other friends, parents to explain material that has not been understood. In the interview, the lecturer mentioned that sometimes the material presented was not necessarily understood by all students, but as a lecturer, of course, he had tried his best to explain the material as well as possible so that all understood. However, due to limited time, not all students can be checked one by one.

Lecture environment

The classroom environment in Mathematics 2 course is very good, but because the classroom uses a mathematics laboratory with glass walls, lecturers and students are disturbed by the glass walls in the mathematics laboratory, because if there are people who pass by, they can interfere with learning concentration. This is in accordance with the opinion of (Souviney, 1994) who defines mathematical concepts as basic patterns that connect a collection of objects or actions with each other. So in learning must focus. This interest will settle and develop in him to get support from his environment in the form of experience. Swarat, Ortony, & Revelle (2012) in his research said that to generate interest can be done by making changes to aspects that can be manipulated in the learning environment.

CONCLUSIONS

Based on the results of the research and discussion above, it can be concluded that the difficulties experienced by students in mathematics lessons on the number system material, namely there are integers, prime numbers & composite numbers (FPB and KPK), the real number system, namely fractions, decimals and percent are very high. The results obtained that the average pretest and posttest scores of A1 and A2 students in fractional materials were very low compared to other materials, namely that the average pretest A1 on integers was 87.77, the average score for the FPB KPK was 87.22, the average for fractional values was 66.11 , and the average value for decimal and percent is 67.78, while the average value for class A2 is 75.88 in integers, the average score on the KPK FPB is 74.11, the average for fractional values is 62.35, and the average value for decimal and percent is 67.05. For the posttest A1 average score of 87.22, the average score for the FPB KPK is 85, the average for fractional values is 67.22, and the average value for decimals and percents is 69.94, while the posttest average value of A2 is 69.94. integers 79.41, the average score on the KPK FPB is 75.88, the average for fractional values is 63.52, and the average value for decimals and percents is 70. Factors that cause difficulties in learning mathematics in fractions for A1 and A2 PGSD UPY students includes factors that cause errors in doing test questions, internal factors and external factors. Factors that cause students to make mistakes in doing questions are students having difficulty understanding the meaning of the questions; lack of understanding of the concepts of distance, time, and speed; difficulty understanding and memorizing formulas; difficulty counting; and carelessness or carelessness. Internal factors that affect students' mathematics learning difficulties are students' low intellectual abilities, students' learning attitudes that tend to be indifferent and less disciplined, low learning motivation, learning concentration does not last long, low ability to remember some students, and impaired sensory abilities. External factors that affect student learning difficulties are lecturers in providing unclear understanding, less supportive curriculum, less supportive family environment, and a mirrored lecture environment that interferes with concentration.

Students should increase their motivation to study hard and pay attention to the learning delivered by the lecturer, in order to better understand the mathematics learning material. Students should also form study groups in their living environment so that they can discuss and study together to solve difficulties in understanding mathematical material. To overcome the difficulty factor that comes from within students, lecturers can provide guidance and counseling to students who have a high emotional level, in order to direct students to control their emotions. Continuous training of questions can be done to help students who have intelligence below other friends to be able to follow the lesson. To increase student attention and interest in learning, it can be done by creating pleasant learning conditions and providing encouragement so that students pay more attention to lessons and give rewards when students get good achievements. To increase student motivation, lecturers and parents can provide reinforcement in the form of praise and advice. The difficulty factor that comes from the teaching system and also the method needs to be overcome by the lecturer. Lecturers need to repeat learning on subjects that are still not mastered by all students. Lecturers also need to use a variety of learning methods so that students learn to run effectively. Factors come from outside the students themselves, is also a factor that affects learning difficulties. Infrastructural facilities in lectures also need to be met so that the learning process runs well.

REFERENCES

Ardani, R. A., Setyaningrum, W., & Salsabila, N. H. (2018). The Perceptions of Students and Teachers About The Use of Edutainment Instructional Media in Mathematics Learning. *), Volume 160 University*, *160*(July). https://doi.org/10.2991/incomed-17.2018.49

Barber, M., & Mourshed, M. (2007). *How the world's best performing schools come out on top*. McKinsey & Company.

Bell, F. H. (1981). *Teaching and learning mathematics (in secondary school)*. Dubuque: Wm. C. Brown Company Publisher.

Blitzer, R. F. (2019). *Thinking Mathematically* (7th ed.). USA: Pearson.

Booth, J. L. (2014). *Why Can ' t Students Get the Concept of Math ?* (June), 31–35.

Brousseau, G. (2002). *Theory of didactical situations in mathematics*. Dordrecht: Kluwer Academic Publishers.

Brown, S. A. (2008). *Exploring Epistemological Obstacles to the Development of Mathematics Induction Stacy A. Brown Pitzer College*. 1–19.

Ciltas, A., & Tatar, E. (2011). Diagnosing learning difficulties related to the equation and inequality that contain terms with absolute value. *International Online Journal of Educational Sciences*, *3*(2), 461–473.

Ciosek, M., & Samborska, M. (2016). The Journal of Mathematical Behavior A false belief about fractions – What is its source ? *Journal of Mathematical Behavior*, *42*, 20–32. https://doi.org/10.1016/j.jmathb.2016.02.001

Cooney, T. J., Davis, E. J., & Henderson, K. B. (1975). *Dynamics of teaching secondary school mathematics*. New York: Houghton Miffin.

Cortina, J. L., Visnovska, J., & Zuniga, C. (2014). Equipartition as a didactical obstacle in fraction instruction. *Acta Didactica Universitatis Comenianae: Mathematics*, *14*, 1–18.

D'Augustine, C., & Smith, C. W. (1992). *Teaching Elementary School Mathematics*. New York: Harper Collins Publisher.

Fosnot. (1996). *Enquiring teachers, enquiring learners: A constructivist approach for teaching*. New York: Columbia University.

Gagne, R. M. (1988). Mastery Learning and Instructional Design. *Performance Improvement Quarterly*. https://doi.org/https://doi.org/10.1111/j.1937-8327.1988.tb00003.x

Gattuso, L., & Ottaviani, M. G. (2015). *Complementing Mathematical Thinking and Statistical Thinking in School Mathematics*. (June 2011). https://doi.org/10.1007/978-94-007-1131-0

Geller, E. H., Son, J. Y., & Stigler, J. W. (2017). Conceptual explanations and understanding fraction comparisons. *Learning and Instruction*, *52*, 122–129. https://doi.org/10.1016/j.learninstruc.2017.05.006

Greenberg, D. (1996). *Funny & Fabulous Fraction Stories: 30 Reproducible Math Tales and Problems to Reinforce Importanr Fraction Skills.* New York: Schoolastic Professional Books.

Gulo, W. (2008). *Strategi belajar mengajar*. Jakarta: Grafindo.

Jordan, N. C., & Levine, S. C. (2009). Socioeconomic variation, number competence, and mathematics learning difficulties in young children. *Developmental Disabilities Research Reviews*, *15*(1), 60–68. https://doi.org/10.1002/ddrr.46

Kang, J. S., Choi, I. W., Han, M. H., Lee, D. S., Kim, G. Y., Hwang, H. J., … Choi, Y. H. (2015). The cytoprotective effect of Petalonia binghamiae methanol extract against oxidative stress in C2C12 myoblasts: Mediation by upregulation of heme oxygenase-1 and nuclear factor-erythroid 2 related factor 2. *Marine Drugs*, *13*(5), 2666–2679. https://doi.org/10.3390/md13052666

Kereh, C. T., Sabadar, J., & Tjiang, P. C. (2013). Identifikasi kesulitan belajar mahasiswa dalam konten matematika pada materi pendahuluan fisika inti. *Proceedings of Seminar Nasional Sains Dan Pendidikan Sains VIII, Fakultas Sains Dan Matematika*, 10–17.

Khiat, H. (2010). A grounded theory approach: Conceptions of understanding in engineering mathematics learning. *Qualitative Report*, *15*(6), 1459–1488.

Lenhard, W. & Lenhard, A. (2013). *Learning Difficulties. L. Meyer (Ed.), Oxford Bibliographies in Education*. New York: Oxford University Press.

Lerner, L. K., & Lerner, W. B. (2003). *World of Microbiology & Immunology*. United States of America: The Gale Group, Inc.

Madanhire, I., & Mbohwa, C. (2016). Application of Statistical Process Control (SPC) in Manufacturing Industry in a Developing Country. *Procedia CIRP*, *40*(May), 580–583. https://doi.org/10.1016/j.procir.2016.01.137

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A methods Sourcebook*. Retrieved from http://library1.nida.ac.th/termpaper6/sd/2554/19755.pdf

Mullis, I. V. S., Martin, M. O., Foy, P., & Arora, A. (2012). Timss 2011 International Results in Mathematics. In *TIMSS & PIRLS International Study Center* (Vol. 2012). Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3295935&tool=pmcentrez&rendertype=abstract

Musser, G. L., Burger, W. F., & Peterson, B. E. (2011). *Mathematics For Elementary Teachers: A Contempory Approach*. John Wiley & Son, Inc.

Mwakapenda, W. (2004). Understanding student understanding in mathematics. *Pythagoras*, 28–35. Retrieved from https://www.researchgate.net/publication/268008138_Understanding_student_understanding_in_mathematics

NCTM. (2015). Strategic Use of Technology in Teaching and Learning Mathematics. *Livestock Research for Rural Development*, *24*(4), 6.

Nitko, A. J. & Brookhart, S. M. (2011). *Educational Assessment of Students*. Bostom: Perason Education.

Novak, D., & Renzo, A. D. (2013). *Twelve mathematical concepts: a study guide for the ithaca college math placement exam*. New York: Ithaca College.

OECD. (2019). *PISA 2018: Assessment and Analytical Framework*. 11–20.

Rahman, S. A. (2010). The development of a framework to assess mathematical thinking of stage one pupils. *Procedia - Social and Behavioral Sciences*, *8*, 307–311. https://doi.org/10.1016/j.sbspro.2010.12.042

Rautiainen, M., Mäensivu, M., & Nikkola, T. (2018). Becoming interested during teacher education. *European Journal of Teacher Education*, *41*(4), 418–432. https://doi.org/https://doi.org/10.1080/02619768.2018.1462329

Rose, C. M., & Arline, C. B. (2008). *Uncovering Student Thinking in Mathematics, Grades 6-12: 30 Formative Assessment Probes for the Secondary Classroom*. United Kingdom: SAGE Publications.

Siegler, R. S., Thompson, C. A., & Schneider, M. (2011). An integrated theory of whole number and fractions development. *Cognitive Psychology*, *62*(4), 273–296. https://doi.org/10.1016/j.cogpsych.2011.03.001

Skemp, R. R. (1971). *The Psychology of Learning Mathematics*. Baltimore: Richard Clay (The Causer Press) Ltd.

Smith, Claire Wyatt., Elkins, John., & Gunn, S. (2011). *Multiple Perspectives on Difficulties in Learning Literacy and Numeracy*.

Souviney, R. J. (1994). *Learning to Teach Mathematics* (2nd ed.). San Diego: Macmillan Publishing Company.

Stern, J., Lauriault, N., & Ferraro, K. (2017). *Tools for Teaching Conceptual Understanding, Elementary: Harnessing Natural Curiosity for Learning That Transfers*. California: Corwin.

Stigler, J., Givvin, K., & Thompson, B. (2010). What Community College Developmental Mathematics Students Understand about Mathematics. *MathAMATYC Educator*, *1*(3), 4–16.

Sugihartono. (2012). *Psikologi Pendidikan*. Yogyakarta: UNY Press.

Sulaiman, W. I. W., Mahbob, M. H., & Azlan, A. A. (2011). Learning outside the classroom: Effects on student concentration and interest. *Procedia - Social and Behavioral Sciences*. https://doi.org/https://doi.org/10.1016/j.sbspro.2011.05.003

Suneetha, E., Rao, R. S., & Rao, D. B. (2011). *Methods of learning mathematics*. London: SAGE Publications.

Swarat, S., Ortony, A., & Revelle, W. (2012). Activity matters: Understanding student interest in school science. *Journal of Research in Science Teaching*. https://doi.org/https://doi.org/10.1002/tea.21010

Tambychik, T., & Meerah, T. S. M. (2010). Students' difficulties in mathematics problem-solving: What do they say? *Procedia - Social and Behavioral Sciences*, *8*, 142–151. https://doi.org/10.1016/j.sbspro.2010.12.020

Torbeyns, J., Schneider, M., Xin, Z., & Siegler, R. S. (2014). Bridging the gap : Fraction understanding is central to mathematics achievement in students from three different continents. *Learning and Instruction*. https://doi.org/10.1016/j.learninstruc.2014.03.002

Vulperhorst, J. P., Wessels, K. R., Bakker, A., & Akkerman, S. F. (2018). How do STEM-interested students pursue multiple interests in their higher educational choice? *International Journal of Science Education*, *40*(9), 828–846. https://doi.org/https://doi.org/10.1080/09500693.2018.1452306

Vygotsky, L. S. (1978). *09 y 13. Internalización de las funciones psicológicas superiores*. In El Dessarrollo de los procesos psicológicos superiores.

Westwood, P. (2008). *What teachers need to know about learning difficulties*. Australia: ACER Press.

Widyastuti, N. S., & Pujiastuti, P. (2014). Pengaruh Pendidikan Matematika Realistik Indonesia (PMRI) terhadap Pemahaman Konsep dan Berpikir Logis Siswa. *Jurnal Prima Edukasia*, *2*(2), 183–193.

Williams, T., & Williams, K. (2010). *Self-Efficacy and Performance in Mathematics : Reciprocal Determinism in 33 Nations*. *102*(2), 453–466. https://doi.org/10.1037/a0017271

Yilmaz, Ç., Altun, S. A., & Olkun, S. (2010). Factors affecting students' attidude towards Math: ABC theory and its reflection on practice. *Procedia - Social and Behavioral Sciences*, *2*(2), 4502–4506. https://doi.org/10.1016/j.sbspro.2010.03.720

Yoong, W. K. (1987). Aspects of Mathematical Understanding. *Singapore Journal of Education*, *8*(2), 45–55. https://doi.org/https://doi.org/10.1080/02188798708547623