



PROCEEDINGS the 2017 INTERNATIONAL CONFERENCE ON RESEARCH IN EDUCATION

Proceedings

INTERNATIONAL CONFERENCE ON RESEARCH IN EDUCATION

ICRE 2017

"Innovative Pedagogy in a Changing World"

 www.usd.ac.id/icre

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FACULTY OF TEACHERS TRAINING AND EDUCATION
SANATA DHARMA UNIVERSITY
YOGYAKARTA - INDONESIA



OCTOBER 13th - 14th, 2017

ISBN 978-602-5607-27-1



9 786025 607271



SANATA DHARMA UNIVERSITY PRESS
Jl. Affandi, (Gejayan) Mrican, Yogyakarta 55281
Phone: (0274)513301; Ext.51513
Web: sdupress.usd.ac.id; E-mail: publisher@usd.ac.id



Proceedings

THE 2017 INTERNATIONAL CONFERENCE ON RESEARCH IN EDUCATION

Education
Sanata Dharma University
13th-14th October 2017

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Printed Book:

ISBN: 978-602-5607-27-1

EAN: 9-786025-607271

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First Edition, February 2018

iv; 411 pages; 15,5 x 23 cm.

Illustration & layout:

FX Made Setianto

PUBLISHER:



SANATA DHARMA UNIVERSITY PRESS
Lantai 1 Gedung Perpustakaan USD
Jl. Affandi (Gejayan) Mrican,
Yogyakarta 55281
Telp. (0274) 513301, 515253;
Ext.1527/1513; Fax (0274) 562383
e-mail: publisher@usd.ac.id

SUPPORTED BY:

FACULTY OF TEACHERS TRAINING AND
EDUCATION
SANATA DHARMA UNIVERSITY
Jl. Affandi, Mrican, Caturtunggal, Depok, Sleman,
Yogyakarta 55281



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PREFACE

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The International Conference on Research in Education (ICRE), with the theme of “Innovative Pedagogy in a Changing World“, aims at providing a global platform to discuss, discover creative solution, as well as share knowledge, experience and ideas from the results of the research. This Conference Proceedings contains the written versions of most of the contributions presented during the International Conference on Research in Education (ICRE). This conference took place at Sanata Dharma University^{3rd} campus, Paingan, Maguwoharjo, Sleman, D. I. Yogyakarta, Indonesia from 13 – 14 October 2017

This Conference provided a setting for discussing recent developments in a wide variety of topics on innovative pedagogy and provides opportunity for the practitioners, researchers, and policymakers to share topics related to the latest research, best practices in improving the quality of education in the future, and wider professional networking in national or international level.

We would like to thank all participants for their contributions to the Conference program and for their contributions to these Proceedings. Many thanks go as well to All Keynote Speakers, Steering Committee and Organizing Committee for the success of this conference and to all people who participated for the process of proofread of the contributed papers and in preparing this proceedings.

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PEDAGOGY, CULTURE AND CHARACTER BUILDING

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Abstract

Indonesia is a big country that consists of 34 provinces, has many different cultures, languages and different way of thinking. These conditions cause big problems in preparing teachers for schools in different provinces. Some of these cultures are not synchronous to the characters needed for learning. The questions will be "how should the pedagogy be done (practiced) by teachers in the teaching and learning processes so that the qualities of learning and achievement of the students can be made better and the same level of knowledge understanding?". To be able to teach students of different cultures, teachers should:

1. understand well the theory of pedagogy and its practice in the teaching and learning process,
2. have good knowledge of the subject he / she teaches,
3. understand well cognitive psychology,
4. know well the characteristics of the students,
5. open to discuss and can respect the faith of students.

The core of pedagogy is to educate students to become well-rounded human, intellectually competent, respect to others of the same or different faith, open to discuss about the different culture and faith, can manage his emotion, and strive to have a good adversity quotient, can love each other although different in faith and character. This paper will describe some of my experiences to teach students mathematics in some provinces in Indonesia by practising the theory of pedagogy described above.

Keywords: pedagogy, culture, character

Introduction

The progress of sciences that has been achieved by humans up to now make the task of educators, especially lecturers and teachers increasingly heavy and challenging. Various emerging theories, such as the theory of multiple intelligences of Howard Gardner (2003), the theory of emotional intelligence of Goleman (1996), the theory of intelligence that transform the barriers into opportunities (adversity quotient) of Stoltz (2000), and the theory of neuro science need to be understood or mastered by lecturers and teachers, and practiced in the the teaching of subject matter they teach in the classroom to students. In particular, lecturers and teachers of

mathematics, it is necessary to have a good mentality and endurance test, because many students who are less (not) like mathematics owing to their dominant intelligence is not mathematical/logical intelligence.

From the perspective of pedagogy, lecturers and teachers need to serve students in such a way as to respect their dominant intelligence, and strive to improve their other intelligence in order to succeed in constructing and mastering the knowledge of the subject nurtured by the lecturer or teacher. Lecturers and teachers of mathematics for example, do not have to force students who have dominant intelligence rather than mathematical/logical to achieve the same achievement in the field of mathematics as students whose dominant intelligence is mathematical/logical intelligence. In addition, each student also has different emotional intelligence and adversity quotient. It makes the atmosphere of teaching and learning of a subject in different classes is different. They are challenges for lecturers and teachers so that their students can achieve learning objectives according to demands based on pedagogic theory they understand. There are many factors that influence the student's personality and ability to understand the knowledge he or she receives from the lecturer or teacher, or that constructed by him-/herself.

In addition to the aforementioned, any lecturer or teacher consciously or unconsciously has his or her own philosophy relating to the subject he or she raises or relates to the learning theory of the subject. All of the factors mentioned above affect the learning process designed and executed by the lecturer or teacher in the class which also affects the attitudes and character of students.

Based on past experiences in observing the learning process of teachers in the classroom or in the training of teachers in various regions, many teachers are less aware of the need to build the character of students, for example the teacher lets them fuss in class or talk to other students

when he explains a teaching material, or scolding students who do not pay attention to what he teaches. If the development of this character is not taken into consideration by the teacher or not developed by students in their mind starting from elementary school level. then they will bring their bad character to the next level even up to a higher level of school. For example at Sanata Dharma university itself, many students are noisy outside the classroom, with the effect disrupting the concentration of lecturers who lecture and students who are studying inside. In other words, many of the pedagogical aspects did not work well, both at the school and at the college level.

This raises the question:

1. Is pedagogic theory not being considered in the school where students studied before?
2. Are lecturers or leaders at Sanata Dharma themselves lacking in pedagogical theory to allow Such behavior to occur without any steps to improve the situation?
3. Does our cultures tolerate such behavior?
4. Are such characters already considered as part of our culture and have nothing to do with the ability to raise or develop knowledge?

Pedagogy

What is Pedagogy? Some definitions are:

1. Pedagogy is the art or science of teaching.
2. Pedagogy is the discipline that deals with the theory and practice of teaching. It means that theory of pedagogy concerns with teaching strategies, teacher actions in learning, teacher's judgment and decisions in learning execution, understanding the characteristics of students and their needs, students' intelligences especially their dominant intelligence , emotional

intelligence, adversity quotient, background of each student, teacher and student communication, teacher's assessment of student's learning process and outcomes, and student's attitude and character.

A. Multiple Intelligences

According to Gardner (2003), each person has 7 intelligences (*intelligence is not talent or natural ability which is derivative and permanent but can be developed and enhanced*), but then he finds two other forms of intelligence (see Suparno, 2004). So, according to Gardner there are 9 types of intelligence.

- a. Verbal / Linguistic Intelligence
- b. Spatial Intelligence
- c. Musical / Rhythmic Intelligence
- d. Mathematical / Logical Intelligence
- e. Kinesthetic / Physical Intelligence
- f. Interpersonal Intelligence
- g. Intrapersonal Intelligence
- h. Natural Intelligence
- i. Existential Intelligence.

Among these only one is the dominant for each human. That means, that all students in a classroom do not have the same dominant intelligence.

B. Emotional Intelligence

Emotional Intelligence (EI) is the ability and skill of a person perceiving, accessing and managing his own emotions, the emotions of others and the emotions of a human group.

According to Mayer and Salovey, emotional intelligence includes:

- a. ability to perceive precisely the emotions of him-or herself,
- b. the ability to use emotions to facilitate thinking,
- c. ability to understand the meaning of emotions,
- d. ability to manage emotions.

Salovey and Mayer (2000) (in Emotions and Emotional Intelligence: <http://www.socialresearchmethods.net/galery/young/emotion.htm>), mentions that EI summarizes Gardner's inter- and intrapersonal intelligence and includes capabilities that can be categorized into 4 domains:

1. Self-awareness:

Observe yourself and recognize that feeling as it arises.

2. Managing emotions:

Handling (feeling) and realizing what's behind the feeling; find ways to handle fear and anxiety, anger and sadness.

3. Motivate yourself:

Channel emotions to serve a purpose; controlling your own emotions; delaying satisfaction and withholding impulses

4. Empathy:

Sensitivity to other people's feelings and take their perspective; appreciate the difference how people feel something.

5. Having a relationship

Maintain (manage) emotions while communicating with others; developing social competence and social skills.

According to Daniel Goleman (1996), emotional intelligence is:

- a. the ability to identify and name a person's own emotional state or person and understand the linkage between emotions, thoughts, and activities (actions),
- b. the ability to understand and cultivate a person's emotional state, controlling emotions or changing/shifting unwanted emotions to a better or acceptable state,
- c. ability to enter the emotional state in accordance with the drive to achieve a goal or drive to succeed, readiness and sensitivity to the feelings of others and influence it,
- d. the ability to enter and maintain a satisfactory relationship with others.

Developing Emotional Intelligence is done by:

- a. Controlling your own emotions and awareness of your own emotions.
 1. knowing and realizing your own emotions.
 2. understand and predict a person's emotional reaction to a situations.
- b. Empathy: Requires the ability to understand how a person perceives a situation, including how others perceive an event or event. Empathy requires knowledge of others' perspectives and sees something from one's value system and beliefs.

Empathy is the ability to be fully engaged in the viewpoint of others.

Characteristics of empathy:

1. Not investigating
2. Not supporting
3. Not advising
4. Not interpreting
5. Not blaming

- c. Social Skills: Social skills are the ability to build relationships and social ties with others based on human equality.
- d. Personal Influence: Personal influence is the ability to inspire others through examples, words or deeds. This is the ability to lead others through social skills.

Personal influences are also the ability to read the situation and exercise influence and leadership in the desired direction, including dealing with important issues or debilitating relationships, goals, missions and visions, showing motivation for one's vision, mission, core values and beliefs.
- e. Vision Mastery: The mastery of this vision requires that the individual has the ability to set the direction and vision that is guided by a strong personal philosophy, and the ability to communicate and manifest with convincing direction and vision. Mastery of vision allows us to know ourselves and what we want to do for our lives.

Example: Introduction of emotions and empathic responses:

1. At one time a husband asked his wife, "Is this child indeed our child?"
 - Feelings to be expressed by the husband: Do not believe/suspicious.
 - Empathic response: Does it mean, you hesitate on my loyalty?
2. One day, Risa travel with her brother by car in a high speed. Risa shouted,
 - "Should we go so hurry?"
 - Feelings to be expressed by Risa: Fear.
 - Empathic response: "Are you afraid because of my speed. Ok dear, I reduce it".
3. Siti was late for a fourth time in math lesson, with the reason her bicycle was broken. Her teacher reprimanded him by saying rather curtly, "Your excuses

are always the same!".

- Feeling that the teachers expressed: Bored

- Empathic response: Sorry Mom, that you are bored ya, to hear my reason!

C. Adversity Quotient (Stoltz, 2000)

Adversity Quotient (AQ) is Intelligence that transforms obstacles into opportunities.

- AQ tells a person about his or her ability to cope with adversity and overcome them.

- AQ can predict who is able to overcome difficulties and who will be destroyed.

- AQ predicts who will exceed expectations of their performance and potential and who will excel.

- AQ predicts who will surrender and who will survive. According to Stoltz (Stoltz, 2000, pp. 8-9), humans can be grouped into:

a. Quitters

Humans belonging to the Quitters are those who easily give up when faced with an obstacle.

b. Campers

Humans belonging to Campers are those who are satisfied if they are successful in solving a problem.

c. Climbers.

Humans belonging to Climbers are those who are resilient, not satisfied with the results they get but are always eager and eager to face challenges and solve big and difficult problems.

-According to Stoltz, this adversity quotient can be developed so it is not something fixed and inherited. Compared to intellectual intelligence and emotional intelligence, this intelligence provides more opportunities for success in life. According to Stoltz the core of success is persistence.

Culture

According to Bruner (1996), "culture shapes mind ... it provides us with the tool kit by which we construct not only our world but our very conceptions of our selfs and our powers". It means that we cannot understand mental activity unless we take into account the cultural setting and its resources, the very things that give mind its save account of the cultural setting and its resources, the very things that give mind its shave and scope).

Indonesia consist of 34 provinces, have about 483 ethniss groups and 719 ethniss languages (Kompas, 16 Juli 2017)

For example, Batak ethniss consist of 6 subcultures:

1. Batak Toba,
2. Batak Mandailing,
3. Batak Angkola,
4. Batak Simalungun,
5. Batak Karo,
6. Batak Pakpak

I my self, is Batak Toba and can not speak Karo language. The language of Batak Toba is easy to use for learning arithmetic.

English	Number	Batak Karo
One	1	Sada

Two	2	Dua
Three	3	Tolu
Four	4	Opat
Five	5	Lima
Six	6	Onom
Seven	7	Pitu
Eight	8	Ualu
Nine	9	Sia
Ten	10	sampulu
Eleven	11	Sampulu sada (ten and one)
Twelve	12	Sampulu dua (ten and two)
...	...	...
One hundred twenty-three	123	Saratus dua pulu tolu
Etc		

Batak language is coherent with the writing of numeral in mathematics. But, for example, Javanese language and Indonesian language is not coherent. For example, in Javanese language, they say "eleven" to express 11 and in Indonesian language also "eleven". Javanese languages has three levels: Ngoko, Kromo Madya, Kromo Inggil.

In mathematics, 3×5 is $5 + 5 + 5$ (three times five), in Javanese language 3×5 is $3 + 3 + 3 + 3 + 3$ (tollu ping limo) and in Batak language; 3×5 is $5 + 5 + 5$ (tolu hali lima) the same as in mathematics. That means, teachers from different culture need to learn the culture and language

of the peoples where they work. I suggest, in primary school, teacher can use ethnics languages (for example in Batak land is Batak language, in Sunda is Sunda language, in Middle Java and East Java is Java language, in Sumba is Sumba language, and so on) to teach mathematics in the first up to third grade.

Character Development.

Nowadays, Indonesia is facing a big problem, where many of its/its educated people have bad characters: corruption, narcotics, crimes, lack of tolerances, and so on. The quality of teaching in the school and the quality of students' learning are also not yet good. The achievement of Indonesian students In TIMSS, and PISA were bad, they stand in the lower rank. For example in PISA 2015, Indonesian participants have average score 386 in mathematics (stand in rank 63 among 70 participant country), in reading have average score 397 (stand in rank 64 among 70 participant country) and in science have average 403 score ((stand in rank 62 among 70 participant country). In mathematics, Singapore got the highest score 564, in reading Korea got the highest score 535 and in science Singapore got the highest score 556. The question is how to improve this achievement by mathematics teaching and learning in school? How to enhance the capacity of teachers, especially primary school teachers, so that during the teaching and learning process they can develop the students' character? Can mathematics education take a role in improving the students' character, so that later on the moral hazard can be reduced to the minimum and the mathematics capability of children will be better?

The results show us that characters (often called behavioral or behavioral habits, such as mocking comrades, disorderly, fear of mathematics, not being sincere, etc.) can be changed in a positive direction through education by practicing pedagogical theories, such as Ignatian pedagogy. For 16 years, from 2000 to 2016, I conducted training for teachers (especially

elementary teachers) in various provinces in Indonesia concerning how to teach mathematics by PMRI approach (realistic mathematics education in Indonesia) and before or after training I asked the teachers to give me an opportunity to teach students in class. The learning and learning process is recorded by video camera (to obtain data). In the teaching process for teachers and students I used the theory of Ignatian pedagogy, the theory of Vater Driyarkara (Memanusiakan Manusia) and the theory of Ki Hadjar Dewantara (Tut Wuri Handayani). From these experiences I can draw the conclusion that the character of students can be improved and their knowledge in the field of mathematics can also be improved by implementing correctly pedagogic theory.

Conclusion

From various experiences of training teachers and teachings in the classroom in different places of ethnic groups, by practicing the theory of pedagogy and the theory of cognitive psychology can be obtained better results in constructing and understanding knowledge of mathematics or knowledge in general.

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REFLECTIONS ON STUDENT BEHAVIOR AND LEARNING IN HIGHER EDUCATION IN TURKEY, UNITED STATES, TANZANIA, AND INDONESIA

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Abstract

Students naturally vary in their behavior and learning habits within any population. Such variations could be more pronounced when going from one country to another. The factors that affect the changes in the students' attitudes and learning abilities can be driven by cultural, institutional, and socio-economic differences in the countries involved. For example, if the students in one country do not have the same level of access to the tools of the modern information technology, such as tablets, laptops, and connection to the Internet, it is difficult for them to utilize the vast amount of information that is available online. Under those conditions, the methods for delivery of information to the students have to be adjusted to meet the conditions in that country. During the last 38 years, I have had the good fortune to teach at universities in four countries that have considerably different cultures and cover a wide spectrum in terms of development as measured by the Human Development Index. These countries are Turkey, United States, Tanzania, and more recently Indonesia. I attained my higher education in the United States as a foreign student experiencing the effects of cultural and economic differences among countries. I also had four children go through three different universities in the United States, which gave me the opportunity to observe the higher educational systems at these universities as a parent. Based on these experiences, I offer some insights on differences in student behavior and education in the abovementioned countries with the hope that my observations will help both the researchers who are interested in understanding the educational systems in different countries and those individuals who are interested in teaching in countries other than their own.

Keywords – Student behavior in higher education, cultural aspects of higher education, socio-economic aspects of higher education, teaching at universities overseas, Human Development Index.

(1) Dr. Avci has retired from Argonne National Laboratory in the United States. He can be reached at hiavci@sbcglobal.net

Introduction

This paper provides examples of different student behavior and learning habits in universities across four countries (Turkey, United States, Tanzania, and Indonesia) based on the author's teaching experience in those countries. Even though it is not an exhaustive research into such

matters and involves a very small population of students and higher learning institutions in the mentioned countries, the examples along with the author's comments, insights, and reflections are presented with the hope that they will provide some help to others who want to venture abroad to teach in universities in other countries or to researchers who are interested in such differences among countries with different cultures and socioeconomic status.

The countries involved span a wide spectrum on the development scale and have quite different cultural patterns. In terms of development, one index that is often used to rank the countries is the Human Development Index (HDI) that was developed under the auspices of the United Nations Development Program (UNDP). The HDI integrates three basic dimensions of human development: life expectancy at birth, mean years of schooling for adults along with expected years of schooling for children, and gross national income per person. In the Human Development Report 2016, published by the UNDP (available online at <http://hdr.undp.org/en/2016-report>), the HDI for all the countries in the world ranges from a low value of 0.352 to the highest value of 0.949. Within this range, the HDI values for the abovementioned four countries are 0.920, 0.767, 0.689, and 0.531, respectively for the United States, Turkey, Indonesia, and Tanzania. The UNDP classifies the countries into four categories based on the HDI: those with an HDI of over 0.800 are in the very high human development category, those with an HDI of between 0.700 and 0.800 are in the high human development category, the ones with an HDI of between 0.550 and 0.700 are in the medium development category, and the countries with an HDI of less than 0.550 are in the low human development category. As can be seen, the four countries discussed in this paper cover the entire spectrum of development as defined by the UNDP. Even though there is a great variation among

the people in each country in regards to their socioeconomic status, to a first degree, the HDI for a country can be interpreted as an indicator of the country's socioeconomic condition as a whole.

The four countries are also quite different culturally as indicated by different religions, languages, races, geography, and ethnicity of the people in them. Similar to all other human traits, cultural variation is not just from one country to another, but also exists among regions within the countries themselves. However, there are certain trends that are more prevalent in one country as opposed to another. It is not the intent of this paper to identify such differences among the four countries involved. We will suffice to point out some differences in student behavior in these countries that are likely to be related to the students' upbringing and societal norms in the countries. Such differences should not be taken as representative of the countries and their people. They are only given here as examples of the things that one may encounter when moving from one country to another and should keep an eye out for.

The information provided in the remainder of the paper is organized as follows: Historical Background section provides a historical accounting of the author's teaching experience in Turkey, United States, Tanzania, and Indonesia. The stories in the Anecdotes section are given primarily to provide context for the comments and reflections given in the section entitled Discussion and Reflections. The last section is a short summary with conclusions.

Historical Background

This section provides a factual and historical accounting of my experience in teaching or observing the higher educational systems in Turkey, United States, Tanzania and Indonesia. After graduating from High School in Turkey in 1968, and while attending the English Language Preparatory School of the Middle East Technical University in Ankara Turkey, I won a national exam and went, with a scholarship from the Turkish Government, to the United States in May

1969 to complete my higher education. I obtained three degrees; Bachelors of Science, Masters of Science, and Doctor of Philosophy (Ph.D.), all in Nuclear Engineering, from the University of Wisconsin in Madison, Wisconsin. After working at a private research institute for two years, I moved to Turkey and taught at the Bogazici University (formerly known as Robert College) in Istanbul, Turkey for two years (1980 – 1982). I taught courses in two Departments: Nuclear Engineering and Mathematics. I returned to the United States in 1982 and went back to Battelle Memorial Institute, the same institute that I worked at from 1978 to 1980. In 1990 I transferred to a government owned research and development institute called Argonne National Laboratory (ANL). While working at ANL, I started to teach part time in the evenings at Northwestern University in Chicago, Illinois. I taught in the school of Continuing Studies of the Northwestern University most semesters from 2003 until 2011. The students who were in my classes were mostly working adults who wanted to further their education for self-fulfillment and/or better job prospects.

After retiring from ANL in February 2014, I had the opportunity to go Tanzania in September 2014. I taught at Saint Augustine University of Tanzania (SAUT) in Mwanza, Tanzania for two semesters; first semester of 2014 – 2015 academic year and the second semester of the 2015 – 2016 academic year. In August 2017, I came to Indonesia to teach at Sanata Dharma University for one semester. As I write this paper (early October 2017), I currently teach at Sanata Dharma.

I was the parent of one or more students in college every year from 2003 until 2013. One of my children obtained her Bachelors degree from Northwestern University and her Masters and Ph.D. degrees from Indiana University, in Bloomington, Indiana. My other three children all went to the University of Illinois in Urbana-Champaign, and obtained bachelors degrees.

Anecdotes

This section provides some anecdotal stories that shed some light on the observations and insights provided in later sections.

Tanzania Story 1: in 2014, I was assigned to teach a course entitled “Environmental Impact Assessment” to fourth year Civil Engineering students at St. Augustine University of Tanzania (SAUT), in Mwanza, Tanzania. There were 17 students enrolled in the class. Even though I was at the University at the beginning of the semester, it took several weeks before all the students showed up. Things got started on a good footing and we began the lectures. I wanted the students to do a class project, where they would act as a team and jointly write a mock environmental impact statement (EIS) for a civil engineering project of their choosing in Tanzania. They chose to do it for a gold mining project. I thought that this exercise would be a good learning tool for them. The EIS was supposed to be finished by the end of the semester. I shared with the students several EISs written for projects in Tanzania and the United States and showed them some websites for additional useful information. I assigned them homework that required them to visit some of those sites. I was very excited and ready to help the students in any way that I could.

One day, about a couple of weeks after the lectures began, the students did not show up for my class. When I called the Student Representative who was acting as the liaison between me and the class, he told me that they were in a meeting with the Head of Department (HOD) for Civil Engineering and some examiners from a university in Dar es Salaam. He said they would not be able to come to my class that day. Next day I stopped by the Department office and talked to the HOD. The HOD confirmed that the students had to stay at the meeting the day before, which prevented them from coming to my class and told me that the next two weeks the

students were going to a workshop in the afternoons and since all my classes were taking place in the afternoons, they would not be able to come to my classes. He said my classes had to be rescheduled, and the Student Representative would arrange the schedule in consultation with me and his classmates. It took about a week, but I finally worked out a schedule with the Student Rep and had a class with the students in the morning in a different classroom. I had assigned the students a task related to their class project that was due the previous week. When I asked to receive the assignment, there was none forthcoming. After some silence, one student spoke up and said they were not able to do the assignment because they were too busy with the workshop and with their other classes, and that they would give it to me the following week.

The student's response took me by surprise. I felt that the students should not have the right to delay a homework assignment on their own because they were too busy with other tasks and not tell me about it until after I asked. Thinking that these were 4th year engineering students and next year they would be in the workforce in the real world, I decided to teach them a lesson. I told them that when they get out of school next year, they would most likely be working for engineering establishments on various projects. I told them that they needed to treat the class project I gave them as one of those projects and me as their project manager. I told them that in the real world if they went to their project manager and told him or her that they could not do his or her project because they were too busy with other projects, they would be fired on the spot. I said to them that they can't delay the assignment I gave them by another week because there were other assignments related to their class project that depended on this assignment, and if this one is delayed, then the others would have to be delayed and when that happened they would not be able complete their EIS by the end of the semester. There was about 30 more minutes left in

the period. I stopped lecturing and told them to work on their assignment the rest of the period and turn it in the next time.

The students seemed a little shook up by my response. They moved their chairs around to face each other and started to work on the assignment. And they did turn it in the next time the class met. But the following week things started to change again. They wanted to reschedule my classes again. They said they had some follow-up work regarding the workshop they had attended. I agreed to the schedule change. However, I found out later that they actually gave my class time to another lecturer who came from Dar es Salaam. SAUT did not have enough lecturers to give all the engineering classes. In fact most of the engineering lecturers were coming from the University of Dar es Salaam or the Dar es Salaam Institute of Technology for short periods. They would lecture intensively for a few days or a week and would go back to their home universities. This would happen several times during the semester. I found out later that it was up to the Student Reps and the students to make time for these lecturers. It seemed that since I was at SAUT all the time, the students felt that they can move my hours around to accommodate the lecturer from Dar es Salaam.

When I found out what was going on, I resisted further requests to change my class times and insisted that the students turn in their assignments on time by email even when they moved my class period to another time. Soon after that the Student Rep for my class informed me that all the students were dropping my class, because it was an elective, and they did not need to take it.

The HOD later told me that there were actually five students who had to take my class to graduate because they were specializing in water resources management and for them this was a required core course. However, the students were sticking together and none of them wanted to continue with the class. The Deputy Vice Chancellor for Academic Affairs (DVCAA) for SAUT

got involved and negotiated with the students. It turned out that students were having a hard time in my class because some of them did not have laptops and even those who had laptops did not have easy access to the internet to do the assignments. They also complained that I was being too inflexible. In addition, after they stopped coming to the class and asked the administration that the course be offered again next semester by a different lecturer, they were afraid that, if they came back, I would hold a grudge against them and give them all bad grades.

I assured the DVCAA that I would not give the students bad grades just because they stopped coming to the class. I also told him that I would teach those five students who needed the class to graduate. When this was conveyed to the students, nine of them wanted to continue with the class. By that time, five weeks had elapsed without any classes and I was hesitant to take on more students than were necessary because I wanted to spend as much time as possible with those students who had to take the class. But the DVCAA asked that I take all nine students back. When the nine students returned to the class, the Student Rep, who was one of the returning students, profusely apologized for their behavior and asked that I forgive them as if they were my own children.

Tanzania Story 2: In 2014, besides teaching the Environmental Impact Assessment course to civil engineering students, I also helped to teach two courses in the Geography Department to Education students. The number of students enrolled in both of these classes was over 300. The topics I taught were related to the environmental impacts of water projects in one course and the population and natural resources management in the other course. In both of these courses, the students were so interested in the topics I was teaching and were so eager to learn. As part of the class, the lecturers would divide the students in the class into a number of groups with 10 -20 students in each group at the beginning of the semester. The lecturers then would assign a

specific topic to all the students to research one week and have one of the groups come in front of the class to present their findings to the rest of the class the following week. When I did the same, the students were competing to come in front of the class and present their findings.

Turkey Story: In 1982, I taught a mathematics class on Linear Algebra to mathematics and science majors at Bogazici University in Turkey. When I was reading the final examination papers, I noticed a very peculiar error in one of the papers. Soon I started seeing the same error in seven papers out of a class of about 45 students. The chance of seven students making the same arithmetic error in a long series of calculations was essentially zero. I consulted with the Mathematic Department chair and based on his advice I gave all seven students zero on their final exams. When the students found out that they had gotten zero on the exam, they flocked to my office trying to find out why. I talked to the students individually and asked each student how it happened that he and six others made the same mistake. They all made up stories except one student, who was actually one of the better students in the class and was going into the final exam with an “A” average. He said he gave his exam paper to the student sitting next to him during the exam, and then that student circulated his answer sheet to the others. He apologized for allowing it to happen.

Indonesia Story: As of early October 2017, the time I am writing this paper, I have only been teaching at the Sanata Dharma University for a few weeks. I am teaching a course called Renewable Energy Technologies, to 3rd year Mechanical Engineering students. There are 42 students enrolled in the class. By all indications, the students seem to be a dedicated, hardworking and a conscientious group. However, language may be a problem for some of the students. I have been told that this is the first time the students are being taught entirely in English in a class in the Faculty of Science and Technology (FST) at Sanata Dharma. Most of

the students are being extremely quiet during lectures and are not responding to questions. One nice thing about teaching at Sanata Dharma is that the FST has offered to have another lecturer from the university to sit in my classes and help. The same lecturer also seems to be very interested in the topic and is willing to take and archive all my teaching materials for later use. This is exactly what I wanted to do. Being of retirement age and most likely not a permanent fixture at the university, I am happy to transfer all my teaching aids and as much of my knowledge as I can, not only to the students but also to another lecturer who can be the torch bearer for future students.

Discussion and Reflections

In this section I point out some differences in student behavior and learning using examples selected from the anecdotal stories in the previous section. However, before getting into differences, it is worth noting that I also observed some commonalities among the students in all the countries: (1) They all want good grades; they always show special interest in when the exams are, how they are graded, and what grades they get, and (2) although most students are conscientious and honest, there are always few students who will look for opportunities to game the system in order to get good grades.

Differences among the students are in regards to how they study and learn and how they approach to getting good grades. Some students show great interest in the topics being taught and want to absorb as much of the information presented to them as possible, as demonstrated by Tanzania Story 2, whereas some other students want to cut corners and appear to be more interested in the grades than in learning. The differences among the students' behavior in these matters are undoubtedly due to many factors, however, these factors can be grouped under three general headings: cultural, institutional, and socio-economic. Probably the easiest set of factors

to ascertain is related to the socioeconomic status of the students. If the students do not have the tools they need to do the tasks assigned to them, they are likely to fall short in their work. I will discuss the socio-economic factors first followed by cultural and institutional factors.

Socio-economic factors: A good example of this is from the Tanzania Story 1, where I assigned certain tasks to the students that required them to access various websites and download some documents in order to do the tasks. Being a 4th year engineering students, I expected them to have the tools, i.e., computers and internet access, to do the tasks. But it turned out that some of them did not have computers, and those who had computers, did not have reliable internet connections. So they were having a hard time doing the assignments.

I should have guessed that there could be issues in that regard, because I was having difficulty using the university's wireless system myself; it was too slow and often broke in and out. I purchased a mobile internet flash drive from a telephone company. Even though the cost of the device and the service provided by the telephone company was relatively inexpensive for me, apparently that was not the case for all the students. I learned later that even though SAUT is a private university, many of the students who attend it, get scholarships from the government to come there. Often the government is late with payments and the students have to struggle to make the ends meet.

Socioeconomic factors could have an impact on the students' learning habits and abilities inside a country as well. For example, in the United States, because of the way the primary and secondary school districts are funded, the schools in the affluent suburban communities are well off financially and can afford to hire better teachers by paying them higher salaries. The students in those communities tend to have easy access to all the materials they need for school and to tutors if needed. The same students also tend to go to better universities with continued support

from their families. Whereas the students in poor inner-city school districts do not have all the same amenities and often come from families who are not as educated as the suburban families and can not help their children with school work. These students when they graduate from high school attend small community colleges close to home for the first two years and then transfer to a four-year university or go directly to a four-year university obtaining financial aid in the form of scholarships or student loans. To achieve a high-level of learning and to be successful, these students need to work harder than the wealthy suburban kids.

Having been born into a rich suburban family, however, could also have a negative impact on the students when they go to college. Because of their upbringing and not having experienced any financial hardships, these students tend to have less of an appreciation for the value of money and time. They can be more wasteful and behave in ways that are irresponsible. In that regard, the students from poorer families often work at part time jobs while going to school and have a better appreciation for the money and their education opportunities. The same can also be said about the adult students. As mentioned under the Historical Background section of this paper, most of the students I taught at Northwestern University were adult learners who had regular daytime jobs. These students were like sponges. They wanted to get as much out of the classes they were taking as possible, because they knew what it meant to them in real life.

Cultural factors: Cultural factors that affect student behavior and learning are harder to identify and circumvent. I will list four specific examples in this regard:

1. I found that the students were more cohesive in Tanzania and Turkey than they were in the United States. In Tanzania for example, all 17 students boycotted my class even though five of them needed the class to graduate that year. In Turkey, one student who

was doing well in the class willingly allowed other students to copy from him on the final exam, putting himself at risk. In the Tanzania case, the fact that the students were a cohort who started at SAUT at the same time three years earlier, were going through the same program, taking pretty much the same classes every year, was probably a big factor in their decision. They had developed a special bond among themselves. However, it also seemed that the students in these two countries generally felt closer affinity to other students in the class, either the entire class or a smaller number of students in the class, than the students in the United States. The students in the United States are generally more individualistic; they would not risk their success by willingly providing help to other students.

2. In Tanzania, the students were hesitant to tell me that they were having difficulty with the class and needed help. Even when I asked the Student Rep if I was giving them too much work and if it was too difficult for them to do it, he not only denied that they were having difficulty, he seemed to take offense at the fact that I was asking it. He told me that they had classes much harder than mine.
3. In Tanzania, I felt that the students were afraid to challenge the lecturer. In the United States, if what the lecturer says is not clear or appears to be contradictory to what he had said earlier, the students will point out the contradiction and ask for clarification. In Tanzania, the students never asked anything that appeared to be questioning what I was telling them.
4. Fear of retaliation from the lecturers. I was told that in Tanzania the lecturers do sometimes give bad grades and fail the students on account of what they did. So when the students told the DVCAA that they were afraid to come back to the class fearing that I

would give them bad grades because of what they did, their fears were not totally baseless. In the United States, a lecturer would not dare to fail a whole class because of the students' behavior.

For educators who are teaching in foreign countries, having someone who is familiar with the culture of the country and can speak the same language as the educator would certainly help, but it probably is not sufficient to prevent all potential problems. This is probably one area where you have to learn on the job, but just be careful not to make mistakes that are too serious to rectify.

Institutional factors: Institutional factors relate to the rules and regulations at the institutions that the educators and the students have to interact with to conduct their daily activities. These are primarily the universities and the sub units within universities, such as the faculties and departments, and the government agencies that have jurisdiction over the universities. Some of the issues that I observed and experienced and are directly related to such institutions include:

1. At SAUT, at least in the Faculty of Engineering, the students had too much responsibility and leeway in deciding their daily class schedules. Because of the ever changing conditions related to the traveling lecturers from Dar es Salaam, students constantly had to shuffle their timetables to accommodate the lecturers. This imposed a big responsibility on the students on the one hand and gave them too much power on decisions related to class schedules on the other hand. It was because of this that my schedule was changing frequently. This function should have been handled by the Civil Engineering and Electrical Engineering Departments (which were the only departments in the Faculty of Engineering) or by the Faculty of Engineering. An individual could have been designated to assign class times and rooms and resolve any conflicts. I believe that

this was a problem specific to the Faculty of Engineering at SAUT, which was a relatively new Faculty and did not have the sufficient number of resident lecturers at the university to teach all the necessary courses. Other Faculties at SAUT did not have this problem and I am sure that other universities in Tanzania and in other countries would not have it either. In contrast to what happened at SAUT, at Sanata Dharma, when I needed extra time with the students to make up a couple of weeks of classes that we missed, the secretary of the Mechanical Engineering Department made all the arrangements, making sure that there were no conflicts with other classes, and informed me and the students of the revised schedule.

2. Universities should have clear rules and guidelines to let the students and the lecturers know what they can and cannot do. They should also have clear rules and guidelines in resolving any conflicts that may arise. A well-defined line of authority should be evident as to who to contact in times of conflict. In my experiences, I felt that such rules were available and enforced by the administration at the Northwestern University in the United States and Bogazici University in Turkey, but not at SAUT in Tanzania. In Turkey, when I was faced with the situation of seven students copying from each other on the final exam, and at Northwestern University, when I discovered in one of the classes I taught that two students had copied each other's papers word-by-word on a take-home exam, the department heads addressed the problem right away and rendered a decision. However, at SAUT when the students informed me that they would not continue with my class, I had a difficult time getting help from the Head of the Department and the Dean of the Faculty of Engineering. I had to go all the way up to the Deputy Vice Chancellor for Academic Affairs before someone could talk to the students and find out what was going on. Even

then, it took five weeks to resolve the issue. The DVCAA negotiated with the students and had some of the students return to the class. The dean, who had been newly appointed to his position at the time, actually complained to me that the students at SAUT had too much power, instead of offering his help to resolve the situation. The HOD complained that the students were avoiding him also. He also told me that this was the third time the same students were complaining about a lecturer and requesting a different lecturer and that in the previous two occasions the university administration had ruled in the students' favor and had provided a different lecturer.

3. The government agencies that have jurisdiction over the universities should provide timely advice and guidance to the universities. The agencies that administer student enrollments and scholarships should follow the established schedules and not change them at the last moment. When I went to Tanzania the second time, I was originally scheduled to teach during the first semester of the 2015-2016 academic year. However, in August 2015, I learned that, because of the national elections on October 25, 2015, the start date of the academic year at SAUT and all other universities in Tanzania was being delayed until November. Not only did I have to change my travel plans, but all the students and lecturers at all the universities in Tanzania had to revise their timetables and extend the academic year into July 2016. While at SAUT in 2016, I was told that some of the students may not be able to take the final exam of my class, because the government had not provided the scholarship funds to pay for the students' university fees. These types of last minute changes and schedule delays not only cause undue hardships on the universities and the students, but they also provide bad examples to the students.

Conclusions

University students, just like any other sector of a society, are heterogeneous in their behavior and learning habits. They behave in different ways depending on their upbringing, socioeconomic status of their parents and the communities they live in, cultural norms they are accustomed to, and the types of institutions they attend. Such differences in student behavior can be more apparent when the socioeconomic, cultural, and institutional factors suddenly change in going from one country to another. Some of these differences have been highlighted with examples provided by the author's teaching experience in four countries: Turkey, United States, Tanzania, and Indonesia. These countries not only occupy very different levels on the human development scale as measured by the United Nations Development Program's Human Development Index, as an indication of different socioeconomic conditions in them, but they also show large differences in their cultural patterns and educational institutions.

The highlighted differences in student behavior and learning have been presented not to show which ones are good or appropriate and which ones are not, but rather they have been highlighted to demonstrate that they happen, and that educators who venture into other countries to teach at the university level should recognize their existence. As challenging as these differences can be, they also provide opportunities to the educators to learn about different countries and cultures. These educators should try to learn about the country and the culture of the country they are going to as much as possible before they leave their home country and be mindful of them in their daily activities after they arrive in the country. Although each country is different and the examples provided herein may not apply to all the countries, hopefully this paper will help those educators who decide to go and teach at universities overseas as well as the

researchers who want to explore the differences in higher educational systems in various countries.

ANALYSIS OF MATHEMATICAL CONNECTION AND COMMUNICATION TOPIC OF THE RELATION OF CENTRAL ANGLE AND INSCRIBED ANGLE IN A CIRCLE IN GRADE VIII

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Abstract

This research aims to investigate mathematical connection and communication of students grade VIII SMP Pangudi Luhur 1 Yogyakarta in topic the relation of central angle and inscribed angle in cycle. This research was a descriptive qualitative research. The data was collected through observation, instructional video recording, the result of test, and interview of 8 subjects. Instructional video was analyzed in qualitative with making the transcript of the video, determining topics of the data, and categorizing the data. The result of the tests were analyzed qualitatively to determine the students' mathematical connection and communication. Result of this research showed that some students can associate of the relation of central angle and inscribed angle of a circle. Most of the students have not been able to apply the mathematical connection to solving other mathematics. This is because students do not understand the problem earlier and not accustomed to using reasoning in problem solving. Students' mathematical communication ability was already good. Students can express their ideas orally but students cannot write down the good and right idea. This is because students are not used to write down their ideas mathematically.

Keywords: mathematical connection, mathematical communication, central angle, inscribed angle.

Introduction

Mathematics connection and communication is the mathematical ability of the students. According to NCTM (2000), there are five standards that describe the relevance of mathematical understanding and mathematical competence that students should know and can do. They are understanding, knowledge and skills that students need to have include problem solving, reasoning, communication, connection, and representation.

Mathematical connections and communications are very interesting to research. Mathematical connection helps students to find the relation between contextual problem and mathematical

problem, so that students can solve contextual problems by using mathematical concepts. Students communicate how they solve the problem. They can finish and communicate their idea with drawing, graphics, writing, equation, table, etc. Their expression can be called a mathematical communication.

Based on the observation of the researcher, when the students grade VIII at Pangudi Luhur 1 Yogyakarta Junior High School were given about topic parts of circle and the relation of the central angle and inscribed angle facing the same arc of the circle, the students were unable to link prior knowledge they had to solve the problems related to the circle. Therefore, the researcher wanted to observe the mathematical connection and communication of the students. Researchers observed students' mathematical connections and communication after the researchers implemented Problem-Based Learning.

Theory

A. Mathematical Connections

Mathematical connections are connection mathematical with other lessons or other topics. There are two types of mathematical connections, they are modeling connections and mathematical connections. Modeling connections are the relationships between problem situations that arise in the real world or in other disciplines with their mathematical representation. Meanwhile, mathematical connections are relations between two equivalent representations and between the completion process of each representation.

According NCTM (2000), indicators for mathematical connection ability are: (1) Recognize and use connections among mathematical ideas; (2) Understand how

mathematical ideas interconnect and build on one another to produce a coherent whole;

(3) Recognize and apply mathematics in contexts outside of mathematics.

De Lange (Ariyadi, 2012) divide into two, they are horizontal mathematization and vertical mathematization. Horizontal mathematics deals with the generalizing process. The process of horizontal mathematization begins with the identification of mathematical concepts based on regularities and relations found through visualization and schematization of problems.

The process of horizontal mathematization can be achieved through the following activities. (1) Identification of mathematics in a general context; (2) Schematization; (3) Formulation and visualization of the problem in various ways; (4) Search regularity and relationships; (5) Transfer the real problem into the mathematical model

Vertical mathematization is a form of formalization process in which mathematical models obtained on horizontal mathematization become the foundation in the development of more formal mathematical concepts through vertical mathematical processes. Vertical mathematical process occurs through a series of activities as well as the following stages.

The process of horizontal mathematization can be achieved through the following activities. (1) Identification of mathematics in a general context; (2) Schematization; (3) Formulation and visualization of the problem in various ways; (4) Search regularity and relationships; (5) Transfer the real problem into the mathematical model. The process of horizontal mathematization and vertical mathematization can not be directly separated into two major sections in sequence, which is the vertical mathematization process takes place after the whole process of horizontal mathematization occurs intact (as seen as figure 1).

However, the two processes of mathematization can formed step by step (as seen as figure 2).

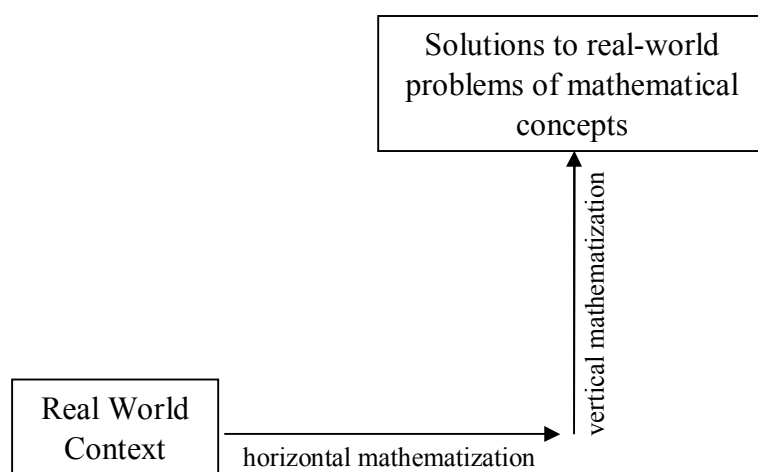


Figure 1.

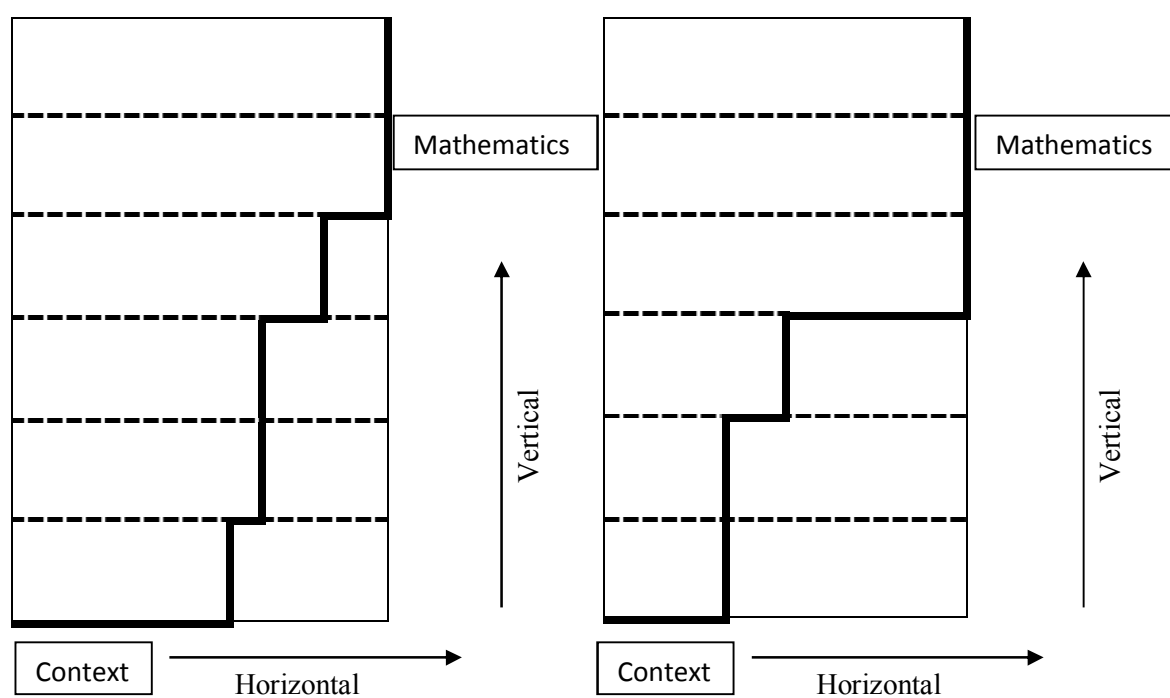


Figure 2.

B. Mathematical Communication

Mathematical communication is the ability of students to use mathematics as a tool of communication (language of mathematics) and the student's ability to communicate mathematics learned as the content of the message should be delivered (NCTM, 1989). NCTM (1989) states that students' communication skills in learning mathematics can be seen from (1) Ability to express mathematical ideas through orally, written, and demonstrate and visualize it; (2) Ability to understand, interpretation, and evaluate mathematical ideas either orally, in writing, or in other visual forms; (3) The ability to use terms, mathematical notations and structures, to present ideas, describe relationships and situational models. In classroom when students are challenged to think and reason about mathematics, communication is an essential feature as students express the results of their thinking orally and writing (NCTM, 2000).

Brenner (Prayitno, 2015) was developed a communications framework for Mathematics which summarized in table below.

Table 1. Kind of Mathematical Communication

Communication About Mathematics	Communication in Mathematics	Communication With Mathematics
Reflection on cognitive process. Description of procedures, reasoning. Metacognition-giving reasons for procedural decision	Mathematical register Special vocabulary. Particular definitions of everyday vocabulary. Modified uses of everyday vocabulary. Syntax, phrasing. Discourse.	Problem-solving tool. Investigations. Basis for meaningful action.
Communication with others about cognition. Giving point of view. Reconciling differences.	Representations. Symbolic. Verbal Physical manipulatives. Diagrams, graphs. Geometrics.	Alternative solutions. Interpretation of arguments using mathematics. Utilization of mathematical problem-solving in conjunction with other forms of analysis.

Mathematical communication in this research is part of mathematical communication in mathematics. In this study, students are given problems about proofing the relationship of the center angle and the roving angle of the circle and the students are asked to solve it. To get the math communication is needed exploration expression mathematical vocabulary, special vocabulary or definition, representation, symbolization, numeric, graph, diagrams, verbal communication, and so on.

C. Problem-Based Learning

These are the stages of a PBL process. This process takes learners through the learning process via the following stages, which are dynamic and iterative in nature. The tutor who is the facilitator, facilitate the process (Ee, 2009). Accord to Forgarty (in Wena, 2011) stages of problem-based learning strategy are as follows:

Table 2. *Phase of Problem-Based Learning*

Phase	Behavior teacher
Phase 1: give orientation about the problem	The teacher tells the learning objectives, describes the various important logistical needs and motivates the students to engage in problem-solving activities
Phase 2 : organizing students to research	Teachers help students define and organize learning tasks related to problems.
Phase 3 : assisting independent and group investigations	Teachers encourage students to get the right information, carry out experiments, and seek explanations and solutions
Phase 4 : develop and present the results of the discussion	Teachers help students in planning and preparing appropriate instructional media, such as reports, recordings, videos, and models and helping them to convey to others.
Phase 5 : analyze and evaluate the problem-solving process	Teachers help students reflect on their investigations and the processes they use.

Methodology

The methodology of this research is descriptive qualitative approach. Descriptive research with quantitative approach is a study that aims to describe phenomena in real, where these phenomena are described based on the calculation of measure, size, or frequency (Nana Sukmadinata, 2012).

This research was conducted in SMP Pangudi Luhur 1 Yogyakarta in Academic Year 2016/2017 in class VIIIE. The data used in this research is the implementation data learning namely: (1) Transcript of video learning (2) worksheet of the implementation of lesson plan (3) Transcript of interview, and students' ability of mathematical connection and communication data which include the students' answer sheet of tests results. The data collection was conducted through test and observation. Analysis of learning implementation from the kind of mathematical connection and communication.

Results and Discussion

Results

Implementation of learning conducted in 2 meetings with each meeting 2x40 minutes. Learning at the first meeting aims to define the elements of the circle. While at the second meeting, students can show and prove that the measure of center angle of the circle is twice the inscribed angle that faces the same arc.

At the first meeting each student is given LKS I which contains the elements of the circle (not with the definitions). Students are asked to define each element of the circle. Previously the teacher gave instructions to draw the circle elements in the worksheet provided. From the

drawing activity students define the elements of the circle. When the student is doing the activity, the teacher walks around to accompany the students who are having difficulty.

At the second meeting, students are asked to group consisting of 3-4 students. Each group is given LKS II (student worksheet). LKS II contains some picture of the center and inscribed angle, then the students answer some questions. LKS II aims for students to show that the measure of center angle of the circle is twice as large as the inscribed angle facing the same arc. Students are given 30 minutes to discuss in groups. After the students complete the LKS I, the teacher discuss the students' work result. After students finish with LKS I, students are awarded LKS III. In LKS III students are asked to prove mathematically that the center angle of the circle is twice the inscribed angle facing the same arc. Here is an example of student work in defining the elements of a circle:

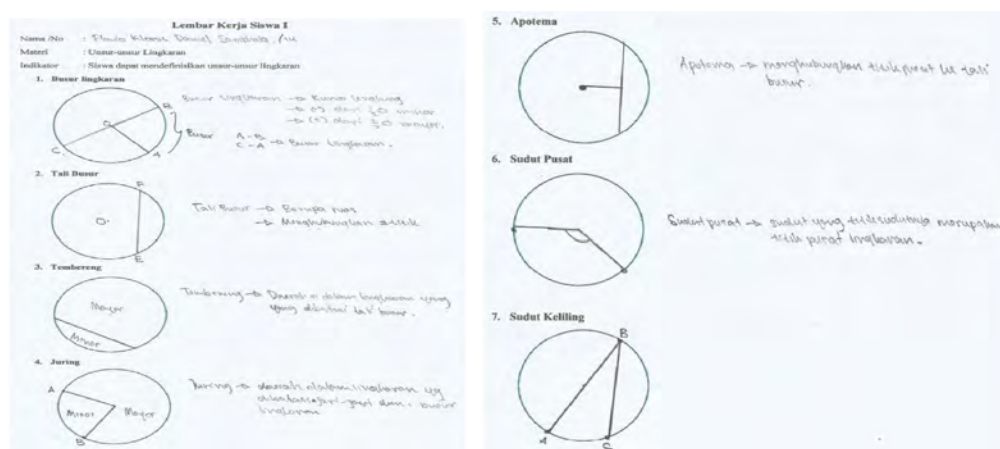


Figure 3. Sample students' solving in determine elements of circle

The following is an example of student work in searching for relationships between the major center angles and the circumferential angles facing the same arc.

1. Student determines three points on the circle, students name it points A, B, and C
Students connect each point on the circle to the center point O. Students mention the characteristics of the circular arc, namely: curve , (-) from semi circle, and (+) from

semi circle. Students indicate the intended circular arc is the curved lines AB and CA. but student has not defined the circular arc.

2. Students determine 2 points on the circle, it is point E and F then students connect that 2 points. Students mention the characteristics of the chord but not yet complete. Students also have not defined the chord.
3. Students can draw the segment and show the major and minor segment. Students can define the segment.
4. Students determine 2 points on the circle then each point is connected to the center of the circle. Student shows major and minor sector. Students can define the sector of circle.
5. Students draw a secant then students draw a perpendicular line from the center point to the secant. Students are less precise in defining apothem.
6. Students can draw the center angle and define it.
7. Students can draw the inscribed angle but have not defined it yet.

The following is an example of student work sheet in searching for relation between the measure of center angles and the inscribed angles facing the same arc.

Lembar kerja

1. Gambar 1 menunjukkan sudut $\angle ODE$ dan sudut $\angle DFE$ menghadap busur $\widehat{DE}$.
 Gambar 2 menunjukkan sudut $\angle ADB$, $\angle ACB$, dan $\angle AEB$ menghadap busur $\widehat{AB}$.
 Gambar 3 menunjukkan sudut $\angle V_1Z$, $\angle V_2Z$, $\angle V_3Z$, dan $\angle V_4Z$ menghadap busur $\widehat{V_1V_2}$.
 Gambar 4 menunjukkan sudut $\angle KOP$, $\angle KAP$, dan $\angle KMP$ menghadap busur $\widehat{KP}$.
 Gambar 5 menunjukkan sudut $\angle DCE$, $\angle DAE$, dan $\angle DBE$ menghadap busur $\widehat{DE}$.
 Gambar 6 menunjukkan sudut $\angle DCE$, $\angle DAE$, dan $\angle DBE$ menghadap busur $\widehat{DE}$.
 Gambar 7 menunjukkan sudut $\angle DCE$, $\angle DAE$, dan $\angle DBE$ menghadap busur $\widehat{DE}$.
 Gambar 8 menunjukkan sudut $\angle DCE$, $\angle DAE$, dan $\angle DBE$ menghadap busur $\widehat{DE}$.

Gambar	Besar Sudut Pusat	Besar Sudut Keliling
No 1	150°	$\angle DFE = 75^\circ$, $\angle DCE = 150^\circ$
No 2	110°	$\angle ADB = 55^\circ$, $\angle ACB = 55^\circ$
No 3	75°	$\angle V_1Z = 40^\circ$, $\angle V_2Z = 40^\circ$, $\angle V_3Z = 40^\circ$
No 4	120°	$\angle KAP = 60^\circ$
No 5	180°	$\angle DCE = 90^\circ$, $\angle DAE = 90^\circ$
No 6	110°	$\angle DCE = 55^\circ$, $\angle DAE = 55^\circ$
No 7	180°	$\angle DCE = 90^\circ$
No 8	180°	$\angle DCE = 90^\circ$, $\angle DAE = 90^\circ$, $\angle DBE = 90^\circ$

3. a. Ya, karena besarnya dan 2 kali sudut, yaitu sudut pusat dengan titik pusat lingkaran.
 b. Ya.
 c. Besarnya sudut keliling dikali 2 jumlahnya a tidak sama dengan b.
 d. Besar sudut pusat = 2 x besar sudut keliling.

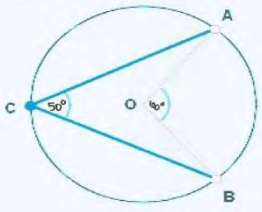
Figure 4. Sample students' solving in relate the central and inscribed angle in a circle

1. In figure 1, the student assumes the GOE angle and the GFE angle does not face the same (the GE arc). In other words, students assume in figure 1 there is no central angle and inscribed angle facing the same arc. Figure 2-8 students answered there is a center angle and a inscribed angle facing the same arc. Then the students mention the inscribed angle and the central angle that faces the same arc on each image. The student measures the center angle and the inscribed angle of each image but has not yet given the description of which center angle facing the same arc with the inscribed angle.
2. Not done yet.
3. In the answers c and d, the answer is not appropriate (contradiction).

LEMBAR KERJA SISWA IIJ

Nama : Nicho / 33, Martin / 29, Nyo-nyoh / 21, Alan / 6

Indikator : Siswa dapat membuktikan bahwa besar sudut pusat adalah dua kali besar sudut keliling yang menghadap busur yang sama



$\angle ACB = 50^\circ$
 $\angle AOB = 100^\circ$

Buktikan bahwa besar sudut pusat dua kali besar sudut keliling yang menghadap busur yang sama!

Benar

Sudah dibuktikan di gambar bahwa sudut keliling pada $\angle ACB$ ialah 50° dan besar sudut pusat $\angle AOB$ ialah 100° , maka pernyataan itu benar karena $50 \cdot 2 = 100$.



$\triangle AOC \text{ \& \; } \triangle BOC$
 $180^\circ - 2y^\circ$
 $180^\circ - 2x^\circ$
 $360^\circ - (180^\circ - 2y^\circ) - (180^\circ - 2x^\circ)$
 $180^\circ + 2y^\circ - 180^\circ + 2x^\circ$
 $2y^\circ + 2x^\circ$
 $2(y^\circ + x^\circ)$

Sudut pusat
 $2(y^\circ + x^\circ)$
 Sudut keliling
 $(y^\circ + x^\circ)$

Figure 5. Sample students' solving in prove measuring of inscribed angle is double the measure of central angle

From the figure above, students measure directly the center angle and the inscribed angle. The measure of inscribed angle is double the measure of central angle so that students assume that it is already proven mathematically. After getting directions from the teacher then the students prove mathematically. Students draw a corner and center angle facing the same arc. Students draw a line from the peripheral point to the center vertex so that two equilateral triangles of the foot, the AOC triangle and the BOC triangle are obtained.

The measure of inscribed angle is $y^{\circ} - x^{\circ}$

The measure of AOC angle is $180^{\circ} - 2y^{\circ}$

The measure of BOC angle is $180^{\circ} - 2x^{\circ}$

The measure of central angle equals to $360^{\circ} - (180^{\circ} - 2y^{\circ}) - (180^{\circ} - 2x^{\circ})$

So the measure of central angle is $2(y^{\circ} - x^{\circ})$

Discussion

A. Mathematical Connections

The mathematical connections analyzed in this journal are viewed in terms of its learning. The designed learning has taken into consideration the relation of a concept and procedure. In this learning modeling connections seen when the teacher gives instruction in the form of writing and students use the information in the form of writing into an idea for the next poured in the form of images of the elements of the circle. Furthermore, from the picture the students are again asked to assemble a definition, which in this activity students are required to use their ability in the language so that the definition of the sentence made is not ambiguous.

Modeling connections that appear are also visible when students are asked to show the relationship between the center angle and the inscribed angle at which the student was previously asked to measure the magnitude of the center angle and the inscribed angle facing and not facing the same arc. From these activities the students linked the results of the measuring activity with their ability to create a pattern and ultimately the student was able to conclude that the measure of central angle was double the measure of inscribed angle.

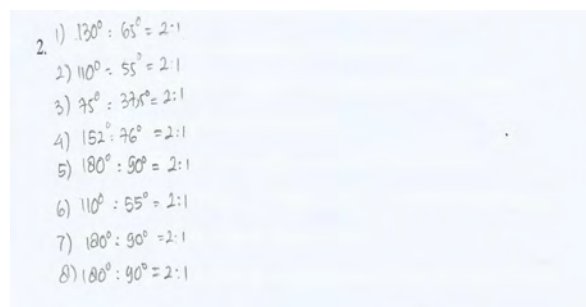
While the mathematical connection arises when the student activity in proving that the large center angle is twice the inscribed of the inscribed. From these activities, students give the idea of proof by using a drawing by drawing auxiliary lines so as to form an equilateral triangle of legs in a circle. Next, students use algebra to prove the magnitude of the center angle and the inscribed of the inscribed. From this activity students connect their ability in using visual representation and representation in equation form (equation).

B. Mathematical Communication

Mathematical communication analysis will be seen in terms of learning, from the observations during the learning activities, and the results of student work. In the activity of defining the elements of the circle, the teacher explores it with the students. From the activities of exploring together, spontaneous ideas emerge from students as teachers stimulate student ideas to define the elements of the circle. Some students argue about his idea of the definition of the element of the circle. Submission of these ideas is an expression of mathematical ideas through verbal, and then the teacher asks the students to write down the idea in the answer sheet so that the communication is re-expressed through writing.

In addition to drawing elements of the circle which had previously been instructed steps through the power point, students also showed the ability to understand the writing into a visual form. After the teacher confirms the exactness of the drawings that the student has made, the teacher invites the students to evaluate the naming of the circle element being drawn, such as when the student draws the shank, then that will be considered the only shield is the minor shield. Then from the students' answers, the students give guided questions so that students can finally realize that the major chord also meets the definition of the chord, as well as when the teacher asks whether the diameter includes a bow or not taliu. From this activity, students have shown their ability in evaluating mathematical ideas both orally and in writing, because after discussing it with the teacher, students then write it in their respective answer sheets.

In terms of indicating that the center angle is double the inscribed of the angle, the student has used mathematical notations, such as the use of angular notation ($^{\circ}$), the angular degree unit ($^{\circ}$), and the ratio of the center angle are twice the inscribed angle as shown on the answer sheet one of the following students:



2. 1) $130^{\circ} : 65^{\circ} = 2:1$
 2) $110^{\circ} : 55^{\circ} = 2:1$
 3) $95^{\circ} : 47.5^{\circ} = 2:1$
 4) $152^{\circ} : 76^{\circ} = 2:1$
 5) $180^{\circ} : 90^{\circ} = 2:1$
 6) $110^{\circ} : 55^{\circ} = 2:1$
 7) $180^{\circ} : 90^{\circ} = 2:1$
 8) $180^{\circ} : 90^{\circ} = 2:1$

Figure 7. One of ratio notation used by student

From the figure above shows that the students use the concept of comparison by writing down the ratio of the measure center angle and the inscribed of the angle is 2: 1,

the student also uses the comparison notation ($:$) and concludes that the center angle is double the inscribed angle.

Conclusion

The mathematical connection that occurs in this learning is modeling connection. Modeling connections that appear are also visible when students are asked to show the relationship between the center angle and the inscribed angle at which the student was previously asked to measure the magnitude of the center angle and the inscribed angle facing and not facing the same arc. From these activities the students linked the results of the measuring activity with their ability to create a pattern and ultimately the student was able to conclude that the measure of central angle was double the measure of inscribed angle.

The mathematical communication that occurs in this learning is expression of mathematical ideas through verbal, using of equation, using of mathematical notations and expressions.

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ANALYSIS OF MATHEMATICAL REPRESENTATION, COMMUNICATION AND CONNECTION IN TRIGONOMETRY

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Abstract

Trigonometry is one of mathematics branch that is difficult to understand according to some students. Some students still struggle to solve mathematical problems associated with trigonometry. In this research, the researchers tried to analyze students' mathematical representation, mathematical communication and mathematical connection in answering mathematics problems. This research is done to obtain data in case recognizing the students' ability of representation, communication, and connection in solving mathematics problems, particularly in trigonometry. These three capabilities are chosen because they are the key of skills in solving mathematical problems. This research is expected to detect students' difficulties in solving problems on trigonometric material accordingly to provide appropriate treatment to students.

The research method used is a qualitative description by conducting qualitative analysis on students' work result and interview to obtain more information. From the analysis results obtained it can be concluded that most of the students still have problems in representing the problem and in building connections with the materials that have been studied. From this result, it can be concluded that the students still need guidance in mathematical representation and connection through the learning process in order to improve their ability in solving the mathematics problem, particularly on trigonometry.

Keywords: trigonometry, representation, communication, connection.

Introduction

Mathematics is one of the sciences that must be studied by the students. Many students find mathematics as a difficult subject to understand. Most of them have negative views beforehand that they will not be able to understand math any more when it comes to formulas that look complicated. Based on the research that has been done by previous authors obtained data that trigonometry is the most difficult material to understand because the students consider it too abstract. Actually, these difficulties can be minimized by improving low math skills. The ability

to learn mathematics itself is divided into 5 parts (NCTM) that is problem solving ability, reasoning ability, communication ability, connection making ability, and representation ability. In this article will only be discussed more deeply related to the three abilities in learning mathematics namely: mathematical representation, mathematical communication and mathematical connections. With this research, researchers can understand the weakness of mathematics skills of each student so that it can immediately overcome in order to get the maximum learning for the students.

Theory

A. Theory of Mathematical Representation

Representation ability is a way that students use to communicate ideas, or answers the problem (Nurhayati, 2013). In order to communicate something (e.g. a math problem) a student needs drawings, graphs, diagrams and other representational forms. It is expected that with representation, the problem that initially looks difficult to solve becomes easier to solve because the problem can be presented more simply. Mathematical representation is very important because it can help students in organizing their thoughts when solving problems. In NCTM it is stated that representation is the center for learning mathematics. Students can develop and deepen their understanding of the mathematical concepts and relationships they make, compare, and use varied representations.

Many mathematicians categorize mathematical representations which as a whole have almost the same classification. In this article we are guided by two expert sources in the categorization of the mathematical representation capabilities, they are Jerome Bruner with

the Learning Theory as well as the grouping of mathematical representations according to Hiebert and Carpenter.

1. Jerome Bruner

a. Enactive Representation (enactive)

At this stage the child learns knowledge where knowledge is actively learned by using concrete objects or using real situations.

b. Iconic Representation (iconic)

In this type, the knowledge is represented in the form of visual imagery, drawings, or diagrams depicting concrete activities or concrete situations found in the enactive stage.

c. Symbolic Representation

At this symbolic stage, learning is represented in the form of abstract symbols, the arbitral symbols used by agreement in the field concerned, both verbal symbols (e.g. letters, words, sentences), mathematical symbols and other abstract symbols.

2. Hiebert and Carpenter

a. Internal Representation

Internal representation is closely related to the process of recovering the knowledge that has been acquired and stored in the memory as well as the relevance of the need to be used when necessary. The process of internal representation is certainly not observable and can not be assessed directly because it is a mental activity in one's mind.

b. External Representation

The results of this embodiment can be expressed either orally, written in the form of words, symbols, expressions, or mathematical notations, drawings, graphs, diagrams, tables, or physical objects in the form of props.

B. Mathematical Communication Theory

Within (1992) states that communication skills become important when discussion between students is done, where students are expected to be able to express, explain, describe, hear, ask and cooperate so as to bring students to a deep understanding of mathematics. Indicator of students' mathematical communication ability according to Ross (in Al Jupri, 2007) in the form of written communication is as follows:

- Describe the problem situation and state the problem solution using images, tables, charts, algebraically.
- Declare results in written form.
- Using a thorough representation to express a mathematical concept and its solution.
- Create a mathematical situation by providing ideas and information in written form.
- Use the language and mathematical symbols appropriately.

Indicators of spoken communication in the form of discussion are students can:

- Take an opinion on the issues discussed.
- Participate actively in responding to the opinions of other students.

- Want to ask questions if there is something that cannot be understood.
- Listen seriously when other students express an opinion so they can understand the opinion.

C. Mathematical Connection Theory

The students' mathematical connection ability is related to connecting the prior knowledge that students have with new knowledge so that the material can have profound meaning. Supporting activities in improving students' mathematical connections are when students look for linkages between mathematical topics, and look for connection between external contexts outside mathematics and pure mathematics.

Three aspects of mathematical connection ability, namely:

- Write down the problems of everyday life in the form of mathematical models.

In this aspect, students are expected to be able to connect between problems in everyday life and math.

- Write down the mathematical concept that underlies the answer.

In this aspect, students are expected to be able to write the underlying mathematical concepts of answers to understand the interrelationships between the mathematical concepts to be used.

- Write the relationship between objects and mathematical concepts. In this aspect, students are expected to be able to write the relationship between mathematical concepts used in answering the given problem.

Methodology

This research type is qualitative description research that is analyzing student answer result when doing problem in trigonometric material. Place of research is conducted at SMA Pangudi Luhur Yogyakarta on the day Thursday to Saturday of March, 14th – 16th. Object in this research is result of student answer in solving problem related to trigonometric material to know ability of representation, communication and mathematical connection of student. While the subject for this research is 5 students of class X SMA Pangudi Luhur Yogyakarta. In this study, the type of data needed is the result of the analysis of student answers in solving the trigonometric problems seen from the ability of representation, communication, and mathematical connection of students. For data collection methods, the researchers make good observations of learning in the classroom as well as observation of student activities. Second, the researchers provide a written test in the form of a matter of trigonometric material for class X. The last method of data collection is to conduct interviews to further deepen the students' intent in solving the problem. Instrument of data collection in this research is in the form of trigonometric and student interview. As for method of data analysis, researchers choose technique of data analysis from Miles and Huberman (1984) that is in the form of data reduction, data presentation and conclusion. Here are the details of the research steps:

The first step is to provide problems related to trigonometric material where in the problem contains the ability of representation, communication and mathematical connections to get the solution. This step is used to determine the problem of mathematical ability experienced by students so that later can be used by researchers to overcome the difficulties of students in learning mathematics specifically trigonometric material. The second step is that students working on the problem with their own thinking ability. Students are given the freedom to find

solutions in accordance with their knowledge. The third step is to analyze the student work. The analysis done is to notice at the stages described by the students in finding the solution of each problem. The last step taken is interviewing some students to clarify the answers they have written to avoid misinterpretations.

Results and Discussion

Student 1

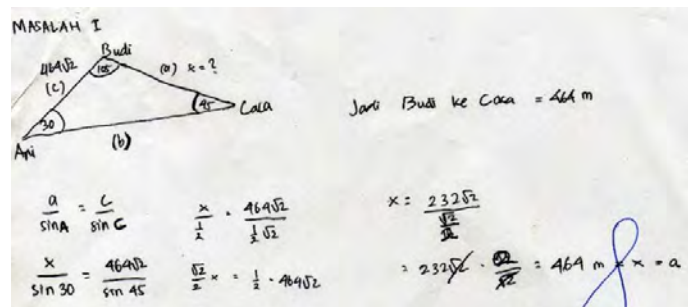


Figure 1.Results of student work 1

Student 1 used iconic representation, seen where student poured the matter into triangular image form. Student also represented the story with a symbolic matter where changing position and distance with the letters then perform calculations with the symbols that have been made and get the right solution. If viewed from an external representation, the student 1 well represented the problem visually visible from the geometry drawing it creates. Students also performed the representation of equations and mathematical expressions in solving the problem that is when doing calculations by utilizing sinus rules. Representation in the form of words is also poured though only slightly.

In written communication, student 1 communicated it in the form of images and symbols and is able to use it to solve the problem appropriately. In connection capabilities, student was able to use materials that have been previously learned as well as using properly and precisely mathematical computing to solve everyday problems

Student 2

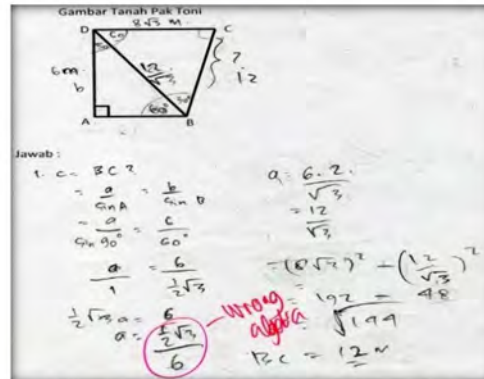


Figure 2. Results of student work 2

Student 2 tried to represent the problem symbolically with visible marks and letters of the right sign and letters that are expressed in mathematical expression even though the execution of the calculation is not yet accurate because of the algebraic problem. In written communication, student has been able to provide information from the problem on the image with precision. But in doing the calculations, there are still errors and through oral communication, student realized the inaccuracy in the completion of algebra, and from this communication can be explained the misconception in understanding the problem. Student tried to connect by connecting pythagoras theory to solve the given problem. However, due to errors in the representation then the connection that is trying to build also experienced errors.

Student 3

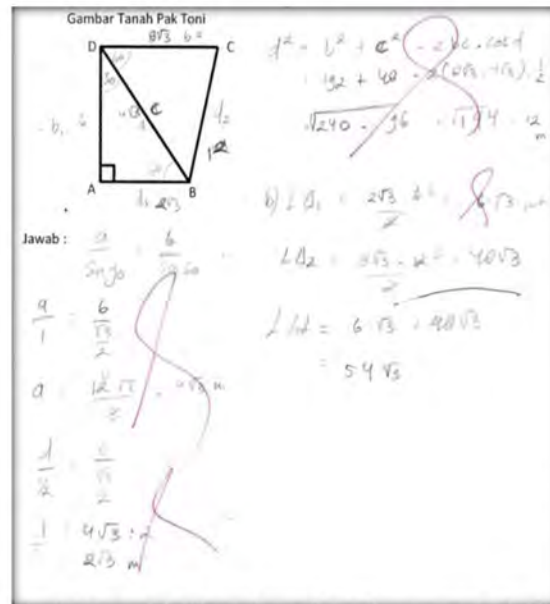


Figure 3. Results of student work 3

Student 3 tried to use symbolic representation by replacing the sides of the yard with letters. For representation in the form of mathematical expression equation is correct. This is the evident from the results of calculations that have obtained the correct solution.

In mathematical communication, student could declare problem solutions by providing precise information on images reinforced by oral communication whereby student can clearly explain each step of the settlement they take. In the ability of connections student was able to connect the knowledge that has previously owned the rules of sinus, cosine rules and the area of triangle to solve the story presented. Connection error associated with representation.

Student 4

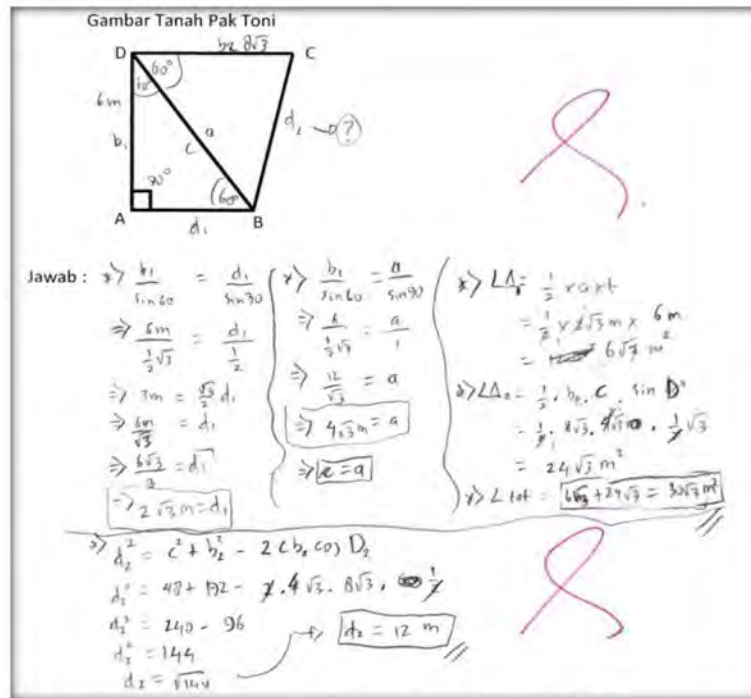


Figure 4. Results of student work 4

Student tried to use a symbol representation in which the student puts sides and corners on the yard with letters. Then with the symbols that have been selected, this students used it to perform calculations and got the results of the calculation. From an external representation, student is able to represent problem solving in mathematical expression correctly and perform calculations of the mathematical expression to get the right results.

In written communication, the student can state the solution of the problem by giving the exact description of the image. Student also has used the algebraic way of solving a and b problems correctly. In oral communication with further interviews, student is able to interpret and evaluate ideas, symbols, terms, and mathematical information as well.

Based on the results of student work is known that student is able to provide mathematical models into the form of mathematical equations that use algebraic equations correctly. The

previous relationship of mathematical concepts can be related so that it is a unity to solve math problems properly and correctly in searching the BC side of the students to relate the settlement with the sinus rules and fractional rules. Whereas in searching the total area, the student associates the area of triangle previously learned and the use of triangle using sinus based on the things that have been known.

Student 5

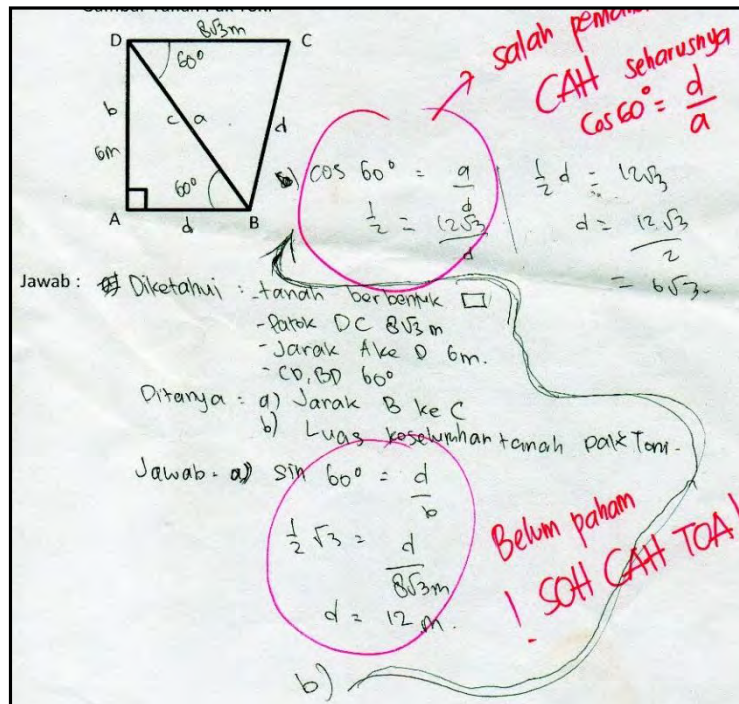


Figure 5. Results of student work 5

Student represents the problem symbolically, where student tries to change the names of the sides of each yard with letters to make it easier to calculate. Student also performs a mathematical expression representation where student solves problems by doing calculations through trigonometric comparison equations even though the student has not been able to get a correct solution. This is because student still lacks the understanding of the use of comparison of trigonometry in right triangle.

In terms of mathematical communication, student tried to pour the idea by using the representation of symbols to change the description of the image. The calculation steps that are trying to build still encounter error, this is because student has not understood the comparison of trigonometry. The symbol used is still not appropriate in calculation

In oral communication through interviews, it is acquired that student still does not understand the calculation so that there are calculations that are still come from cheating results from friends without knowing the origin of the results. In mathematical connections with relation between mathematical concepts, student has tried to relate the problem presented with previous knowledge that is owned by the comparison of trigonometry in right triangle, but since they do not understand it the students tend not to use it in daily calculation problem.

Conclusion

Based on research conducted for 5 students in SMA Pangudi Luhur Yogyakarta, we can notice that:

1. Most of student did symbolic representation correctly, in other hand external representation and equation representation still needed to be enhanced.
2. In communication, some students did not communicate well because they missed the correct representation.
3. In connection, most of students can connect their materials with prior knowledge they had but mistake happen since wrong representation.

From the explanation mentioned, researchers preserve that representation, communication and connection is related each other. Over all, most of the students still have problems in representing the problem and in building connections with the materials that have been studied.

Researchers can conclude that the students still need guidance in mathematical representation and connection through the learning process in order to improve their ability in solving the mathematics problem, particularly on trigonometry.

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AN ANALYSIS OF REPRESENTATION FORMS IN LEARNING MATHEMATICS ON THE TOPIC OF CUBOID'S VOLUME

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Abstract

This study aims to determine the forms of representation that students use in learning mathematics on the topic of cuboid's volume. The method used in this study is descriptive qualitative. Subjects in this study were 8th grade students of SMP Negeri 2 Purwosari which amounted to 31 students. The forms of data in this study are student worksheets and interviews. Based on the results of the study, the forms of representation that students use in learning mathematics on the topic of cuboid's volume are external representation and Bruner's representation. External representation consists of concrete objects representation and verbal representation. Meanwhile, Bruner's representation consists of iconic and symbolic representations.

Keywords: analysis, representation forms, cuboid's volume.

Introduction

Mathematics is one of the disciplines that can improve thinking ability and argue, contribute in solving everyday problems and in the world of work, and provide support in the development of science and technology (Susanto, 2013: 185). Learning mathematics is a sufficient condition to continue education to the next level. Because by learning math, we will learn reasoning critically, creatively, and actively. Mathematics is an abstract idea that contains symbols, then mathematical concepts must be understood first before manipulating the symbols. However, in general the mathematical abstraction, relatively not easy to understand by students.

Therefore, it takes something that can help the student to communicate the abstract mathematical concepts. One means to communicate these ideas is a mathematical representation. According to NCTM (Sabirin, 2014) representations are expressions of mathematical ideas or

ideas that students display in their quest to find a solution to the problem they are facing. With representation, problems that all look difficult and complicated can be viewed more easily and simply, so the problems presented can be solved more easily. Thus representation is important in the learning of mathematics.

Based on the above description, it is necessary to study about the forms of representation used by students in learning mathematics. This study aims to analyze the forms of representation in learning mathematics.

Understanding of Mathematical Representation

Representation is defined as a new form of translations of a problem or idea, or translation of a diagram from the physical model into symbols or words (Susanto, 2013: 216). Furthermore, Susanto explains that representation can help the child explain the concept or idea and make it easier for children to get the solving strategy. In addition, it can increase the flexibility in answering math problems. According to NCTM (in Sabirin, 2014) representations are expressions of mathematical ideas or ideas that students display in their quest to find a solution to the problem they are facing. Representation is the way one uses to communicate answers or mathematical ideas (Cai, Lane, & Jacobson in Syarifah Fadillah, 2008).

Lestari & Yudhanegara (2015: 83) explains that the ability of mathematical representation is the ability to present symbols, tables, graphs, charts, equations, or other mathematical expressions in other forms. From some of the above opinions it can be concluded that representations are expressions of mathematical ideas that students display as models or forms of substitution of a problem situation that is used to find the solution of the problem it is facing.

Forms of Mathematical Representation

Hiebert and Carpenter (in Syarifah Fadillah, 2008) argue that basically representations can be expressed as internal representations and external representations. Thinking of a mathematical idea that is then communicated requires an external representation of its form: verbal, drawing and concrete objects. Pape and Tchoshanov (2001) argue that there exists a mutually interrelated relationship between internal representation and external representation. The relationship between these internal and external representations can be illustrated as in the following figure:

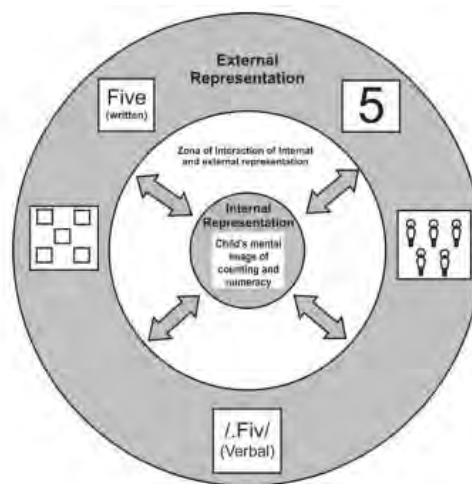


Figure 1. Relationship between Internal and External Representation

Bruner (Luitel, in Wiryanto, 2014), distinguishes three types of mental representational models, namely enactive representations, iconic representations, and symbolic representations:

- a. Enactive representation is a motor sensory representation formed by action or movement. At this stage the representations made through the actions of the child are directly involved in manipulating (tinkering) objects. At this stage the child learns a knowledge where knowledge is actively learned by using concrete objects or using real situations, and children without the use of imagination or words. He will understand something from doing or doing something.

- b. Iconic representation relates to image or perception, which is a learning stage where knowledge is represented in visual images, verbal visuals, drawings, or diagrams depicting concrete activities or concrete situations in the enactive phase. Language becomes more important as a medium of thought.
- c. Symbolic representation deals with the language of mathematics and symbols. The child is no longer associated with objects as in the previous stage. Children are able to use notation without dependence on real objects. At this symbolic stage, learning is represented in the form of abstract symbols, the arbitral symbols used by agreement in the relevant field, both verbal symbols, mathematical symbols and other abstract symbols.

Methodology

The type of this study is descriptive research with qualitative approach. The study was conducted on Monday, March 13, 2017 at SMP Negeri 2 Purwosari. Subjects in this study were 8th grade students, amounting to 31 students. Analysis to see the emerging forms of representation performed on each activity. In first and second activity, the analysis was conducted thoroughly for the subjects in the class of 31 students who had been divided into 5 groups. Meanwhile, on third activity analysis is only done on 5 subjects. These five subjects are selected based on students' activeness during the learning process. The object of this study is the forms of representation in mathematics learning on the topic of cuboid's volume.

The main instrument in this study is researcher and its supporting instrument are Hypothetical Learning Trajectory (HLT) and Student Worksheet. Technique of collecting data in this study are participant observation and test. Data obtained from the implementation of learning and tests were analyzed. This analysis aims to describe the forms of representation that appear in the learning process.

Results and Discussion

The topic constructed in this study is cuboid's volume. The core activities in the learning process are divided into 3 activities as follows:

a. Activity 1

In the first activity, students are asked to explain the following issues:

There are two cuboids containing 40 unit cubes and 300 unit cubes.

1. Determine the number of unit cubes that fill the cuboids!
2. Explain how to calculate it!
3. Describe the relationship with the length, width and height of the cuboids.

b. Activity 2

In second activity, students are asked to explain the following issues:

Miss Tini has 12 unit cubes.

1. Determine the size, width, and height of the cuboids that may be formed from those cubes!
2. Explain your reasons!

c. Activity 3

In the third activity, students are asked to solve two questions. The questions are given to measure the extent to which students' understanding of the studied volume of the cuboids has been studied. The two questions are:

1. Adi has a tub shaped with a length of 9 m, width 7 m, and height 5 m. The tub will be filled with water. How much water does it take to fill $\frac{2}{3}$ of Adi's tub? (Express in liter!)

2. Miss Anisa wants to make a storage area of rice in the form of a cuboid. If she wants the storage area to hold 30 liters of rice, what is the height of the storage area if the length and width are 50 cm and 20 cm respectively?

Activity 1

The first activity aims to direct students to discover the concept of cuboid's volume. In this activity, each group is asked to determine the number of unit cubes that fill a cuboid. The researchers provided two blocks each containing 40 unit cubes and 300 unit cubes. The first cuboid containing 40 unit cubes is used interchangeably by groups 1, 2, 3, and 5. While the second cuboid containing 300 unit cubes is used by group 4. The following representation forms appear in the first activity:

1. External Representation

- a. Concrete Objects

Students are directly involved in manipulating objects in the form of cuboids containing a number of unit cubes. Students use concrete objects in the form of cuboids containing a number of unit cubes to build the concept of cuboid's volume.



Figure 2. Students observe cuboid containing 300 unit cubes

b. Verbal

Students explain how they determine the number of unit cubes that fill the cuboid that they had previously held. Students also explain the relationship between the way they calculate the length, width and height of the cuboid.



Figure 3. Students explain how to determine the number of unit cubes

2. Bruner's Representation

a. Enactive Representation

Students are directly involved in manipulating objects in the form of cuboids containing a number of unit cubes. Students use concrete objects in the form of cuboids containing a number of unit cubes to build the concept of cuboid's volume.



Figures 4 & 5. Students observe cuboids containing 40 unit cubes

b. Symbolic Representation

i. Mathematical Statements

Symbolic representation of mathematical statements appears in the first activity. Students can explain the relationship between the way they calculate the length, width and height of the cuboid. The following interaction of researchers and students represented by group 5:

R: "How do you determine the number of unit cubes that fill this cuboid?"

S: "The first step is to determine the number of unit cubes contained at the top level."

R: "What is the number of unit cubes at the top level?"

S: "The number of unit cubes at the top level is 20 and is obtained from 5×4 ."

R: "How many unit cubes that filled this cuboid?"

S: "The number of unit cubes that meet this block is 40 obtained from $20 + 20$ or 2×20 ."

R: "Why $20 + 20$ or 2×20 ?"

S: "Because there are 2 levels."

R: "What kind of flat builds that formed by the unit cubes at the top level?"

S: "Rectangle."

R: "Then what does 20 represent on a rectangle?"

S: "The area of the rectangle?"

R: "The area of the rectangle was obtained from?"

S: "Area is obtained from length $\times$ width."

R: "The number of levels actually represents what?"

S: "High."

R: "So to calculate the number of unit cubes that meet this cuboid can be done with?"

S: "Multiplying the number of levels by the number of unit cubes at each level, where many levels represent the height and number of unit cubes at each level representing the area of the rectangle (length $\times$ width).

ii. Mathematical Symbols

Symbolic representation occurs when researchers ask students to write down how they determine the number of unit cubes that fill the cuboids. Students use mathematical symbols related to volume cuboid. Visible students use V, p, l , and t as symbols for volume, length, width, and height.

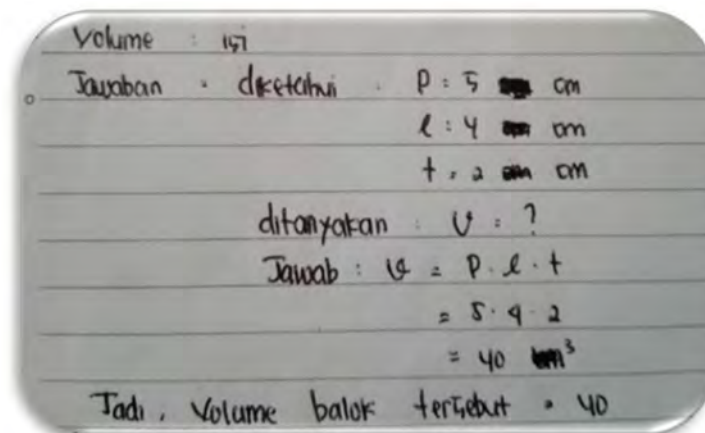


Figure 6. Results of one group's work for the first activity

Activity 2

1. External Representation

a. Concrete Objects

Students directly involved in manipulating (tinkering) objects in the form of unit cubes numbered 12 units. Students use concrete objects in the form of unit cubes to determine the size, width, and height of the cuboids that may be formed from the 12 unit cubes.



Figures 7 & 8. Students form cuboid of 12 unit cubes

b. Verbal

After direct involvement in manipulating cuboids containing a number of unit cubes, students explain how they determine the length, width, and height of the cuboid that may be formed from the 12 unit cubes.

2. Bruner's Representation

a. Enactive Representation

Students directly involved in manipulating (tinkering) objects in the form of 12 unit cubes. Students use concrete objects in the form of unit cubes to determine the size, width, and height of the cuboids that may be formed from the 12 unit cubes.



Figure 9 & 10. Students form cuboid of 12 unit cubes.

b. Symbolic Representation

i. Mathematical Statements

Symbolic representations of mathematical statements appear in the second activity. Students can use the concepts of factor to determine the length, width, and height of the blocks they will form from the 12 unit cubes. The following interaction of researchers and students represented by group 3:

R: "Have you formed a block?"

S: "It's Miss. We have 3 forms of cuboids."

R: "How do you determine the length, width, and height of the cuboid?"

S: "By trial and error. Because the volume is 12 then we have to find 3 numbers which when multiplied the result is 12. Well, the three numbers each represent the length, width, and height. "

R: "There is no relationship between the numbers with 12?"

S: "Relationship? What do you mean? "

R: "You guys say that 3 numbers are multiplied by 12. Which means those numbers are what 12?"

S: "Oh, a factor of 12 Miss."

P: "Then to make it easier, what do you do now?"

S: "Registering factors of 12 Miss."

P: "Good. What are the 12 factors? "

S: "1,2,3,4,6, and 12?"

P: "Okay, now please specify the length, width, and height using the combination of the numbers?"

ii. Mathematical Symbols

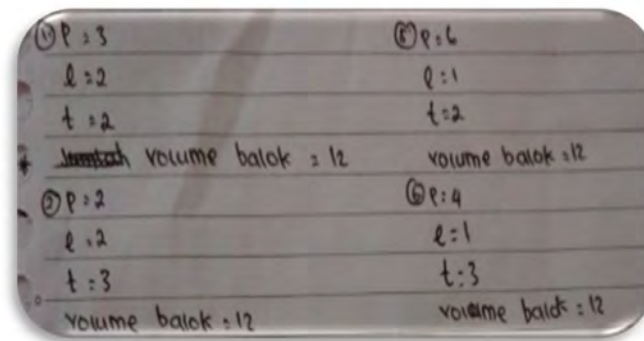


Figure 11. Result of work of one group for the second activity

Symbolic representation occurs when the researcher asks students to write down the number of cuboids they can shape by using the 12 unit cubes distributed to them. Students use mathematical symbols related to cuboid's volume. Visible students use V, p, l , and t as symbols for volume, length, width, and height.

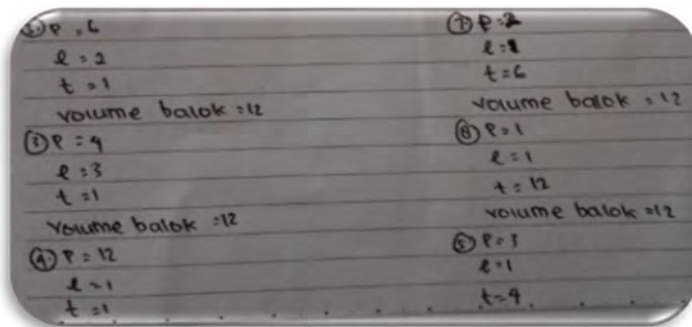


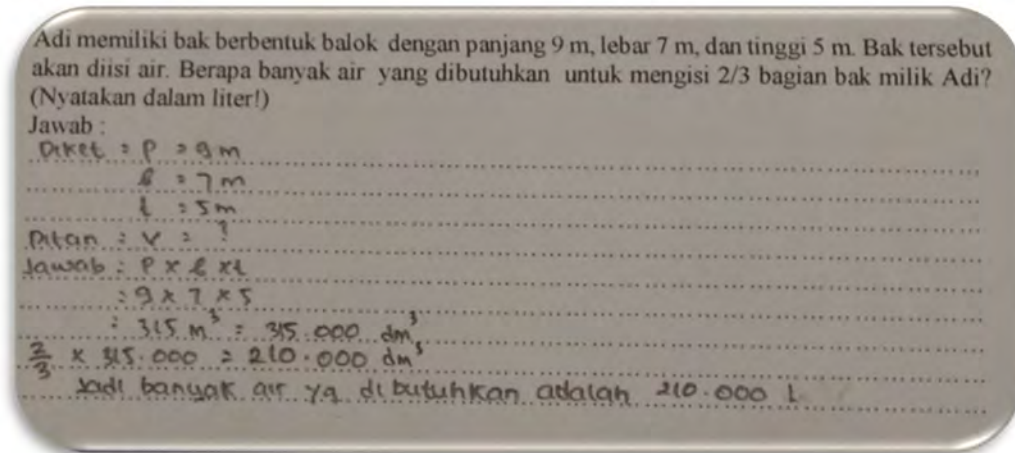
Figure 12. Result of work of one group for the second activity

Activity 3

1. Bruner's Representation

Bruner's representation that appears in the third activity is a symbolic representation. S1, S2, S3, S4, and S5 use mathematical symbols relating to volume to represent elements that are known and asked in question. S1, S2, S3, S4, and S5 using V, p, l , and t as

symbols for volume, length, width, and height. Broadly speaking, the results of the work of the five subjects have similarities in the process of completion. Therefore, researchers only show S5 work only.



Adi memiliki bak berbentuk balok dengan panjang 9 m, lebar 7 m, dan tinggi 5 m. Bak tersebut akan diisi air. Berapa banyak air yang dibutuhkan untuk mengisi $\frac{2}{3}$ bagian bak milik Adi? (Nyatakan dalam liter!)

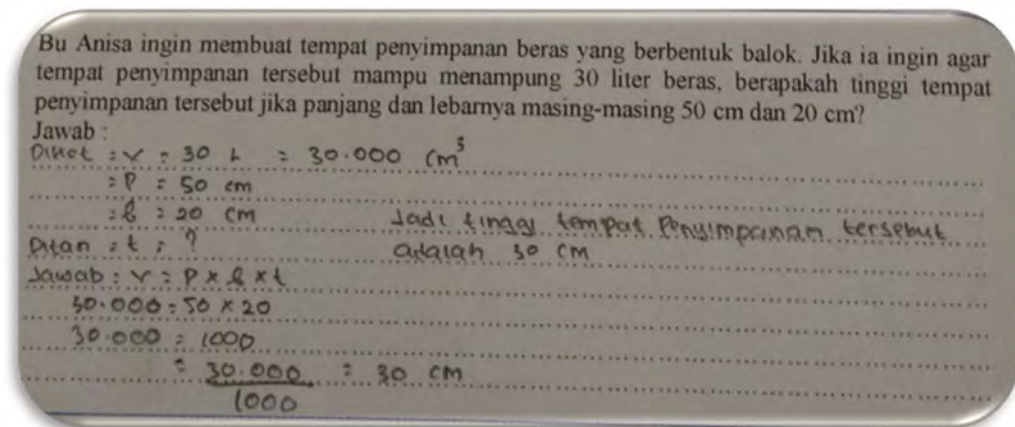
Jawab :

Diket : $p = 9 \text{ m}$
 $l = 7 \text{ m}$
 $t = 5 \text{ m}$

Dit : $V = ?$

Jawab : $V = p \times l \times t$
 $= 9 \times 7 \times 5$
 $= 315 \text{ m}^3 = 315.000 \text{ dm}^3$
 $\frac{2}{3} \times 315.000 = 210.000 \text{ dm}^3$
 Jadi banyak air ya dibutuhkan adalah 210.000 l

Figure 13. Result of S5's work for question number 1 on third activity



Bu Anisa ingin membuat tempat penyimpanan beras yang berbentuk balok. Jika ia ingin agar tempat penyimpanan tersebut mampu menampung 30 liter beras, berapakah tinggi tempat penyimpanan tersebut jika panjang dan lebarnya masing-masing 50 cm dan 20 cm?

Jawab :

Diket : $V = 30 \text{ L} = 30.000 \text{ cm}^3$
 $p = 50 \text{ cm}$
 $l = 20 \text{ cm}$

Dit : $t = ?$

Jawab : $V = p \times l \times t$
 $30.000 = 50 \times 20 \times t$
 $30.000 = 1000t$
 $t = \frac{30.000}{1000} = 30 \text{ cm}$

Jadi tinggi tempat penyimpanan tersebut adalah 30 cm

Figure 14. Result of S5's work for question 2 on third activity

Conclusion

Based on the data analysis can be concluded that the forms of representation that appear in the learning of mathematics on the topic of the cuboid's volume is an external representation, enactive representation, and symbolic. In the first and second activity the emerging form of representation is an external, enactive, and symbolic representation. While the activity of the 3 forms of representation that emerges is a symbolic representation only. In this study, the form of internal representation does not appear. This is because researchers do

not conduct in-depth interviews on the subject of research. Therefore, researchers who will conduct similar research should conduct in-depth interviews and prepare test questions that can elicit various forms of representation.

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ANALYSIS OF STUDENTS' MATHEMATICAL COMMUNICATION SKILL FOR ALGEBRAIC FACTORIZATION USING ALGEBRA BLOCK

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Abstract

Based on the results of interviews from teachers, students' mathematical communication skills in algebraic factorization are lacking. This can be reinforced from the observation of the two classes, the students are less responsive to the material given by the teacher. The activities of the students in the classroom are only listening and writing, because the teacher uses the conventional method. The research was conducted at SMP BOPKRI 1 Yogyakarta in grade VIII students. There are 6 students who were taken randomly in this research. This research is a qualitative descriptive research. This research aims to analyze students' mathematical communication skills in algebraic factorization using Algebra Block props. In this study there are 3 indicators of students' mathematical communication skills. The students' mathematical communication skills are related to the cognitive and psychomotor aspects. If the cognitive and psychomotor aspects are good, then the students' mathematical communication skills are also good. After using Algebra Block, students' mathematical communication skill fulfills 3 indicator of mathematical communication skill which is expected. The results of this analysis are reinforced by student questionnaire which states that students are more helpful in solving algebraic modeling using Algebra Block. The results of this analysis can be used to change the method of learning so that students' mathematical communication skills will be better.

Keywords: Mathematical communication skill, Algebra Block, Analysis mathematical communication skill.

Introduction

During this time, learning math focuses more of calculations. Other aspects of mathematics learning are not applied like students mathematical communication skills. Communication is one of five standard process in NCTM (2000): (1) solving problems, (2) reasoning and proof, (3) communication, (4) connection, and (5) representation. With communication, students can express their own ideas. So, the use of students' mathematical communication skill is to understand, interpret, express, respond, and use mathematical symbols to present ideas in oral

and written form. The results from the observation of the researchers in two classes: students do not respond to the material given by the teacher, and the activities of students are only hearing and writing, because the teacher only uses conventional methods. This is reinforced by the results of interviews to students. Students say that math is difficult to understand, especially Algebra. Therefore, in this study we will take the material for factoring algebra with the use of Algebra book. Algebra block is a tool in the form of pieces of flat-shaped paper (square and rectangle) which will be arranged in accordance with the given algebraic form. Expectation by using Algebra Block, students will understand the material Factoring the Algebra, so that the students' mathematical communication skills will improve.

Mathematical Communication Skills

Opinions on how important communication in mathematics learning is proposed by NCTM (2000) which states that mathematics learning program should give opportunity to students to (1) arrange and link their mathematical thinking through communication, (2) communicating their logical and clear mathematical thinking to their friends, teachers and others; (3) analyze and assess mathematical thinking and strategies used by others; (4) using mathematical language to express mathematical ideas correctly. According to LACOE (2004), mathematical communication includes both written and oral or verbal communication.

Indicators of mathematical communication skills according to NCTM are as follows: (1) skill to express mathematical ideas through oral, written, and demonstrating them and visualizing them visually; (2) skill to understand, interpret, and evaluate mathematical ideas both orally and in other visual forms; (3) skill to use terms, mathematical notations and structures to present ideas, describe relation, and situational models. While Greenes and Schulman (1996) write the mathematical communication skill in three things :(1) expressed mathematical ideas through

speech, writing, demonstration, and portraying them visually in different types, (2) understand, interpret, and assess the ideas presented in writing, orally, or in visual form, and (3) construct, interpret and connect diverse representation of ideas and relation.

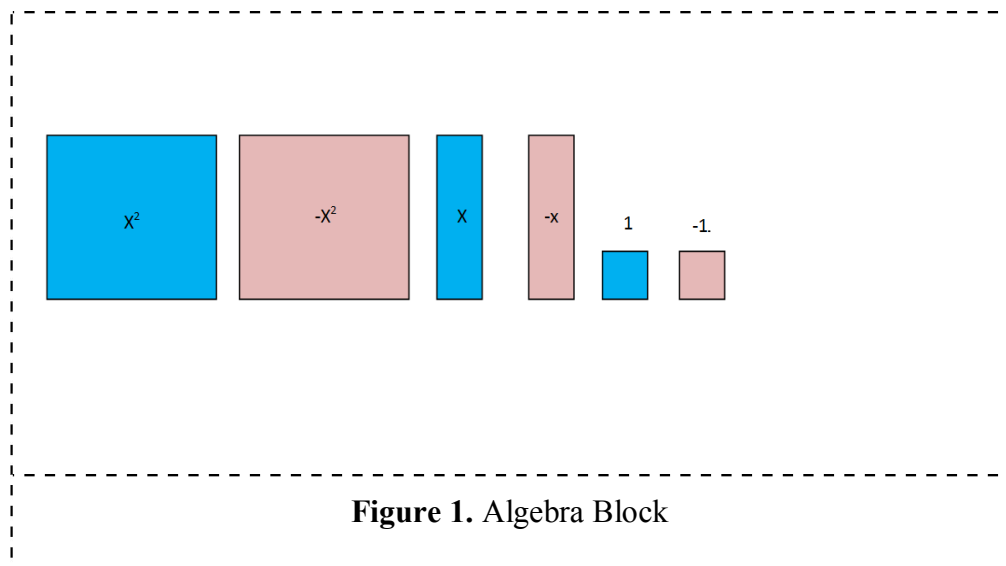
From some opinions about mathematical communication indicator above there are similarities between indicators to be used in this research, (1) expressing mathematical ideas in oral or written form, (2) understand, interpret and assess or respond to mathematical ideas in oral and written form, (3) using terms, notations, and symbols to present mathematical ideas in oral and written form. For more details can be seen in Table.1 below.

Table 1. Indicator of Mathematics Communication Skill

Communication Form	Indicator
Expressing mathematical ideas.	Students can express mathematical ideas in oral and written form.
Understand, interpret and assess or respond to mathematical ideas.	Students can understand, interpret and assess or respond to mathematical ideas in oral and written form.
Using terms, notations, and symbols to present mathematical ideas.	Students can use terms, notations, and symbols to present mathematical ideas in oral and written form.

Algebra Block and How to Use It

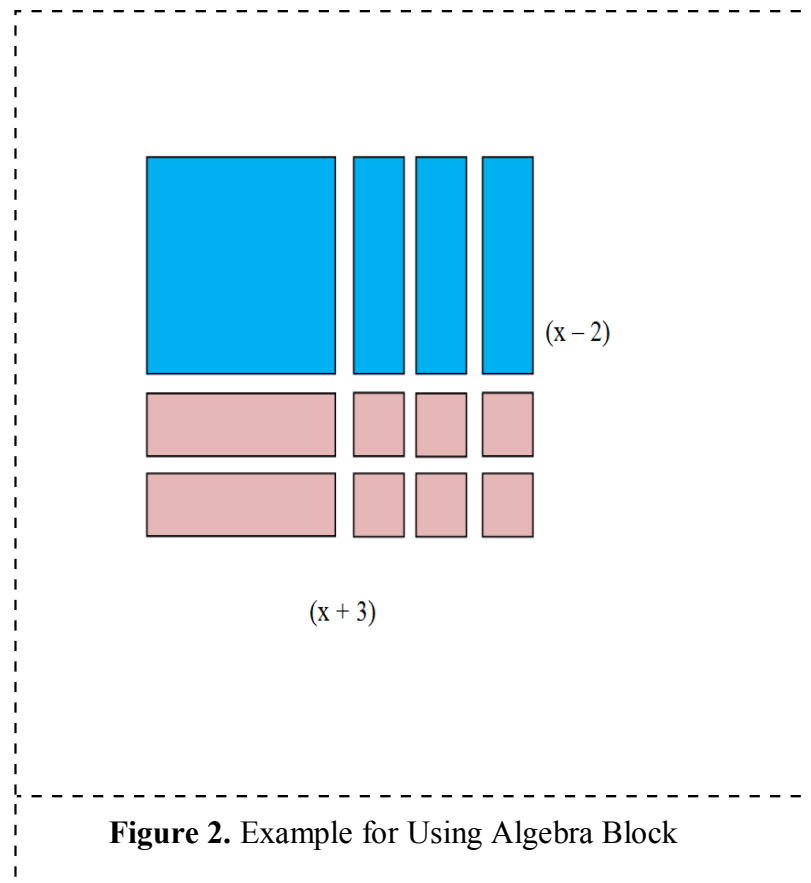
Algebra block is a prop in the form of pieces of flat-shaped paper (square and rectangle) which will be arranged according to the given algebraic form. For more clear by information can be seen below in **Figure.1**.



The pieces of paper above can be arranged into square or rectangles according to the given algebraic form. The steps of constructing algebraic blocks are as follows.

- 1) Identify coefficients of each variable and constant whether positive or negative in algebra form.
- 2) Select or put pieces of paper according to coefficients and constants.
- 3) Arrange the pieces of paper to form a square or rectangles shape.
- 4) Determine the length and width of the square or rectangle formed.

For example, an algebraic form $x^2 + x - 6$, the possible arrangement of algebraic blocks is as follows.



After the arrange of algebra blocks into square or rectangles, the next step determines the length and width. **Figure 2** shows that the length is $(x + 3)$ and width is $(x - 2)$. So the algebraic factorization of $x^2 + x - 6$ is $(x - 2)(x + 3)$.

For factoring algebraic form using the distributive, it would be easier if you see blocks of algebra that has been formed. We see in **Figure 2**, pieces of build geometry (square or rectangle). There is one large blue square means that the representation of x^2 , then there are 3 pieces of blue rectangle is a representation of $3x$, then 2 pieces of red rectangle representation of $-2x$, and there are 6 small squares of red which are representations of constants -6 .

$$\begin{aligned}
x^2 + x - 6 &= x^2 + 3x - 2x - 6 \\
&= (x^2 + 3x) - (2x + 6) \\
&= x(x + 3) - 2(x + 3) \\
&= (x + 3)(x - 2)
\end{aligned}$$

Analysis of Mathematical Communication Skill

In this research, the students' mathematical communication skills were analyzed. The students' mathematical communication skill is the skill to understand, interpret, express, respond, and use mathematical symbols to present ideas in oral and written form. This skill is related to the cognitive and psychomotor aspects. The cognitive aspect in this study is knowledge of algebraic factorization. While for psychomotor aspect in this research is student skill in applying knowledge about algebraic factorization using Algebra Block. Both aspects are related to determining students' mathematical communication skills. If the cognitive aspects of the students are good, then to apply in psychomotor aspects on the use of Algebra Block props will look good. This is based on David Ausubel's Cognitive Theory. According to Ausubel the type of learning is 3, that is (1) learn with meaningful discoveries, (2) learning with invention is meaningless, and (3) learn to receive a meaningful expository. From the three types of learning, this study takes the type of learning number one that is learning a meaningful discovery by combining the knowledge possessed with learning materials learned. Or, students discover the knowledge of what they learn and then the new knowledge is combined with past knowledge.

In this case the students understood algebraic factorization, then the knowledge is combined with the use of Block Algebra for factoring algebraic form for easier, and without the use of conventional methods. This analysis is based on student questionnaire results, student work results, and student reasoning. The students' mathematical communication skills are good if the reasoning and skills are good.

Methodology

This research is a qualitative descriptive research. The research was conducted in August 2017. The research was conducted at SMP BOPKRI 1 Yogyakarta. Subjects in this study were students of class VIII taken at random from 2 parallel classes. The instrument in this study is divided into two main instruments and supporting instruments. The main instrument is the researcher, while the supporting instrument consists of Algebraic Factorization test using Algebra Block and questionnaire. Data collection techniques used observation techniques, interviews, written tests, and questionnaires. Data analysis techniques in this study in accordance with the disclosed Miles and Huberman which includes data reduction, data presentation, and withdrawal of conclusions.

Results and Discussion

In this discussion, will be discussed students with mathematical communication skills high, medium and low. The selection of students with high, medium and low mathematical communication skills is based on observations during the learning process and the students' initial ability derived from the results of last semester class test. Obtained by students with the highest ability that is S6 with result 84,375; students who have medium mathematical

communication ability that is S1, S3, S4 and S5 which value almost same that is 75; and students who have the lowest mathematical communication skill that is S2 with result of 66,25.

A. Students' with High Mathematical Communication Skill (S6)

When the research go on, S6 is not active, not much to ask, and faster to arrange the Algebra Block. S6 is more like working individually and when really having trouble ask the teacher to help solve questions 5 and 6. Here's an interview during the guidance:

S6 : Mom, why can not this be compiled? This coefficient is negative. Hard to set up.

Teacher : If it is difficult to be formed into a square or rectangular building, then it can add pieces of wake geometry the condition should be zero.

S6 : Ooo ... this must be blue and red, ma'am? A pair?

Teacher: Why a pair?

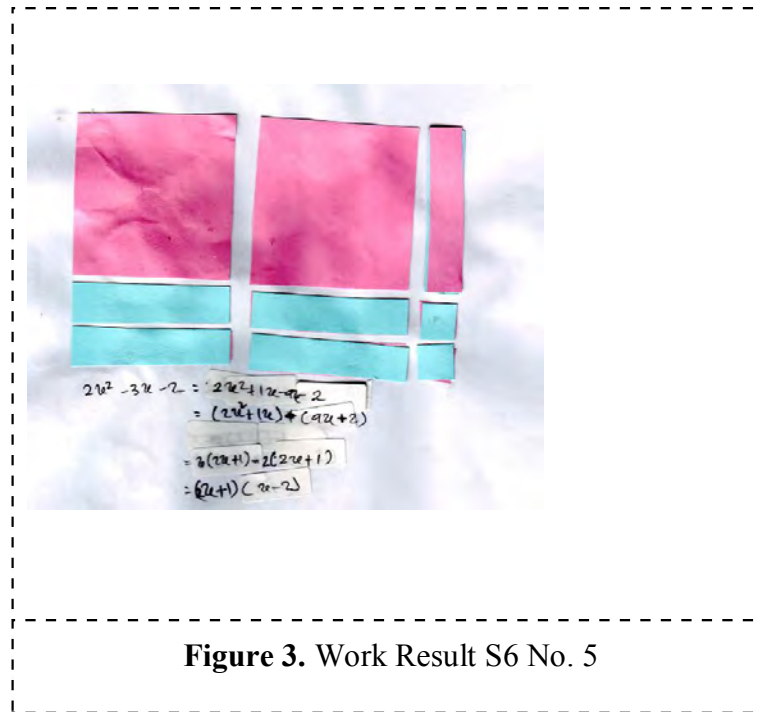
S6 : for example take $-x$ and x , if it adds zero.

Teacher: Ok. That's right.

From the results of the conversation, it appears that students have good reasoning and in accordance with the expected mathematical communication. Psychomotor aspects are also good, can be seen from how to arrange the Algebra Block into a square or rectangular build, so that the arrangement will look neat. The psychomotor aspect is concerned with how to factoring algebraic forms using distributive.

When the teacher asks S6, to explain the results of the number 5, S6 is able to explain from the taking of the pieces of paper, then the way the algebra block is compiled and the

result of its factoring. S6 has also been able to explain the algebraic factorization with the distributive based on the algebraic blocks formed. This indicates that S6 has met 3 indicators of mathematical communication skill that have been determined.



B. Students' with Medium Mathematical Communication Skill (S1, S3, S4, S5)

In this research, students with medium mathematical communication skills are there are some students, namely S1, S3, S4, and S5. When the learning process takes place, the cognitive aspects that include reasoning ability and understanding are almost the same. The psychomotor aspect of applying algebra blocks to the concept of algebraic factorization is same. They have difficulty in arranging algebra blocks especially in negative x coefficients and negative constants to add algebraic blocks of extent x still need help. As well as in arranging into a square or rectangular shape still needs guidance. In the case of numbers 5 and 6, the algebra blocks of x^2 extent are 2. So the students need guidance to compile into a square or rectangular build. From the algebra blocks obtained, students in algebraic

factorization using distributive method still need guidance. So the ability of application from image to nature of distributive still less. So it can be concluded that students' mathematical communication skills are still lacking.

5. $2x^2 - 3x - 2 = (2x+1)(x-2)$

$$\begin{aligned}
 & \Rightarrow 2x^2 - 3x - 2 \\
 & = 2x^2 + 1x - 4x - 2 \\
 & = (2x^2 + 1x) - (4x + 2) \\
 & = x(2x + 1) - 2(2x + 1) \\
 & = (x - 2)(2x + 1)
 \end{aligned}$$

Figure 5. Work Result S6 No. 6

6. $2x^2 + 3x - 2 = (2x-1)(x+2)$

$$\begin{aligned}
 & \Rightarrow 2x^2 + 3x - 2 \\
 & = 2x^2 + 4x - 1x - 2 \\
 & = (2x^2 + 4x) - (1x + 2) \\
 & = 2x(x + 2) - 1(x + 2) \\
 & = (2x - 1)(x + 2)
 \end{aligned}$$

Figure 6. Work Result S6 No. 6

C. Students' with Low Mathematical Communication Skill (S2)

In preparing the Algebra Block S2 many ask for guidance and take a long time in doing. S2 is still confused to determine the number of square and rectangular geometry to build the Algebra Block. In determining the length and width of the rectangle of the build order of geometry also still need to be guided. In fact, the determination of length and width is a factor of the given algebraic form. In algebraic factorization by means of distributive of algebraic blocks that are formed still need guidance. It is seen that the cognitive aspects of S2 are still lacking that is not understood the concept of algebraic factorization, and psychomotor aspect is also still less marked by not yet able to apply its knowledge in Algebra Block. Because the ability to understand the concepts and skills of Algebra Blocks is still lacking, this has an impact on the mathematical communication skill. The skill of mathematical communication S2 is still low, seen when explaining the results of his work is still unclear because the knowledge is still lacking. In presenting the results of the work, S2 still needs help from the teacher.

5. $2x^2 - 3x - 2 = (2x+1)(x-2)$

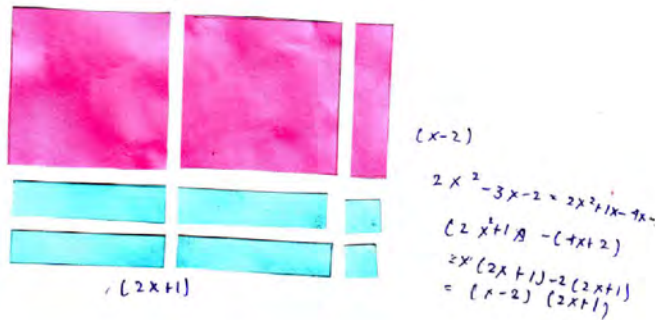


Figure 7. Work Result S5 No. 5

6. $2x^2 + 3x - 2 = (2x-1)(x+2)$

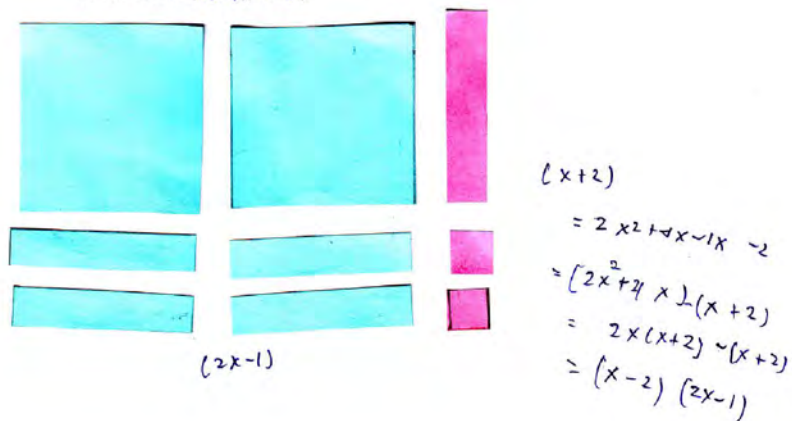


Figure 8. Work Result S5 No. 6

Tabel 2. Recap Analysis of Student Mathematical Communication Skills.

Indicator	Subject					
	S1	S2	S3	S4	S5	S6
• Students can express mathematical ideas in oral and written form.	v		v	v	v	v
• Students can understand, interpret and assess or respond to mathematical ideas in oral and written form.	v	v	v	v	v	v
• Students can using terms, notations, and symbols to present mathematical ideas in oral and written form.						v

Conclusion

Cognitive and psychomotor aspects are high, the students' mathematical communication skill is also high. So that impact on the provision of guidance on the learning process. While students with cognitive and psychomotor aspects are low, the students' mathematical communication skill is also low. Therefore, in the learning process students with low communication skills in the learning process needs special guidance.

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CHARACTERISTICS ANALYSIS OF LEARNING MODEL USING THE CONTEXT OF REFLECTIVE PEDAGOGY PARADIGM

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Abstract

To get the right model, we need to know the learning model with what characteristics can be applied in class. Therefore, analyzing the characteristics of learning model that appropriate to be implemented in Elementary Statistics Course in Class A based on the context in Reflective Pedagogy Paradigm becomes the purpose of this research. This research was conducted from August to December 2016, which are 33 students who take Elementary Statistics course in Class A become the subjects. Data of the context were analyzed qualitatively which were collected through open questionnaire, directly interview, study program document, and SIA document. The findings of this research showed that based on the context, the learning models which can be implemented in Elementary Statistics course in Class A are learning models that have the following characteristics: Can be implemented in class which the students have heterogeneous capabilities and origin; Students can interact and cooperate with each other; Learning self-direction becomes the main thing; Real problem becomes a starting point in learning; The learning challenges students' knowledge, attitude and the students' competence through the problem; Can facilitate the success of problem-solving ability, communication, cooperation, and interpersonal skills; Students can construct their knowledge.

Keywords: reflective pedagogy paradigm, context, characteristics of learning model.

Introduction

The learning process will be success if it is effective and efficient. To create an effective and efficient learning process, a teacher has to design a learning process that is suitable for students' condition and the purpose of the learning. One of the important thing in designing of the learning process is determining a model that can be applied without ignoring the important aspects of learning, those are the purpose of learning, the context of the students, and the topic of the subject.

Suparno (2014) said that we can choose an appropriate learning model through the context. Reflective Pedagogy Paradigm, with five elements: context, experience, reflection, action, and evaluation, is a paradigm that considers about the context in the learning process. The context in

RPP consists of four things, those are students' context (family, friends, origin); social, economic, political and cultural; the institutional environment of the school of learning center; the initial concept of students (value, understanding). Through this context, the teacher knows the life experience of the learner. In this way, the teacher can adapt the lesson in light of students' circumstances. Suparno (2014) said that context is very important because context can influence in determining experience and model that will be implemented in the learning process. If the learning process is suitable with the context then students can understand the subject easily. But before we determine the model, we need to know the learning model with what characteristics can be applied in class, and it can be analyzed through the context. Through context in Reflective Pedagogy Paradigm, the researcher will analyze the characteristics of learning model that appropriate to be implemented in Elementary Statistics Course in Class A.

Theoretical Construct

A. Context in Reflective Pedagogy Paradigm (RPP)

Suparno (2015) said RPP is a paradigm that has long been done in Jesuit education. The learning process using the Reflective Pedagogy Paradigm in one cycle consists of five stages. The three main stages in a PPR cycle are experience, reflection, and action. The other two stages are context and evaluation, done before and after the three main elements. The context is done before the three main stages are performed and it is the main component in the RPP's cycle that is done early in the cycle. Through this context, the teacher can create an atmosphere for learning that is suitable for the student's own life situation. According to Caruana (2014), "Context is the first principle which anchors the rest of the teaching and learning experiences of both learners and faculty." Suparno (2014) said that context will influence the choice of experience and also the learning

model that will be used. Context also can inform about students' background. Because of that, the context in RPP's cycle is very important.

There is some information in a context that needs to be explored. This information can be used for teacher in knowing the learning model with what characteristics can be applied. Suparno (2014) said that there is the information in RPP's context that must be known, those are student context (family, friends, origin), social, economic, political and cultural, the institutional environment where students study, the initial concept of students (value, understanding), and Indonesian Education context.

ICAJE in Caruana (2014) defines the context in RPP are students' life, socio-economic, political and cultural context, the institutional environment of the school of learning center, what the acquired concepts of students bring with them to the start of the learning process. Korth (2008) stated, "We as faculty need to understand the world of our students, including ways in which family, friends, social pressures, politics, economics, media and other realities." Based on the above opinions, it can be concluded that the context information that needs to be considered are:

1. Student's context

As the first step, teacher requires learning students' live. For example, the occupation of their parents, family, friends, or origin.

2. Social, economic, political and cultural

Caruana (2014) said that Societal and cultural beliefs and norms are patterns that perpetuate the values that bind together institutions and individuals. The political-ethical context explores the notions of the obligations of a democratic society and

the structural equalities and inequalities that are found in our past and current definitions of social roles.

3. The institutional environment of the school of learning center

The context that can be explored in the institutional environment of the school of learning center is about the vision of the institution or study program. Not just about the vision of the institution where students learn but can also be seen more narrowly related to the purpose of syllabic based goals of the learning and the learning outcomes.

4. The initial concept of students (value, understanding)

Student's understanding of the concept is needed for the teacher. Through this information, the teacher can know the deepening of student's concept and can decide the way to give the material.

B. Learning Model

The learning model is a plan or pattern that can be used to make the curriculum (long-term learning plan), design learning materials, and guide learning in class or otherwise (Joyce and Weil, 1980: 1). Rusman (2012) said the teacher can choose a learning model that suitable and efficient for achieving the education purpose. Before we decide what the learning model that the teacher will use, there are some things that need to be considered, those are:

1. The purpose that will be achieved

The questions that can be proposed are what is the purpose of learning that to be achieved according to the competence, personality, social and the vocational

competence of students, how the complexity of the learning model that will be achieved, are they needed academic skills to achieve the purpose.

2. The topic or the subject matter

The questions that can be proposed are is the subject matter in the form of facts, concepts, laws or certain theories, do we need the precondition in learning the subject matter, are the sources available.

3. The students

The questions that can be proposed are does the learning model suitable with the level of development of students, does the learning model suitable with the interests, talents, conditions of the students, does the learning model suitable with the students' learning style.

4. Non-technique

The questions that can be proposed are do we need another method to achieve the learning purpose, does the model have value effectiveness?

Methods

This research was conducted from August to December 2016 with the number of subjects were 33 students who take Elementary Statistics course in Class A. The data, which were collected through open questionnaire, interview, observation, study program document and SIA document, are analyzed descriptively with the qualitative approach. Open questionnaire and directly interview is used to collect data about students' origin, students' major in senior high school and students' understanding of statistics. Vision of mathematics education study program and syllabus, subject's goal and the learning outcomes, are collected using study program

document while SIA document is used to collect social context data and students' GPA. The technique that is used for analyzing is interactive technique. According to Miles and Huberman (1984), this technique has three activities, those are data reduction, data display, and verification.

Findings and discussions

The following presents the findings related to context and learning model's characteristics analysis in Elementary Statistics Course in Class A.

A. Context in RPP

There is some information that can be explored in RPP to know the context, those are:

1. Students' context

The information that is explored in students' context consists of the origin and also the students' major in senior high school. The following is the data regarding students' origin:

Table 1. Students' Origin	
Origin	Number of Students
Special Region of Yogyakarta	6
Central Java	10
West Java	2
West Borneo	5
South Borneo	1
East Borneo	1
Bali	2
NTT	4
Bangka Belitung	1
Riau	1
South Lampung	1

From the data, we get information that 53% students come from Java, 20% come from Kalimantan, 6% come from Bali, 12% come from NTT, 3% come from Bangka Belitung and 6% come from Sumatera. It means 47% students do not understand Javanese. Therefore, the teacher must reduce Javanese using in teaching, so that the students can understand what teacher says. Besides, the data also give information that the students who learn Statistics in Class A originate from various regions.

The following data talk about students' major in senior high school.

Table 2. Students' Major in Senior High School

Major	Number of Student
IPA	34
IPS	1
Bahasa	0

From the data, it is known that 97% of students choose a science major. It means that most of the students have gained knowledge related to Statistics.

Based on students' contexts information, we can conclude that the class has students who come from the heterogeneous origin and most of them have already learned Statistics in Senior High School.

2. Social, economic, political and cultural

In this context, the researcher only collects social data. In extracting this context, information is obtained from observation and interview to lecturers who have taught them. The result shows that the students are less able to socialize with other friends. They tend to hang out with their close friends and chose their close friends to be discussion partner. During student mentoring, where the researcher as a companion lecturer, the researchers observed they tend to sit in groups. They do not want to mingle with others. Thus, among students in Class A are not familiar with each other.

3. Environmental institutions of the school of learning center

Suparno (2014) explains that this context includes learning situation, moral value, organization, curriculum, and the role play. But this article only explains about the organization (vision of mathematics education study program) and curriculum (syllabus regarding subject's goal and the learning outcomes).

The first information is the vision of mathematics education study program. The vision is to become a superior and professional study program in producing competent and humane mathematics teachers, conducting research and dedication that provides solutions to mathematics education problems. It means that this study program has a purpose to create professional mathematics teacher. To be a professional teacher, students not only know about the material but also have to understand the concept and have the ability to explain the material.

The second is learning goals and the learning outcomes of elementary statistics. Based on learning design the learning outcomes of this subject are:

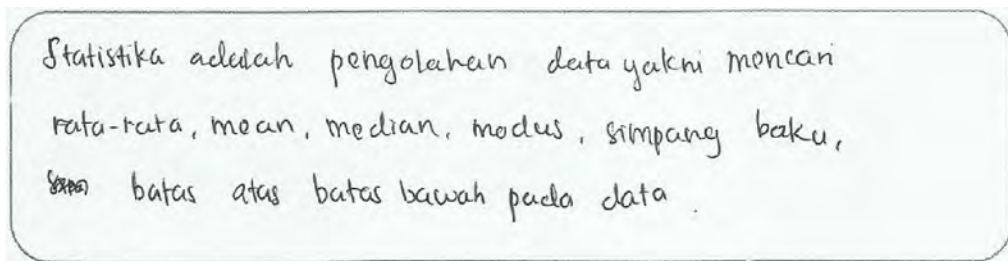
- a. Mastering materials, structures, concepts and mindsets of elementary statistics to teach mathematics learning in schools and to follow the development of elementary statistics.
- b. Applying the concept of elementary statistics materials to facilitate the development of potential learners through effective and empathetic communication.

We can conclude that there are two learning outcomes for descriptive statistics there are students master the concept of statistics for teaching in senior high school and students can apply the concept in real problems.

The goals of the elementary statistics especially the descriptive statistics are students can identify the descriptive statistics problem and inferential statistics, identify the correct measure based on the data, do the correct calculation about measure of location and measure of variability, define the difference and the meaning of measure of location and measure of variability, and present the data incorrect table, diagram or graphics.

4. Students' concepts (value, understanding)

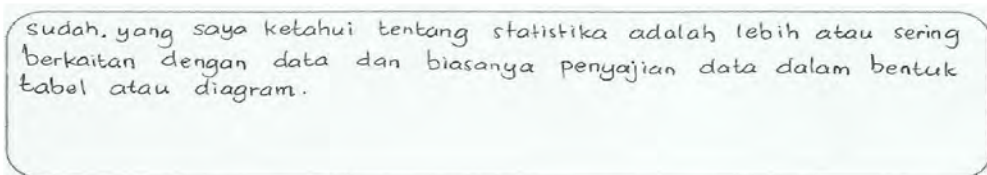
Suparno (2014) explained that the context which can be found in students' concept are all scores, knowledge, and early concept that students have before learning process. In this article, the author only explains about students' Statistics knowledge and GPA score. Based on the students' major, we get information that most of the students have already got Statistics in Senior High School. Questionnaire and directly interview are the instruments that are used for knowing their Statistics knowledge. These are their answer:

A photograph of a handwritten note on a light blue background. The text is written in Indonesian and lists statistical measures: mean, median, mode, standard deviation, and upper/lower limits.

Statistika adalah pengolahan data yakni mencari rata-rata, mean, median, modus, simpang baku, ~~dan~~ batas atas batas bawah pada data.

Figure 1. Students' Answer 1

Student says statistics is data processing that finds mean, median, mode, and standard deviation.

A photograph of a handwritten note on a light blue background. The text is written in Indonesian and describes statistics as data processing often presented in tables or diagrams.

sudah, yang saya ketahui tentang statistika adalah lebih atau sering berkaitan dengan data dan biasanya penyajian data dalam bentuk tabel atau diagram.

Figure 2. Students' Answer 2

The other student says that statistics is related to data and usually the data is presented in table or diagram. According to the questionnaire, almost 100% students said that Statistics is data processing to find the value of the mean, median, mode, variance, standard deviation, and how to present the data on the table or diagram. Based on the interview, students do not understand about what the meaning of the values if it is connected to students, and why they present the data on the table. These results show that students do not understand what statistics is. When the researcher asks about the meaning of the values, they cannot answer correctly.

Based on their Statistics knowledge, the teacher can design the lessons by giving questions words as "why", "what does it mean" not "what it is", "how much it is " or "how to present it" to improve their knowledge about descriptive statistics. Through these questions, the lesson is more emphasized to the terms' meaning in Statistics that are linked to students' life and explanation of where the formula originated. The introduction of terms, calculations - calculations, and explanations of how to present the data in the diagram are not the focus of the lessons. Such that the role of the teacher in this lesson is to be a facilitator in assisting students in constructing their knowledge. Besides the concepts of students, in this context author also seeks their GPA score. Based on data that obtained from SIA document, the students' GPA is as follows:

Table 3. Students' GPA

GPA	Frequency	Percentage	Average	Variance
GPA < 2.50	8	22.86%	2.77	0.22
$2.50 \leq \text{GPA} < 3.00$	17	48.57%		
$\text{GPA} \geq 3.00$	10	28.57%		

Based on the average, it is found that the students' ability is good. While viewed from the variance, the ability of students in class A is said to be heterogeneous. Some of them are below average and some are above average.

B. The Characteristics of Learning Model based on Context

Based on the above context, the following results are obtained:

Table 4. Characteristics of Class

Context	Results	Characteristics of Class
Students' context: • Origin • Major in Senior High School	• Students come from various regions: 53% come from Java, 20% come from Kalimantan, 6% come from Bali, 12% come from NTT, 3% come from Bangka Belitung and 6% come from Sumatera. • 97% of students choose science as their major when they are in senior high school	• Students come from different provinces • Students already learned about statistics in senior high school
Social, economic and cultural	Students tend to be in groups, not mingling with others.	Students are less sociable with friends who are not so close.
The environment where students learn: • The vision of study program • Goal of the learning • Learning outcomes	• The vision of the Mathematics Education Study Program is to create professional mathematics teacher • The learning outcomes of descriptive statistics are students master the concept of descriptive statistics for teaching in senior high school and students can apply the concept to real problems • The goals of descriptive statistics learning are: • Competence Students can identify the descriptive statistics problem and inferential statistics,	• Students are expected to become professional teacher • Students master the concept and can apply it in real problem • Students are able to be fair, caring and able to cooperate with other students • Students have responsibility, perseverance,

Context	Results	Characteristics of Class
	identify the correct measure based on the data, do the correct calculation of measure of location and measure of variability, define the difference and the meaning of measure of location and measure of variability, and present the data incorrect table, diagram or graphics. • Compassion Students are able to be fair, caring and able to cooperate with others • Conscience Students have responsibility, perseverance, thoroughness, and curiosity	thoroughness, and curiosity
Students' concept: • Students' knowledge • GPA score	• Students do not understand what statistics is and do not understand the meaning of the central tendency measures and statistical dispersion measures but they can calculate the value of central tendency measures and statistical dispersion measures correctly. • The average of student's GPA is 2.77 with variance value is 0.22.	• Students have not understood the concept well, but they have already known how to calculate and found the values in descriptive statistics well. • The ability of students in the classroom is good with a fairly heterogeneous ability.

Based on the results above, we can analyze the characteristics of learning model that are needed in Elementary Statistics course in Class A, those are:

Table 5. Characteristics of Learning Model that are Needed

Characteristics of Class	Characteristics of Learning Model that are Needed
• Students come from different provinces • The ability of students in the classroom is good with a fairly heterogeneous	• Can be implemented in class which the students have heterogeneous capabilities and origin.

Characteristics of Class	Characteristics of Learning Model that are Needed
ability. Students are less sociable with friends who are not so close. • Students are expected to become professional teacher • Students master the concept and can apply it in real problem • Students are able to be fair, caring and able to cooperate with other students • Students have responsibility, perseverance, thoroughness, and curiosity • Students already learned about statistics in senior high school • Students have not understood the concept well, but they have already known how to calculate and found the values in descriptive statistics well.	• Students can interact and cooperate with each other. • Learning self-direction becomes the main thing. • Real problem becomes a starting point in learning. • The learning challenges students' knowledge, attitude and the students' competence through the problem. • Can facilitate the success of problem solving ability, communication, cooperation, and interpersonal skills. • Students can construct their knowledge.

Based on the context, it can be concluded that the learning models that can be implemented in Elementary Statistics (especially in descriptive statistics) in Class A are learning models that have the following characteristics:

- Can be implemented in class which the students have heterogeneous capabilities and origin;
- Students can interact and cooperate with each other;
- Learning self-direction becomes the main thing;
- Real problem becomes a starting point in learning;
- The learning challenges students' knowledge, attitude and the students' competence through the problem;
- Can facilitate the success of problem solving ability, communication, cooperation, and interpersonal skills; Students can construct their knowledge.

Conclusion

Based on the context, it can be concluded that the learning models which can be implemented in Elementary Statistics course (especially in descriptive statistics) in Class A are learning models that have the following characteristics:

1. Can be implemented in class which the students have heterogeneous capabilities and origin;
2. Students can interact and cooperate with each other;
3. Learning self-direction becomes the main thing;
4. Real problem becomes a starting point in learning;
5. The learning challenges students' knowledge, attitude and the students' competence through the problem;
6. Can facilitate the success of problem solving ability, communication, cooperation, and interpersonal skills;
7. Students can construct their knowledge.

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EDUCATION FOR EUROPEAN TAXPAYERS'S COMPLIANCE: A LITERATURE STUDY OF EUROPEAN EDUCATION AS A LESSON FOR ASIAN TAXPAYERS

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Abstract

Education and taxpayers compliance are two things that mutually support each other. Through these two things, this study aimed at examining the influence of education systems applied in EU and Asia, especially East Asia and Southeast Asia on taxpayers compliance. This study use a literature study approach with the use of secondary data as an analysis materials. The results of the comparison of EU member states with East Asian and Southeast Asian countries show that the performance of education system in EU countries is much better than that of Asian countries. The better education system in EU countries is demonstrated by human development index as an indicator of the advance of human capacity development. However, these conditions are in contrast to the level of taxpayers compliance where taxpayers compliance rate in the Asian region is higher than the taxpayers compliance rate in the European region. Nevertheless, this distinction does not close Asian countries to study the education system in Europe that emphasizes on sustainable innovation in order to form constructive human resources, including forming compliance with taxpayers constructively.

Keywords: Education, Taxpayers compliance, European Union countries, and Asia countries.

Introduction

Taxpayers compliance is still a contentious issue between society and the government. The debate itself is triggered by tax non-compliance cases in which one of the factors causing the cases is the issue of education. One factor causing taxpayers non-compliance is the lack of proper education provided for the community, especially taxpayers. Some taxpayers might have inadequate educational background. The low level of education is believed to be the source of the raise of tax non-compliance problem. Therefore, the government needs to pay attention on providing education that is aimed to increase taxpayers compliance awareness beside improving the tax system and regulation.

Based on the results of the tenth Asia-Europe Meeting (ASEM) Summit held in Milan in October 2014, the economic and financial cooperations emphasized on the anticipation of tax evasion. In line with the cooperations, education cooperation was also a commitment initiated by the leaders because education can be the basis of the formation of human resources who are obedient to their obligations. Therefore, this study examines the education system in the EU as a comparison of the educational system built in Asian countries. To examine this comparison, the researcher posed two questions: first, what kind of education systems does the EU apply to get constructive taxpayers perspective on the tax compliance? And second, the question was based on the premise that the taxpayers compliance in European countries is not much different from the level of taxpayers compliance in Asian countries. If this premise is compatible with existing data, is there any aspect of learning that can be used by Asian countries to improve taxpayers compliance in paying taxes?

Theoretical Framework

Taxes, Taxpayers Compliance, and Taxes Issues

Taxes are a source of state revenues that are collected from taxpayers. Taxpayers themselves are people who obligate to pay their taxes. Taxpayers divided into in two types namely individual taxpayers and corporate taxpayers. This division is generally applicable in any country. In the management of the state budget, tax becomes the largest source of the state revenue compared to the other sources. The revenue management in every country always places tax as the priority of the state revenue.

As a result, taxpayers compliance becomes an integrity of the taxpayers expected by the government to increase the state revenues on an ongoing basis. Taxpayers compliance is an

attitude of discipline in fulfilling the obligations of paying taxes. Compliance is not only seen from the compliance of taxpayers alone, but it can also be measured from taxation compliance comprehensively. It is seen from the aspects of legal obedience, social aspects, administration aspects (Hauptman, et.al., 2014), ethical aspects of international agreement commitment, economic aspects (Asnawi, 2013) and aspects of the transparent service of tax authorities (Puspita, et.al., 2016). In general, taxpayers compliance is done consciously, both due to the extent of taxpayers's knowledge of the tax benefits they pay or their awareness of the legal consequences that they will receive when they commit an offense (Puspita, et.al., 2016). Therefore, the built stigma of compliance can become a constructive mental of taxpayers in building their positive personal characters of as a whole.

However, taxpayers non-compliance is often a problem that occurs in every country. This disobedience is certainly part of the taxation problems experienced by a country. In other words, the problem of taxation is a state problem causing the distability of state revenues. There are several types of taxation issues, e.g., tax avoidance, tax evasion (Owens, 2011), management disruption, corruption, system disruption, transfer pricing (Asia, 2011) and miscommunication. Tax evasion and tax avoidance are taxation issues occuring oftenly in some countries. These problems also become a polemic or risk that is often difficult to resolve (European tax, 2008; Rizea, 2010). In European countries, cases of Apple, McDonalds, Starbucks, and Amazon are examples of cases of tax avoidance. While in Asia, Google's tax case that occurred in Indonesia is an example of tax avoidance cases, just like what happens in European countries. Some tax avoidance cases that occur, at least, indicate that the tax system, tax regulation, and government policies still seem to provide loopholes for taxpayers and tax authorities who are not responsible for committing violations.

Education to Solve Tax Problem

Education (pedagogy) is a part of the government's and community's programs that has a goal in improving the knowledge of the community. Hence, the community is expected to solve the problems they encountered including resolving tax issues. Problems can be solved by having good educational background because it influences their perspective of life (*weltanschauung*) to find a resolution strategy according to the context of the problems they face. Directing mindsets and behaviour to a better directions is the essence of educational goals because through education, a person will be able to converge his source of learning obtained from his surroundings or other sources that he experience since the early period of his life (Tilaar, 2015).

Resolving tax issues is a part of one's constructive behaviour after he gets appropriate education. Constructive behaviour is generally formed from the implementation of one's senses, including social norms (Bobek, et.al., 2013), which are then connected into his behaviour to overcome the existing problems he faces (Karwono and Mularsih, 2017). This behaviour emerges as a series of responses and stimuli. In the classical conditioning theory, Ivan Pavlov (1849–1936) said that the education or learning processes of a person cannot be separated from the relationship between stimulus and response. Therefore, education is one of the strategies that can be used to resolve tax problems besides the settlement of the tax problems which emphasizes on the administration improvement of the tax management as the state revenue (Hauptman et.al., 2014)

Methodology—Literature Review

This research uses qualitative methodology with literature review approach. Furthermore, the research's object used compares index and ranking indicators of the performance of education

system and of the financial tax system built in Europe and Asia. For the European region, countries to be observed include EU Member States. The EU itself has 28 member states. Meanwhile, for the Asian region, countries to be observed include 3 countries in East Asia (i.e, Japan, South Korea and China) and 11 countries in Southeast Asia (i.e, Indonesia, Malaysia, Thailand, Singapore, Philippines , Vietnam, Cambodia, Laos, Myanmar, Brunei Darussalam, and Timor Leste).

In the process of searching the literature materials to be used as reference materials, the researcher uses Ebscohost dan Proquest as a journal search engine. In the search for literature material, the five keywords used are ‘Taxpayers,’ ‘Taxpayers compliance’, ‘European tax’, ‘Asian tax,’ and ‘Tax education’. In addition, the search is also limited by literature sources released from 2007 to 2017. From all the search results, the literatures used was chosen at random with attention to the purposes of this study. As supporting materials for research analysis, the secondary data and information to be used come from United Nation Development Program (UNDP), TMF Group, and QS World University Rankings.

Taxpayers Compliance and The Performance of Education Systems in Europe and Asia

The taxpayers compliance indicator becomes an assessment to determine whether taxpayers compliance in Europe is much better than taxpayers compliance in Asia. To find out the comparison of taxpayers compliance levels, The Financial Complexity Index (FCI) 2017 which is the output of the assessment of TMF Group becomes a common indicator to see taxpayers compliance level in some countries. This index is measured by looking at a comparison of ratings of 94 countries in which these ranks are a composite of the assessment on tax compliance rating and the assessment on the complexity of financial management in a country.

The FCI index can be seen in Table 1. In the table, the disparity of the ranks of countries in the European and Asian regions tends to have a fairly diverse range of ranks. In the same table, Italy, Belgium and Greece are ranked as the top 10 in Europe. Similarly, China and Vietnam, both are ranked in the top 10 in Asia. The top 10 position shows that the five countries have very complex financial management systems. However, this condition does not guarantee that the five countries have high taxpayers compliance rates as well.

Tabel 1. The Financial Complexity Index—2017

Region					
European Union				Asia	
Country	Ranking	Country	Ranking	Country	Ranking
Austria	21	Italy	3	Japan	76
Belgium	8	Latvia	36	South Korea	50
Bulgaria	66	Lithuania	62	China	7
Croatia	20	Luxembourg	24	Singapore	83
Cyprus	63	Malta	33	Malaysia	59
Czech Republic	60	Netherlands	55	Thailand	27
Denmark	71	Poland	47	Indonesia	37
Estonia	61	Portugal	40	Philippines	25
Finland	42	Romania	54	Myanmar	73
France	11	Slovakia	65	Cambodia	86
Germany	N/A	Slovenia	81	Vietnam	5
Greece	4	Spain	18	Brunei Dar.	N/A
Hungary	N/A	Sweden	77	Lao PDR	N/A
Ireland	58	United Kingdom	78	Timor Leste	N/A

Source: the TMF Group report

Based on the results of TMF Group's study on the FCI index, 50 countries observed in Europe, Middle East and Africa contribute to the tax compliance rate (especially tax compliance on possibility of tax audits) of 13%. Meanwhile, the 20 countries observed in the Asia Pacific region contributed to taxpayers compliance rate of 20%. This indication shows that taxpayers compliance in the Asian region is much greater than in Europe.

Tabel 2. Human Development Index 2016

Region					
European Union				Asia	
Country	Index	Country	Index	Country	Index
Austria	0.893	Italy	0.887	Japan	0.903
Belgium	0.896	Latvia	0.830	South Korea	0.901
Bulgaria	0.794	Lithuania	0.848	China	0.738
Croatia	0.827	Luxembourg	0.898	Singapore	0.925
Cyprus	0.856	Malta	0.856	Malaysia	0.789
Czech Republic	0.878	Netherlands	0.924	Thailand	0.740
Denmark	0.925	Poland	0.855	Indonesia	0.689
Estonia	0.865	Portugal	0.843	Philippines	0.682
Finland	0.895	Romania	0.802	Myanmar	0.556
France	0.897	Slovakia	0.845	Cambodia	0.563
Germany	0.926	Slovenia	0.890	Vietnam	0.683
Greece	0.866	Spain	0.884	Brunei Dar.	0.865
Hungary	0.836	Sweden	0.913	Lao PDR	0.586
Ireland	0.923	United Kingdom	0.909	Timor Leste	0.605

Source: the United Nation Development Program

However, this condition will seem contrast when juxtaposed with the indicator of the performance of educational system built in the European region. The Human Development Index (HDI) in Table 2 provides evidence of such contrasting conditions in which the education system in the European region has succeeded in increasing the capacity of human resources. In the table it is very clear that the human development index in the European region on average has a very high success rate. Only Bulgaria has a quite high level of successful human development.

On the other hand, human development capacity in Asia, especially Southeast Asia, has average moderate success rate (medium). Only Singapore, Brunei Darrussalam, Malaysia, and Thailand have a quite high level of success (high) and very high. In East Asia, Japan and South Korea have very high success rate of human development. While China has a high enough level of success in building its human resources (high).

The successful development of human resources in the European region is basically also supported by the advanced role of educational institutions. The growing educational institutions are an indicator of the success of the educational system built by the government and the people of Europe. The advance of educational institutions is generally assessed from several aspects, such as teaching materials, number of studies, number of foreign students, and the contribution of students' researches to the community.

All of these assessments are parameters to measure the advance of educational institutions through the world's best university ranks. One international institution that determines the status of the world's best university ranks is QS World University Rankings. In the period of 2016—2017, QS World University Rankings put several universities of European countries ranked as 200 world's largest universities. In the Asian region, several universities of East Asian countries were also ranked among the world's 200 largest universities. Only three universities in Southeast Asia are ranked among the 200 largest universities of the world, namely National University of Singapore (rank 12), Nanyang Technological University (rank 13), and University of Malaya (rank 133).

This contrasting data implication concludes that the excellent education system in Europe has not been a guarantee of increasing tax compliance, including taxpayers compliance. On the other hand, the high level of human development and education system in Asian countries, especially East Asia, can provide hope that education still provides benefits, especially the benefits of raising the awareness of taxpayers compliance.

Thus, the contrasting conditions do not degrade the essence of education. Education is still a useful program for shaping the proper transformation of human resources in the changing environment around it. For some international societies, education in European countries is still a

reference. The education system in European countries is judged to form positive characters, values, and perspectives (Arriazu and Solari, 2015). The education system in Europe is even legally guaranteed by the European Union through the Functioning of Treaties of the European Union (TFEU). Through the TFEU, the EU guarantees a cooperative education system (article 165), health understanding (article 168), understanding of commercial issues (article 207), or even understanding consumer protection issues (article 169).

With education, such as financial education (Blechová and Sobotovicová, 2016), society can form constructive patterns of thinking, and with constructive thinking, the awareness to build collective interests will also be formed automatically. This means that constructive thinking indirectly also opens the thought of the taxpayers to fulfill their obligations in supplementing the collective needs.

One thing that encourages education in Europe to be more advanced than the education in the Asian region in general is the sustainable innovation. Improved research and innovation productivity are the hallmark of educational institutions in European countries (Hodžić, 2012; Paci, et.al., 2013). Cooperation between educational institutions and between states also become one of the educational innovations developed by educational institutions in Europe. It is the innovation that forms a constructive educational system for the European community that indirectly also contributes to the formation of constructive taxpayers mindset. However, taxpayers compliance levels in the Asia Pacific region better than that of the European region did not close Asian countries to keep taking the learning aspects of education in European countries.

The sustainable innovation in the education system of European countries is a learning aspect that Asian countries can take. Even with the growth of motivation, ease of access to knowledge,

and financial support, education innovation systems in Asian countries to improve taxpayers compliance will be possible to apply in the future.

Conclusion

The implication of this study concludes that the education system of European countries is much better than the education system in Asian countries, especially in Southeast Asia. The progress of the education system in Europe is seen from the achievements of the successful development of human resources of European countries compared to those of Asian countries. However, a good education system in Europe does not guarantee the high levels of taxpayers compliance. Taxpayers compliance rates in Asia are much higher than taxpayers compliance rates in Europe.

Nevertheless, Asian countries can still take the best lessons from the education system in Europe. With sustainable innovation, education systems built in Asian countries can shape their constructive human thinking, including establishing constructive taxpayers compliance. To add value to this study's shortcomings, further researches are suggested to examine in more detail manner the tax system, the number and motives of compulsory taxpayers established in the EU as well as in Asian countries. In addition, the contribution of education to the improvement of taxpayers compliance also needs to be studied further.

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EFFECT OF LEARNING STYLE TO MATHEMATICS LEARNING ACHIEVEMENT OF 7TH GRADE SMPK ST. ALOYSIUS WEETEBULA

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Abstract

Learning achievement is one of the important part that can not be separated from education. Student's learning style is something to consider in the teaching and learning activities in the classroom. There are three learning styles will be addressed in this research; visual (tend to learn through what they see), auditory (learning by what they hear) and kinesthetic (learning through movement and touch). This study aims to obtain an empirical description of the effect of learning styles (visual, auditory, kinesthetic) to mathematics learn achievement.

The approach used in this study is a quantitative approach. The results were obtained: the most dominant learning style used is auditory learning style with a frequency of 67 people. From the results of multiple linear regression was obtained: there is no significant positive effect between learning styles on mathematics learning achievement of student's at 7th Grade SMPK St. Aloysius Weetebula. Value of the adjusted coefficient of determination (Adjusted R Square) is 0.003%, which means learning achievement dependent variable explained by the independent variables of learning styles by 0.3%. While the rest is explained by variables beyond the variables used in the study.

Keywords: learning style (visual, auditory and kinesthetic), learning achievement.

Introduction

Learning achievement is one important part which can not be separated from the world of education. In teaching and learning activities at school there are two important subjects of teachers and students. Student learning style is something to keep in mind in teaching and learning activities in the classroom. Marsh in (Suyono and Hariyanto, 2011: 147) also revealed that each student has their own learning style, such as a signature that is a person's specificity.

Learning style according to Heinich dkk in Benny quoted by Sutikno (2013) is a habit that someone shows in processing information and knowledge and learn a certain skill. Broadly known there are three learning styles, namely visual, auditorial, and kinesthetic learning styles (Sutikno, 2013: 14) and (Suyono and Hariyanto, 2011: 149).

- a. Visual learning style is a learning style where vision plays an important role.
- b. Students who have an auditorial learning style are students who are easier to learn by listening.
- c. Students with kinesthetic learning styles are students who can learn through physical movements.

The problem formulation of this research is:

1. Is there any influence between visual learning styles on student's mathematics learning achievement?
2. Is there any influence between auditorial learning style on student's mathematics learning achievement?
3. Is there an influence between kinesthetic learning style on student's mathematics learning achievement?
4. Is there any influence between visual, auditorial and kinesthetic learning styles on student's mathematics learning achievement?

The purpose of this study to answer the problem formulation.

The benefits of this research are:

1. For students: To be able to know what learning styles they have.
2. For teachers to be able to know the learning styles of students and adjust what methods fit the learning style of students during the learning process.
3. For parents: to be able to know the learning style of their children and direct the way of learning according to the learning style.

Theory

There are several notions of learning in terms of several sources, among others, Skinner in Sutikno (2013: 3) interpreted learning as a process of progressive adjustment of behavior. Usman (1995: 5) defines learning as the process of changing individual behavior because of inter-individual interaction and individuals with their environment. Morgan in Sutikno (2013: 3) defines learning as a relatively settled change in behavior as a result or results from past experience.

According to Winkel cited by Nuniek Pradita Sari Achievement learning is a proof of a student's learning success or ability in doing the learning activities according to the weight achieved, the weights in question are visible student grade or expressed in the form of report cards, index of study achievement, number of graduation and predicate of success. Sundari, cited by Nuniek Pradita Sari, defines learning achievement results obtained during the lesson at a certain period in an educational institution whose results are declared within a certain time in a teaching program and the results are expressed in the form of report cards, index of study achievement, graduation rate and predicate of success. While Suryabrata, who was also quoted by Nuniek Pradita Sari, defines that learning achievement is a result of the act of undertaking the stated judgment with numbers or symbols, where it's all about progress or student learning outcomes over a period of time.

According to Zainal, cited by Dewi A. Sagitasari, learning achievement has several main functions, among others:

- a. As an indicator of the success and quantity of knowledge that has been mastered students.
- b. As a symbol of desire curiosity gratification, as an information material in educational innovation. Assuming that learning achievement can be a driving force for students in improving science and technology, and acting as a feedback (feed back) in improving the quality of education.
- c. As an internal and external indicator of an educational institution. Internal indicator in the sense that learning achievement can be the productivity level of an educational institution. An external indicator in the sense that the high level of achievement can be used as an indicator of the success rate of students in the community, and
- d. As an indicator of the absorption (intelligence) of students. Therefore, it is important to know the achievements that students achieve in the teaching and learning process achieve success indicators in the learning process.

Learning achievement is things that can not be separated from learning activities, and basically it is interaction results between various factors both of in the individual (internal factors) as well as from Suryabrata, quoted by Dewi A. Sagitasari, in general says that, the factors that affect learning achievement can be classified into two namely: (1) internal factors, namely factors derived from in the individual, includes physiological factors and psychological factors, and (2) external factors, ie factors derived from outside the individual self, including social factors and non-social factors. Physiological factors derive from the physical state of the

individual self itself, usually closely related to physical functions such as senses and the health of others.

Learning achievement in school environment understood as the value or grade given by the teacher on students based on mastery. Or skills that students have through the evaluation of learning is done. Mathematics as one of the lessons given based on the curriculum that has been achieved demands a lot of potential and student effort in it order able to achieve achievement or optimal result. Learning achievement is referred to in this study is the level of success achieved by the seventh grade students of SMPK St. Aloysius Weetebula through the list of math scores in the odd semester reporting academic year 2013/2014.

A person's ability to understand and absorbing lessons is definitely different levels. Some are fast, moderate, and some are very slow. Therefore, they often have to resort to different ways to be able to understand an information or same lesson. According to Nasution, who was quoted by Sagitasari (2010: 25), learning style or "Learning style" students are how students act and using stimulants which he receives in the learning process. According to Sufyan and Dadi (2009: 66) learning style is a combination of how to absorb, organize, and process information that enters the brain. Learning styles by Heinich et al in Benny cited by Sutikno, is a habit that is shown by individuals in processing information and knowledge as well as learning a skill.

There have been many attempts made for recognize and categorize the way people learn, how to enter information into the brain. Outline, there are 7 commonly known approaches with different reference frames and developed also by different experts with its respective variance. Adi Gunawan, quoted by Sagitasari, is an expert of mind technology and self-transformation in his book "Born to be a Genius" summarizes the seven ways of learning, namely:

Approach based on information processing; determine a different way in viewing and processing new information. This approach was developed by Kagan, Kolb, Honey and Umford Gregorc, Butler, and McCharty. (2) Approach based on personality; determine the different character types. This approach was developed by Myer-Briggs, Lawrence, Keirsey & Bartes, Simon & Byram, Singer-Loomis, Gray-Whellright, Holland, and Geering. (3) The approach is based on sensory modalities; determine the degree of dependence on certain senses. This approach was developed by Bandler & Grinder, and Messick. (4) Approach based on environment; determine the different responses to physical conditions, psychological, social, and instructional. This approach was developed by Witkin and Eison Canfield. Approach based on social interaction; determine the different ways of dealing with others. This approach was developed by Grasha-Reichman, Perry, Mann, Furmann-Jacobs, and Merrill. (6) Approach based on intelligence; determine different talents. This approach was developed by Gardner and Handy. (7) Approach based on brain region; determine the relative dominance of different parts of the brain, such as the left brain and right brain. This approach was developed by Sperry, Bogen, Edwards, and Herman.

Teti Widiyanti, in her research entitled "The Effect of Learning Styles on Mathematical Problem Solving Abilities", concluded that students' learning styles effect on ability mathematical problem solving. Dewi A. Sagitasari, in her research entitled "The Relationship Between Creativity and Learning Style With Junior Student Learning Achievement", conclude that:

- a. VII junior high school students in Godean has a high enough creativity as much as 49.42%, dominant learning style is visual learning style of 44.1%, and learning achievements are quite competent as much as 37.21%;

- b. There is a positive and significant relationship between creativity and learning style with mathematics learning achievement VII junior high school students in Godean. With the regression equation $Y = 19.610 + 0.802 X_1 + 0.177 X_2$, obtained correlation coefficient value of 0.906 and value of determination coefficient of 0.820, or the variance of mathematics learning achievement.

Methodology

This study includes the type of survey research with a quantitative approach. The population in this study is all students of grade VII SMPK St. Aloysius Weetebula is even semester in academic year 2013/2014. Class VII is divided into four classes. In this research, the sample size is 127 students. Obtained based on the table determining the number of samples from a specific population developed from Isaac and Michael with a 5% error rate (Sugiyono, 2009: 128). The sampling technique used in this research is random sample or simple random sample. Data in this research is quantitative data type. Data sources are respondents, researchers themselves, documents. Data collection techniques used in this study are questionnaires / questionnaires and documentation. Technique of data analysis with validity test.

Results and Discussion

Of 115 samples, there were 20.87% of students who studied visual and kinesthetic style, or 24 people each and who studied auditorial style as much as 58.26% or 67 people. In the first hypothesis about the relationship between visual learning style and mathematics learning achievement of grade VII SMPK St. Aloysius Weetebula points out that there is no significant positive relationship. This is shown through the results of simple regression analysis, obtained

tcount value of 2.905. The tcount is greater than the ttable ($t(0.05; 22) = 2.073873$). While the coefficient of determination of 0.917 shows that 91.7% variance of mathematics learning achievement can be explained through the visual learning style. In the second hypothesis concerning the relationship between auditorial learning style and mathematics learning achievement of grade VII students SMPK St. Aloysius Weetebula points out that there is no positive and significant relationship. This is shown through the results of simple regression analysis, obtained by tcount of 0.562. The tcount is greater than the ttable ($t(0.05; 65) = 1.997138$). This means that there is a significant positive influence between the learning style of auditorial with the achievement of learning mathematics. While the coefficient of determination of 0.191 shows 19.1% variance of mathematics learning achievement can be explained through the style of auditorial learning.

The results of this study indicate that in an effort to improve student achievement, the student's learning style of auditorial needs to be considered. In the third hypothesis about the relationship between kinesthetic learning style and mathematics learning achievement of grade VII SMPK St. Aloysius Weetebula points out that there is no positive and significant relationship. This is shown through the results of simple regression analysis, obtained by tcount of 0.805. The tcount is greater than the ttable ($t(0.05; 22) = 2.073873$). This means that there is a significant positive influence between the learning style of auditorial with the achievement of learning mathematics. While the coefficient of determination of 0.146 shows 14.6% variance of mathematics learning achievement can be explained through the style of auditorial learning. The results of this study also shows that in an effort to improve student achievement, the student's visual learning style should be considered. Fourth hypothesis about the relationship between creativity and learning styles with mathematics learning achievement of students of grade VII

SMPK St. Aloysius Weetebula shows that there is a positive and significant relationship. This is shown through the result of multiple regression analysis of 3 predictors, obtained Fcount value of 0, 127. Price Fhitung much smaller than Ftabel value with 1% significance level equal to 2.685643. This means that the three learning styles of visual, auditorial and kinesthetic learning styles together have an influence on the achievement of mathematics learning of grade VII of SMPK St. Aloysius Weetebula.

Conclusion

Based on the results of research data can be concluded that:

1. VII Student of SMPK St. Aloysius Weetebula who has a visual learning style of 24 people or as many, 67 auditorial learning styles and 24 kinesthetic learning styles. Thus it can be concluded that the students of grade VII SMPK St. Aloysius Weetebula tends to have an auditorial learning style.
2. VII Student of SMPK St. Aloysius Weetebula who has the highest learning achievement of math 93 and lowest 69. For visual learning style maximum score of 84 and minimum 70, for auditorial learning style maximum value 93 and minimum 69, while kinesthetic learning style maximum value 85 and minimum 70. There is a significant positive relationship between visual learning style with mathematics learning achievement of grade VII SMPK St. Aloysius Weetebula.
3. Based on the above, it can be concluded that learning styles have an effect on improving student's mathematics learning achievement, so that it can get attention from parties related to education, especially teachers, parents, and students themselves.

By looking at the influence between student learning styles with student's mathematics learning achievement, then the teacher's task helps the students to know their own learning style, because by knowing the learning styles of the students, the teacher can adjust his teaching style with the teaching style of the students so that the students can easily accept and understand what they teach. This is closely related to efforts to improve the quality of graduates SMPK St. Aloysius Weetebula. To the students are advised to know each learning style in order to achieve the desired goals so as to realize the ideals. Given this research is only regression it becomes a challenge to be studied whether the learning style will affect student achievement. Therefore, it is necessary to continue with experimental research so that the educator knowing how the contribution of learning style and other factors to the achievement of student achievement in school.

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EVALUATION OF BIOLOGY EDUCATION STUDENTS' WRITING AND PRESENTATION SKILLS THROUGH PERSONALITY ASSISTANCE AND LEARNING METHOD PART II

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Abstract

The demand for self-development competence in the globalization era is higher. Ability of academic field is a major requirement for mastering contents, but this condition needs to be supported with the potential of writing skill and oral presentation. This study aims to investigate the skills of writing and presentation of biology education students at Sanata Dharma University. This qualitative research is conducted in the Program of Personality Assistance and Learning Method Part II, which became one of the places to develop writing and presentation skills at Sanata Dharma University. Qualitative data analysis techniques include data collection, data reduction, data presentation, and conclusions. Writing and presentation skills are conducted through the individual roles in the group when creating two types of papers. The results show that 38,46% of students are good and 61, 54% are good enough in writing. Overall, all students are competent in presenting the work.

Keywords: evaluation, writing, presentation, skill.

Introduction

The potential development of each student is different. Especially for students in the second semester, who have undergone a semester of lecture and adapt to learning system at campus. The lectures at Sanata Dharma oriented on Ignatian pedagogy and student-centered demands a rapid development for every student. Students need a container that can assist in self-development in the form of Personality Assistance Program and Learning Method Part II. This unique program and the privilege of Sanata Dharma University from all other campuses teaches you how to know your potential, be grateful for what you have, live up to the basic values of USD and practice writing a scientific work. This research focuses on Personality Assistance Program and Learning Method Part II which aims to introduce students, especially for the students from Biology

Education at USD. There are 40 students in the class that I have taught in that semester. They came from many provinces in Indonesia, such as Yogyakarta, Magelang, Toraja, East Nusa Tenggara, etc. In my first observation, the class condition are conducive and attractive, the students had high antusias and very excited with this subject. They have said this is the special program from USD that can't be found in the other universities, but only some students have a talent to try and learn the writing skill as the basic skill for them.

The topics including the four basic values of Sanata Dharma University (about the truth, diversity, justify, and humanism) will be the main topic in discussion session. After the introducing and looking for the articles that have closest relationship to four core values, the students must present their papers, continue to sharing and discussion. The students have been taught about the correcting of writing from lecturers and train them to write papers of popular scientific papers and scientific papers. The goals of this program is to prepare some students that have good potential in writing and presentation skill will be sent and prepared to go the next competition in scientific writing, perhaps can go to national competition, even international event. The stages of the student journey from Personality Assistance Program and Learning Method Part II play a role in shaping the potential character to be developed in writing form in Personality Assistance Program and Learning Method Part II. It aims to improve the sharpness of thinking, effective and good writing, and well presented too, although this will be difficult for most students. The product of this idea is a work that can be observed further by taking note of the students' writing skills and oral presentation. Both of these skills are a provision in terms of the establishment of independence, creativity, and communication between students. Writing skills need to be evaluated and integrated into individual presentations in each group.

Theory

Personality Assistance Program and Learning Method Part II is a learning assistance program. This program focuses on how students are able to live up to the four core values of Sanata Dharma University: love the truth, fight for justice, respect diversity, and uphold the nobility of human dignity combined with the practice of making scientific and popular writings (Sarkim, 2015). This paper was consulted with lecturers, revised, and presented in groups.

Wright (2011) revealed that in this era writing skills are very important and people are increasingly motivated to write well and competitively. Technology supports the design and creativity in writing, so it takes the ability to try to write well in accordance with the rules of writing the standard and true.

Hasani (2016) said that writing is the most complex ability compared to others. When writing, one must have indirect communication ability, language structure, writing techniques, and the ability to extract ideas from text. This is the challenges for all people, not only for students. We must know that is not easy way if this is your first time moment to write. You can begin with the imagine, pictures, verbal, and senteces. It will be really coherence paragraph to complete the sentences.

Our argumentative writing will be the main powerful weapon to desrribe the condition. Pranowo (2000) explained that successful of argumentative writing is when reader can be persuaded, brought, and conveyed to the paradigm that is stated and believed by the writer. It can be supported by data, claim, warrant, backing, modal qualifiers, an rebuttal as become good argumentative writing (Shehab and Nussbaum, 2015; Toulmin, 2003, 2009).

Dolan (2016) summarize that three components to be a good presentation such as the structure, body language and movement, and verbal delivery. This component will be done by students to explore the presentation skill and be daring in the class.

Writing and presentation skills are part of the language competencies that must be owned by everyone, especially students. The emphasis on writing and presentation competencies is a student centered model of learning and can be integrated into mentoring programs such as Personality Assistance Program and Learning Method Part II. Mulyani (2008) explains that language competence is a tiered and observable competency in terms of performance, language usage, interaction, and ability to access and use information.

Methodology

The method that used in this research is descriptive. The subjects of this study were forty students of biology education class of 2016 in the course of Personality Assistance Program and Learning Method Part II at Sanata Dharma University which took place during the even semester of 2016/2017. Instruments used in the form of presentation and writing assignments. The students only practice first by doing the writing skill (individualization in each group) and continue in the class by presenting their papers. It was happened after the two meeting after discuss the four core values at USD. Qualitative and quantitative data were collected during the study of writing through lecture observation. Data analysis is an interactive analysis consisting of data collection, data presentation, conclusion, and verification (Miles & Huberman, 1984).

Results and Discussion

A. Writing Skill

Writing skills is the student's primary capital for interpreting various language expressions. In this case, students are required to develop the results of writing into the form of works in the form of papers and popular scientific papers. Guidance and consultation were conducted twice and presented. The lecturer checks the paper work and gives a summary of the review of the paper. Table 1 shows the results of the assessment of students' writing:

Table 1. Evaluation of Scientific Papers

No	Group	Notes	
		Popular Scientific Paper	Scientific Paper
1	1	The use of words and sentences effectively not too good, the order of the sentence and the link is still not good and has not shown coherence	Structuring really good, fairly structured, the source of the majority references from internet
2	2	Fairly good, opinion is strong enough in describing the message works	Fairly enough, the script type can be more neat again
3	3	Paragraph is too long, but substance is good. Types of text can be neat, too tight	How to quote there is still something wrong, the construction of the sentence needs to be improved, the substance is quite good
4	4	The contents of the writing is quite good, the sentence sequences can still be improved, how to write the bibliography is still a mess	The script type can be tidied up again, pay attention to consistency in typing, the list of libraries fall apart
5	5	Substance is good enough, can be tidied up again	Good substance, typing can be more neat again
6	6	Substance is good enough, typed less tidy	Substance is good enough, less tidy type
7	7	Good substance, typed neatly enough, can be tidied up again	Good substance, typed can be tidied again
8	8	Substance is good, aesthetics of writing can be improved again	Good substance, typing can be made again
9	9	Substance is good enough,	Good substance, spacing

No	Group	Notes	
		Popular Scientific Paper	Scientific Paper
		typewriting can be spaced again	consistency please noted
10	10	Substance is good enough, but 1 paragraph is too long	The writing is good, but 1 paragraph is too long
11	11	Good substance, keep in mind spatial consistency	Good substance, can be improved
12	12	Good substance, typing can be more tidied again	Good substance, typing can be more tidied up again
13	13	Substance is quite good, need attention in typing manuscript	Substance is good, can be improved again from the side of typing neatness

Writing is not easy assignment. The complexity of writing activity requires systematic and well-ordered thinking that must be mastered by students and which finally will be the way of their behavior (Gonye *et al.*, 2012). The results show that 38,46% of the students were good in writing and 61,54% were good enough in writing. There are still many students who are constrained by the grammar and how to cite a theory source. The majority of students use the source of internet links. Overall, students are dynamic and creative enough to extract information about a paper linked to the four basic values of USD (each group makes a paper with two different USD's core values), but must to pay attention when typing manuscript, Some mistakes has been found in their papers. Futhermore, Hasani (2016) explained that at university, students usually write argumentative writing when they create a paper for daily routine tasks or thesis. They use these argumentative writings because a paper deals with new and original ideas, and it must be written with strong and convincing argumentation. Meanwhile, Walsh (2010) add writing is an important communication activity for developing self potential and can use the help of some applications or software in this modern learning.

B. Presentation Skill

Presentation skills rely on individual speaking skills. Each presentation, the student must make a powerpoint and deliver the paper systematically. The class condition is relatively conducive, there are some interaction among all the students for the problem that have suitable with four core values, such as corruption, the social justice including gender. The students explained clearly and ask to their friends if necessary. The weakness are some students still reading when present and explain, and the sentences in power point is too long to be one slide. Students can be creative and design the eye catching pictures and display of their content. Overall, the average student in the group has a competent attitude with an average score ranging from 48 from 60. Students can provide text when introducing each topics and revisit again to objective learning (Dolan, 2016). Presentation grain points refer to Sutrisno (2011: 139-140) which states that presentation judgments include how to open presentations, using language, systematic presentation, mastering content, mastering classroom condition, time management, communicative, and closing the presentation. Class discussion is considered to be quite alive in every lesson. This is supported by the quality of argumentation and tolerance to the opinions of friends. This condition is certainly not separated from sharing things, Granescu (2016) explains that the motivation and culture of students greatly affect the skills of speaking for presentation.

Conclusion

Based on the discussion that has been done, it can be concluded that the final evaluation of 38,46% of students is good in writing and 61,54% others are quite good in the writing skills' procedure. Meanwhile, all students are competent in presenting the work orally. The effect of writing skills and presentations is not only ended in the lecture Personality Assistance Program and Learning Method Part II, but in the long term such as doing lectures, following the writing

contest, and preparing the thesis. Therefore, it is expected that in the future the students can continue their competence in writing and presenting the findings that can be shared to all people. Students can attend and practice in some activities or events such as seminar, workshop, doing assignments regularly, and try to follow any competition that can improve the good writing and presentation skills.

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IMPROVING THE SCIENCE PROCESS SKILLS OF PHYSICS EDUCATION STUDENTS BY USING GUIDED INQUIRY PRACTICUM

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Abstract

This research investigate that science process skills significantly improve after doing some practicum activities. The research population are fifth semester physics education students and the research sample are fifth semester physics education students who was doing electricity and magnetism experiment C class course. We used two questionnaires, the first one is given to the students after doing three experiment activities and the second one is given after doing six experiment activities. This research is quantitative research using paired sample t test analysis that compared the first questionnaires score and the second questionnaires by using *SPSS* software. The result indicates that the number of practicum activities is able to improve the science process skills significantly.

Keywords: Science process skill, guided inquiry, guided inquiry practicum.

Introduction

The development in the education world especially physics education is very rapid because of the development of technology. Nowadays, the students from elementary until high school can access everything from media for example you can find information about atomic structure lecture from *youtube* or *blog*. But, the media in internet can contain wrong informations. In this case, the role of teachers as educator and companions is very needed.

To begin with, the teacher's skills and mastery of teaching materials should be deepened. Moreover, the scientific approach is used and taught in 2013 curriculum (K13). Not only scientific approach, character building also is introduced so that the students have good knowledge and character. Therefore, the most important and easiest way to reach K13 goals is to

improve the science process skill of teacher candidate students in university. Particularly physics teacher candidate.

University plays a role to teach and deepen content knowledge and an appropriate method to teach a concept or teaching material. The offered course in the study program is expected can develop the affective and psychomotor aspect besides the cognitive aspect.

One physics learning method that is able to combine both aspects is practicum. The practicum method is a method that involves students to be active in an experiments of physics materials that have or will be studied. This practicum method is one of the constructivist methods, i.e the students will find something during the practicum at lab so that students do not memorize but find something. It is hoped that the students will become deeper in understanding the concepts of physics so that they are ready to become teacher in the future.

In practicum, the students are also taught to work in groups, both in assembling, analyzing, discussing and concluding what has been obtained by doing practicum. By using practicum method can also train some characters building such as: rational thinking, cooperation, respect for others, honest, conscientious, disciplined, respect for nature and God. The importance of practicum experiences as a key determinant of pre-service science teachers' emerging inquiry-based science views and practices (Fazio dkk, 2017).

Theory

Physics education is a part of science education which have three elements, that are knowledge, process and attitude (Martin, 1991). The knowledge about nature laws and the underlying theory always be emphasized in physics education. Student study physics material for

example Newton Law, Relativity, Atomic Theory, etc to improve and apply this material to daily life.

Physics education helps students to know how the physicists work when they did some experiments and made a conclusion from those experiments. This is what we call scientific method. By using scientific method, student is hoped can think rationally and making a conclusion from data that they have collected. Physics education also helps students in developing correct learning attitude, for example honest, discipline, thorough, objective, not doing data manipulation, and teamwork.

Sugianto et al. (2009) said that science process approach is teaching and learning approach which emphasize the study process, activity, and creativity of students when obtain the knowledge, skill, achievement and attitude, and also apply the theory in daily life. Hamalik (1995) said there are six aspects which want to be improved by using science process approach, that is (1) question, (2) hypothesis, (3) investigation, (4) observation, (5) classification, (6) prediction, (7) interpretation and (8) communication.

Suparno (2007) said that, in general experiment methods is teaching method which invite student to do experiment or practicum as verification of the theory. This method also invite students to be active and doing in groups so we can identify which student is active or passive. Hamalik (1983) said that there are some benefits by using experiment or practicum in teaching and learning, (1) exercise to apply the theory that have been learnt, (2) To obtain practical experiences that did not obtain in class, (3) to find another theory.

Methodology

This research is quantitative descriptive. The population is the fifth semester of physics education student and the sample is 15 students of electricity and magnetism practicum class C. The instrument used is two questionnaires, the first after doing three practicums and the second after doing six practicums.

This research is a quantitative research with analysis using paired sample t-test. The instrument that used is a Likert-scale questionnaire on aspects of science process skills. The first questionnaire was given to the students after three practicums and the second questionnaire was given after six practicums. The first and second questionnaire scores will be compared using paired sample t-tests with help of the SPSS 22 program to see the significant improvement or not.

Results and Discussion

A. Science Process Skill Improvement

The mean value from pretest and posttest for six aspects of science process skill is shown in table 1. We can see that the mean value is increase from 76,33 to 82,40 after posttest.

Table 1. The science process skill pretest and posttest mean value

		Mean	N	Std. Deviation	Std. Error Mean
Pair I	pretrampil	76.33	15	8.772	2.265
	postrampil	82.40	15	9.934	2.565

Table 2. The value of paired sample t-test of science process skill

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair pretrampil – postrampil	-6.067	10.194	2.632	-11.712	-.421	-2.305	14	.037

Furthermore, with the help of SPSS program will be analyzed whether by doing practicum will be a significant improvement in science process skills. The results of the analysis are presented in Table 2. From Table 2 the analysis using SPSS program, related to the process of science skills experienced a significant improvement. This is indicated by the value of $p = 0,037 < \alpha = 0,05$. So it can be concluded that by doing more experiments will improve students' science process skills.

B. Science Process Skill Aspects

There are eight aspects of the science process skills that will be seen in this study: (1) asking, (2) hypothesis, (3) investigation / planning experiment, (4) observation, (5) classification, (6) prediction, (7) interpretation and (8) communication. The mean pretest and posttest values for the eight aspects of the science process skills are presented in Table 3. It can be seen that there is an improvement in mean values for the eight aspects of the science process skills.

For further research, it will be analyzed using paired sample t-test with the help of SPSS 22 to know which aspects of process skill are significantly improved. The results are shown

in Table 4. From Table 4 it can be seen that significant increase occurs in two aspects, namely observation aspect ($p = 0,009 < \alpha = 0,05$) and communication aspect ($p = 0,023 < \alpha = 0,05$). While for the six other aspects (ask, hypothesis, investigation, classification, prediction and interpretation) improved but not significant.

Table 3. Pretest and posttest science process skill aspects mean value

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Prebertanya	6.27	15	1.486	.384
	Posbertanya	6.87	15	1.552	.401
Pair 2	Prehipotesis	7.27	15	1.534	.396
	Poshipotesis	7.60	15	1.352	.349
Pair 3	Preinvest	13.73	15	2.251	.581
	Posinvest	15.00	15	2.360	.609
Pair 4	Preobserv	15.20	15	1.656	.428
	Posobserv	16.40	15	1.724	.445
Pair 5	Preklasif	8.73	15	.799	.206
	Posklasif	9.07	15	1.033	.267
Pair 6	Prepredik	6.80	15	1.082	.279
	Pospredik	7.00	15	1.000	.258
Pair 7	Preinter	11.00	15	1.604	.414
	Posinter	12.00	15	2.204	.569
Pair 8	Prekomun	7.33	15	1.397	.361
	Poskomun	8.47	15	1.187	.307

Table 4. Paired Sample t-test of science process skills aspect

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 prebertanya posbertanya	-.600	1.882	.486	-1.642	.442	-1.235	14	.237
Pair 2 prehipotesis poshipotesis	-.333	1.799	.465	-1.330	.663	-.717	14	.485
Pair 3 preinvest posinvest	-1.267	2.492	.643	-2.647	.113	-1.969	14	.069
Pair 4 preobserv posobserv	-1.200	1.521	.393	-2.042	-.358	-3.055	14	.009
Pair 5 preklasif posklasif	-.333	1.113	.287	-.950	.283	-1.160	14	.265
Pair 6 prepredik pospredik	-.200	.676	.175	-.574	.174	-1.146	14	.271
Pair 7 preinterpre posinter	-1.000	2.360	.609	-2.307	.307	-1.641	14	.123
Pair 8 prekomun poskomun	-1.133	1.727	.446	-2.089	-.177	-2.542	14	.023

Observation and communication aspects have a significant improve when students do practicum. The more numbers of practicum that students do make them become more proficient in reading tools, especially multimeters because the electric and magnetism practicum almost every practicum using a multimeter. After doing a lot of practicum students become not easily satisfied with the data obtained. They will continue to repeat the data retrieval process. As for the communication aspect, the practicum report written by the student becomes more coherent and clear in making the discussion. As the oral exam of the students is increasingly adept at assembling tools and explaining what was done in the experiment.

Conclusion

Based on the results of research that has been done the researchers obtained some conclusions as follows.

1. Practicum improves students' science process skills significantly.
2. There are two aspects that experienced a significant increase in aspects of observation and communication.

Acknowledgment

We want to thank to P4 and LPPM Universitas Sanata Dharma for the support so this research can be done. Also we want to thank to Prof. Dr. Paulus Suparno, SJ, M.S.T for the disscussion.

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INCREASING THE ABILITY OF RESOLVING QUADRATIC EQUATIONS BY USING GROUP DISCUSSION METHOD FOR STUDENTS IN CLASS X-6 OF SMA KOLESE DE BRITTO YOGYAKARTA IN ACADEMIC YEAR 2016/2017. CLASSROOM ACTION RESEARCH.

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Abstract

This research aimed to find out whether a group discussion method could improve the ability of the students in class X-6 of SMA Kolese De Britto Yogyakarta in academic year 2016/2017 in resolving the quadratic equation. The main data was obtained by using pre-test and post-test. Meanwhile, the subordinate data was collected by using observation sheets which were completed with significant notes written by three observers. The data analysis technique used in this research was descriptive qualitative which was used to analyze the main data which was obtained from pre-test and post-test. In order to find out the increase occurred, the researcher used the data which was obtained from pre-test and post-test and calculated the percentage of learners who successfully passed those tests and vice versa. Based on the results from the first cycle until the third cycle, group discussion method is able to improve the ability of learners in resolving quadratic equations using the perfect quadratic method, the ABC formula, and the factoring. Group discussion method as what has been studied in this classroom action research is highly recommended in the process of learning mathematics in the classroom. In addition to improving learning outcomes, group discussion method can also help students discuss the materials and learn together. Besides, through group discussion method, students are able to share their knowledge, accept different thoughts and finally use the best thought for the sake of the group and their self-progress.

Keywords: increasing, ability, resolving quadratic equations, group discussion method.

Research Background

Learning process is one important factors that can influence the achievement of the preferred learning objectives. In order to learn something or to solve a problem one has to master the simpler abilities or rules as qualifications of the solution (Nasution, 2005). There are thirty five male students in class X-6 of SMA Kolese De Britto Yogyakarta in Academic Year 2016/2017. The daily learning process of mathematics in the classroom is done by delivering perceptions such as explaining the learning materials which have been planned before as the teacher's core

activity, guiding students in doing the individual exercises, discussing both materials and exercises, and the closing the lesson by concluding the learning materials that have just been learned. Through those learning processes, the number of learners who successfully pass the minimum criteria of tests and vice versa are categorized as follows:

Tabel 1.

Numbers	Test 1	Percentage	Test 2	Percentage	Midterm Test	Percentage
Those who didn't pass the minimum criteria	4	11%	11	31%	14	40%
Those who passed the minimum criteria	31	89%	24	69%	21	60%

Based on the table, it can be seen that there is an increasing numbers of students who cannot pass the minimum criteria of each test. Hence, based on the background described above, the researcher formulates this research problem: Is the group discussion method able to improve the ability of students in class X-6 of SMA Kolese De Britto Yogyakarta in Academic Year 2016/2017 in solving the quadratic equation?

Review Of Related Literature

Theoretical foundations used in this study include: (i) Improvement (ii) The ability to solve quadratic equations (iii) Group discussion methods.

A. Improvement

The “improvement” comes from the word “level” which means the layer or layer of something which then forms the arrangement. Level also means standard, rank and class. While improvement means progress. In general, improvement is an effort to increase the degree, level, and quality, as well as quantity. Improvement also means the addition of skills and abilities to get better. (<http://www.duniapelajar.com> retrieved on Friday, September 2nd, 2016 at 3.10 P.M.).

B. The Ability to Solve Quadratic Equations

The ability to solve quadratic equations is the ability of learners to find the roots of quadratic equations by using the factoring, completing the perfect squares, and using the ABC formula. The ability to solve quadratic equations involves understanding and the learning mastery relating to the method or procedure to accomplish the problems. Therefore, the ability to solve the problems is a cognitive ability.

John A. Van de Walle elaborates the principles and standards of verbs related to the of mathematics processes. They are revealing, investigating, guessing, completing, proving, presenting, formulating, discovering, constructing, testing, explaining, estimating, developing, illustrating and applying.

The verbs above state the process of "understanding" and the "explaining". When learners are involved in the various activities based on the verbs above, they must not have been passive listeners or observers. They need to be actively involved in intellectual about the mathematical ideas discussed. If these activities are done every day, the learners will surely get a reinforcing message: "You are able to understand this, you are able to do math!". (John A. Van de Walle, 2007)

C. Group Discussion Methods

David W. Johnson and Roger T. Johnson stated that learning together or group discussion is a learning style that prioritizes teamwork. In this method learners are allowed to exchange ideas and ideas to enable them to interact actively and positively. In this case the teacher only acts as a facilitator who associates the higher comprehension of learners' own understanding. It means that the teachers do not only provide knowledge for the learners, but also build knowledge in students' mind so that learners have a deep understanding of the concepts delivering by the teachers.

Group discussion is a form of learning in which learners learn and work in small collaborative groups whose members consist of four to six people with heterogeneous group structures. In this kind of learning, the cooperation among members of the group is emphasis. However, each member of the group also has individual responsibility. It means that the success of the group depends on how individual learner involves in the group, so that each member of the group is ready to face other activities when he or she has to work individually.

A group learning can be categorized as a group discussion if it consists of several things as follows:

- a) Each learner in the group is responsible for everything done in the group, as well as what is done by his or herself.
- b) Each learner must know that all learners have the same goals.
- c) Each learner in the group should share the same duties and responsibilities among the group members.
- d) Each learner will be subject to evaluations that will influence the evaluation in his group.
- e) Each learner in the group shares leadership and requires skills to learn together.
- f) Each learner in the group requires individual responsibility for the cases solved in cooperative groups.

Methodology

This research is a classroom action research, which will involve teachers, students, and observers collaboratively. The study was conducted in class X-6 of SMA Kolese De Britto at Jalan Laksda Adisucipto 161, Depok, Sleman, Yogyakarta. The research was conducted on 19th October 2016 up to 26th October 2017. The subject of this study were thirty five male students in

class X-6 class of SMA Kolese De Britto. The main data was obtained by using students' pre-test and post-test scores from every cycle. Meanwhile, the subordinate data was collected by using observation sheets and the results of students' reflections which were done at the end of the lesson in every cycle.

Result and Discussion

This study consists of three cycles. Each cycle consists of four stages: planning, action implementation, observation and reflection. In the first cycle the topic of learning materials is to solve quadratic equations using the perfect quadratic method. In the first cycle, the average scores of the post-test was 68.7 which was better than the average scores of the pre-test that was 20.9. However the percentage of students' mastery which was 43% did not reach the performance indicator, so that cycle two was needed.

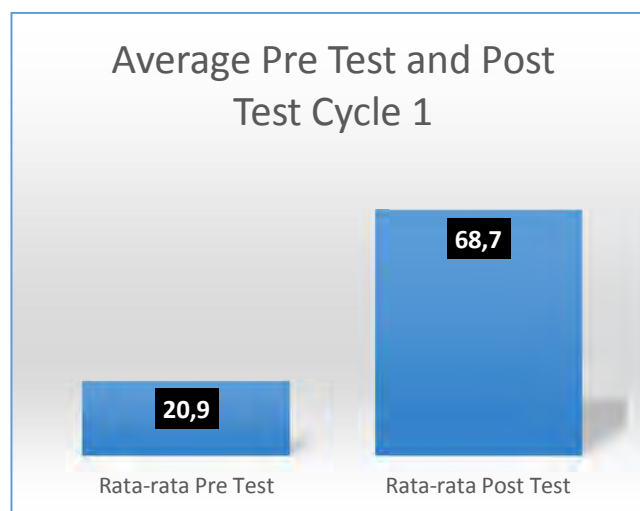


Figure 1.

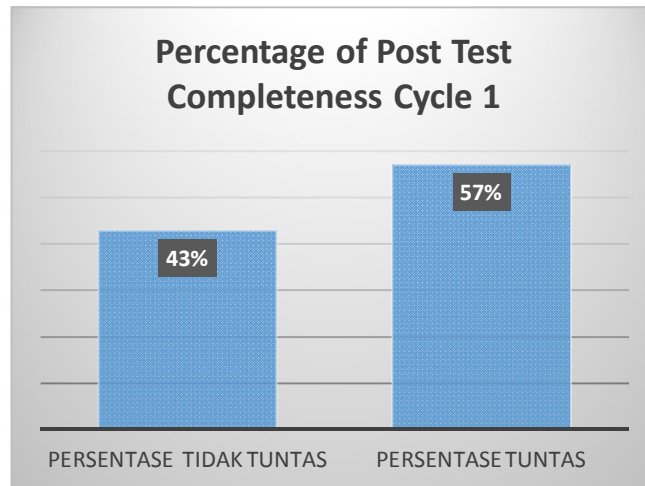


Figure 2.

After examining the pre-test and post-test results, the observers' notes and the results of student reflection, the researcher reflects some significant points. They are: (i) Generally, the learning process has worked well. Students' involvement as an individual and also as a group are good. (ii) Performance indicators cannot be achieved due to time management which is not in accordance with the time allocation as planned before. The period which was planned for the main part of the learning process was 45 minutes. However, it changed to 55 minutes due to the need of more time in reviewing the definition of quadratic equations, the relation of quadratic equations and quadratic functions, and in explaining the definition of resolving the quadratic equations. This unbalanced time allocation shorten the learners' time to discuss and solve the problems in the group discussion. Thus, it also lead to the lack of students' optimum ability in resolving the quadratic equations. According to the group discussion's report, the group was able to solve the problem well. However, the good results was dominated by the answers of one or two students in the group. It follows, the discussion process and sharing of the knowledge to master the ability had not been optimal due to the time constraints. Consequently, for the second cycle, the researcher should pay more attention to the allocation of time for each cycle. Besides, the researcher needs to ensure the learning process in the group can be done better.

However the percentage of students' mastery which was 43% did not reach the performance indicator, so that cycle two was needed. In the second cycle, the average scores of the post-test was 80.4, which was better than the average scores of pre-test that was 31.4. Nevertheless, the percentage of students' mastery of the post-test was 79% which still did not reach the performance indicator. Therefore, the research was continued to cycle three.

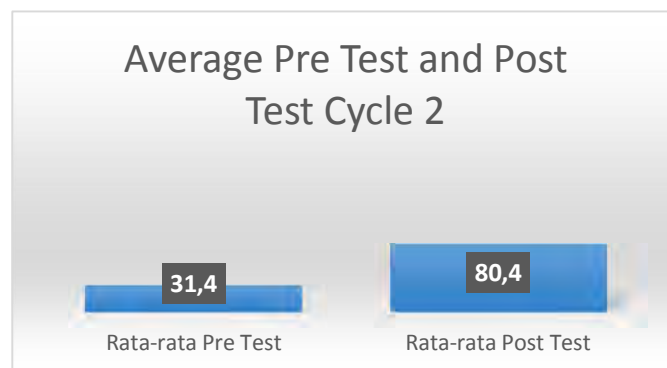


Figure 3.

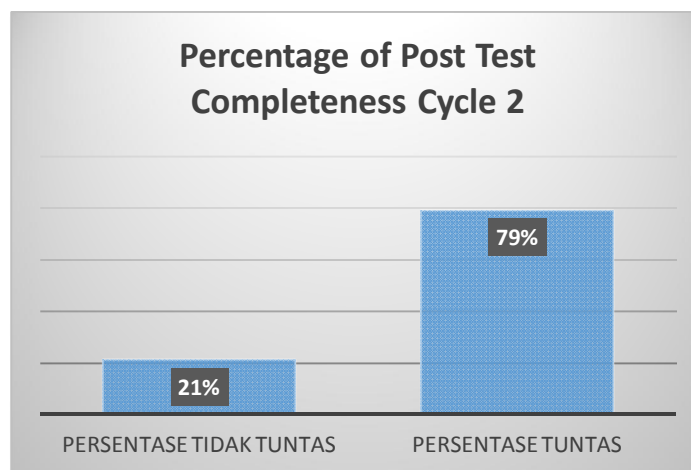


Figure 4.

After examining the pre-test and post-test results, the observer's notes, and the results of student reflection, the researcher reflects: (i) Learning process in accordance with the planned. Time allocation as planned. (ii) Student involvement in group work has been good, but there are still students who participate less actively and even sleep during lessons. (iii) Although the percentage of students' total score on post test increases compared to the percentage of post test

score in cycle 2, this increase has not yet reached the predetermined performance indicator. This means the research process goes into the third cycle with improvement plans on optimizing the active participation of students at all stages of the learning process. Teachers need to go around all the students to accompany and ensure all students learn actively. Also, the sitting position of the observer needs to be addressed. In cycle 1 and cycle 2 the three observers sit in groups in the right rear corner so as to close the teacher's path to reach the students in the back right corner. In cycle 3 the observer sitting position is planned to be separated, each in the right, middle, and left rear corner. This placement is in addition to facilitate the teacher to go around the classroom as well as for the attention and observation of the observer to all students become more optimal.

In the third cycle, the topic of learning materials is to solve quadratic equations using the factoring method. In the third cycle, the average scores of post-test was 85.6. It was better than the average scores of the pre-test that was 39.5. Moreover, the percentage of students' mastery of the post-test was 85%, which has reached the performance indicator. Considering this, the classroom action researched was accomplished.

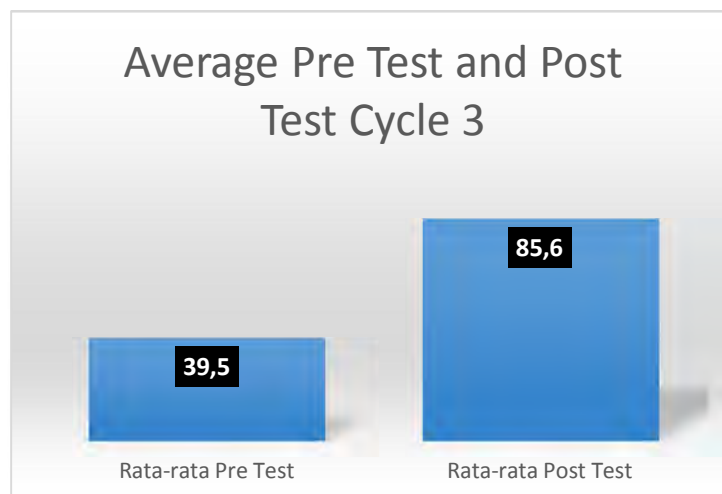


Figure 5.

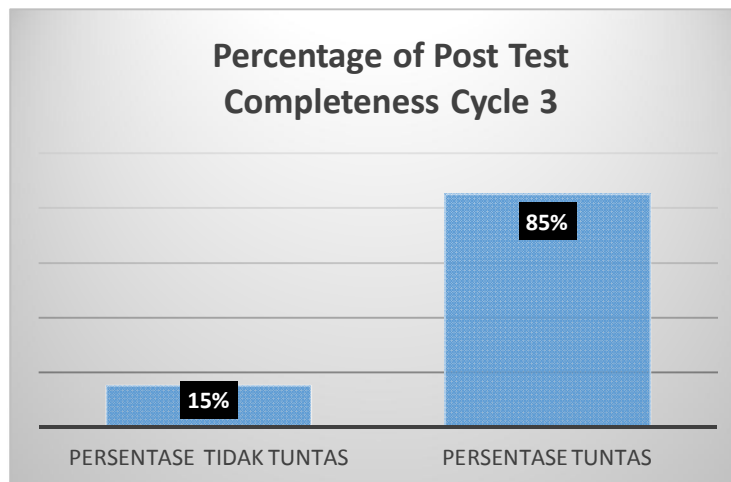


Figure 6.

After examining the pre-test and post-test results, the observer's notes, and the results of student reflection, the researcher reflects other points: (i) The overall learning process has been working very well. (ii) Students' involvement as an individual and also as a group has been excellent. (iii) All groups are guided and motivated so that all students are enthusiastic to follow the learning process. (iv) By having a good learning process and high student enthusiasm, the post-test result is better than the pre-test result and the percentage of the students' mastery of the post-test score is 85% which is more than 80% as specified in the performance indicator.

Conclusion

The performance indicator used in this research is the ability of learners in resolving the quadratic equation. It could be said that there is an improvement of learners' ability in resolving the quadratic equation if the average scores of post-test is better than the average scores of pre-test and more than 80% of learners achieved the post-test results above the minimum criteria of mastery learning that is 75. Based on the results from the first cycle until the third cycle, group discussion method is able to improve the ability of learners in resolving quadratic equations using the perfect quadratic method, the ABC formula, and the factoring.

Recommendation

Group discussion method as what has been studied in this classroom action research is highly recommended in the process of learning mathematics in the classroom. In addition to improving learning outcomes, group discussion method can also help students discuss the materials and learn together. Further, through group discussion method, students are able to share their knowledge, accept different thoughts and finally use the best thought for the sake of the group and their self-progress.

If teachers want to apply group discussion method to improve the students' achievement or to increase the learning outcomes, teachers should seriously prepare the groups that will work together during the learning process. Groups should be heterogeneous in terms of academic ability, background of learners, gender, the former junior high school (if the students are in class X) and other diversity.

In the learning process, the teacher should pay more attention by going around to guide each group so that each group and learners in the group surely work together in accordance with the signs or rules of the game that has been set.

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INNOVATIVE DIGITAL MEDIA: I-PEN FOR TEACHING WRITING

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Abstract

Inevitably, to get involved in the Asia digital era, every student that learns English as a foreign language requires materials and teaching media in digital English. To support the creativity of students, especially in students' writing, it would demand development of interesting and challenging activities. This paper proposes an innovative digital media called **I-PEN** (*I create texts with a pen*) for teaching writing to the seventh grade of junior high school that had been designed using Research and Development (R&D) consisting of three steps: First, *Point* is an area to look for ideas and critical thinking sentences in integrating the clue given in each activity. Second, *Elaboration* is a creative pattern to encourage students to make a paragraph in a variety of text types in accordance with the template provided. And the last, *Net* is a style in writing that exists in the game. It has phenomena to enrich knowledge, experience and new vocabulary. The product (I-PEN) had been validated through Forum Group Discussion (FGD). The results of this research were as follows: a) Every tasks and activities in I-PEN can give motivation to students to create sentences and texts easily. b) I-PEN provides games to develop the students' creativity in creating descriptive text.

Keywords: *I-PEN, students' writing creativity, teaching writing.*

Introduction

Inevitably, to get involved in rapid change of information technology, every student that learns English as a foreign language requires materials and teaching media in digital English. As an English teacher, selecting media for teaching writing skill is not easy. There are some characteristics of materials namely self instruction, stand alone, adaptive, self contained, and user friendly (Widodo dan Jasmadi, 2008). So, he or she has to consider before using the digital media. It should be related to the curriculum, syllabus, and the students' needs.

One of the English skills that has to be mastered by the seventh grade students of junior high school is writing. It learns how to write sentences and texts correctly. Creating descriptive text includes in describing a person, things and animals. Sometimes, students got difficulties when

they begin to write it because they felt confused to arrange the sentences related to the generic structure and language focus of descriptive text.

Creativity on writing is a must. Students can use their imagination to develop their creativity in writing. Creative writing is used to refer to the activities we engage (Graeme Harper, 2010). To support the creativity of students, especially in students' writing, it would demand the development of interesting and challenging activities. Therefore, the researcher attempts to develop an innovative digital media called **I-PEN** (*I create texts with a pen*) for teaching writing. It consists of *Point*, *Elaboration* and *Net* step to encourage students' creativity in writing.

Writing

Exploring ideas is an exciting activity. It can be applied into written form. In writing, there are two crucial points to consider such as the different target readers and the purpose of writing. A process view of writing (Hyland, 2009) are as follows:

a) Writing is problem-solving. It means that in creating texts, planning is to point an aim. There are four stages in the planning process: analysis, finding ideas, selecting and clustering and developing an outline (Thoreau, M. 2011).

b) Writing is generative. Students not only have to distinguish types of sentences: simple, compound, complex or compound complex sentences but also they should know how to write sentences in declarative, imperative, interrogative and exclamatory form. Then, students can try to explore their ideas in paragraph writing. It has four parts: a topic sentence, controlling idea, supporting sentences, and concluding sentences (Dorothy E. Zemach & Carlos Islaln, 2011).

c) Writing is recursive. Then, students can check unity, coherence and cohesion of their paragraphs. And the last, kinds of texts that want to be used such as descriptive, narrative,

recount, procedure or report text (Derewianka, B. (1990). Students can identify kinds of texts through the purposes, generic structures, and language focus of texts.

d) Writing is collaborative and developmental. Finally, students can revise their draft after getting feedback from their teacher to improve their writing.

Promote *I-PEN* Activities

I-PEN (*I create texts with a pen*) is an innovative media that developed for teaching writing. Basically, I-PEN has three main steps. First, *Point* is an area to look for ideas and critical thinking sentences in integrating the clue given in each activity. Second, *Elaboration* is a creative pattern to encourage students to make a paragraph in a variety of text types in accordance with the template provided. And the last, *Net* is a style in writing that exists in the game. It has phenomena to enrich knowledge, experience and new vocabulary. Activities in every steps of I-PEN discuss how to create from sentences until texts that have been designed related to core competence and basic competence of the seventh grade students of high school.

Research Method

This research used a Research and Development (R&D) study adapted the R&D model proposed by Plomp (1997). There are five cycles and three of them were used in this research. They are as follows: First, Pre-Research, before making needs analysis and develop the course grid, the researcher conducted observation and interview the seventh grade students of junior high school in SMP N 1 Mungkid. The reason for choosing this school was it has A accreditation and language laboratories. Next, the researcher developed the draft of the media called I-PEN. The last, I-PEN had been validated through Forum Group Discussion (FGD) that consisted of three expert judgements, two teachers and four students in the evaluation cycle. They filled the

instruments about the I-PEN product that relate to content, writing skill developed: tasks and activities and graphics.

Results and Discussions

In observation activity, the seventh grade students of junior high school used a book entitle When English Rings a Bell (WERB) and students worksheet in their teaching learning process. They also used both traditional and modern media like whiteboard, pictures, flash cards and the example of texts for teaching writing.

Based on the result of interviews, there were students faced some problems in learning writing. They said that the writing materials were difficult to understand, sometimes they got difficulties to look for appropriate vocabulary, they felt confused to create sentences or texts although their teacher has explained it and the writing media was less challenging. The results of need analysis were planned as follows:

Table 1. The Results of the Need Analysis

Target Needs	Necessities	Students' objective of learning English writing is to write sentences and descriptive text.
	Lacks	Students are often confused to look for ideas.
		Students got difficulties to create a sentence and descriptive text.
	Wants	Students want their teacher selects the materials, tasks and activities that can improve their knowledge in writing by using an interesting materials or digital media.
Learning Needs	Input	Students want to create sentences related to the clue given.
		Students want to create descriptive text using provided template.
		Students want to identify the generic structure and language focus through games.
	Setting	Students want to do the tasks and activities both in individual and in group.
	Teachers	Students want their teacher giving detail explanation when they got difficulties with the materials and

	Role	using interesting media. Students want their teacher gives feedback on their writing.
	Procedures	Students want to write sentences and descriptive text based on the clue given, using provided template and through games.

After conducting the need analysis, the researcher made the course grid. It was used as a guideline to design the materials in media related to the result of needs analysis. It consisted of competence, topic, language focus: writing skill developed, method, and tasks and activities for the seventh grade of junior high school.

The product of this research is I-PEN. It is an innovative media application that can be used in smartphone or laptop. It stands for *I create texts with a pen*. It means that students can use their pen or forefinger to write sentences or texts based on their creativity. It has three steps as follows:

(a) **Point** is an area to look for ideas and critical thinking sentences in integrating the clue given in each activity. In tasks and activities, ***Point*** has an attractive clue and the five senses activity that explain how to create sentences. It begins from simple, compound and complex sentences. If the students want to open this activity, they have to insert the password. They can find the first password from their teacher and the next password; they will get it from the previous score activity. Here are the examples of two activities above:

a) An attractive clue activity

An attractive clue is like playing puzzle. It makes different because one picture is divided into seven parts. In every part can appear and move one by one. Then, students are required to create seven sentences related to the part of picture that appeared above. If the students have finished writing sentences, the complete image will appear.

b) The five senses activity

Students look for a word spontaneously based on their five senses: taste, sight, smell, touch, and sounding. Then, students create a simple, compound and complex sentence using that word. It also provides some guidance how to create sentences easily.

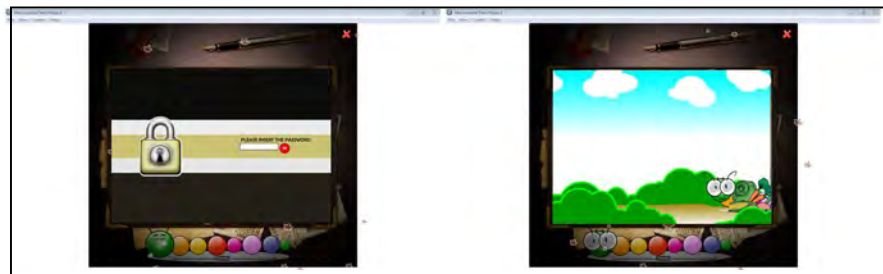


Figure 1. Password and an attractive clue

(b) **Elaboration** is a creative pattern to encourage students to make a paragraph in a variety of text types in accordance with the five text types template provided. In this research, tasks and activities in elaboration provide template to create a paragraph in descriptive text. It consists of topic sentence, controlling idea, supporting sentences, and concluding sentences. Here is an example of elaboration activity:

- a) Students can choose a picture.
- b) Then, select the template of descriptive text.
- c) Next, write a paragraph based on the generic structure of descriptive text.
- d) Finally, submit it to their teacher through email.

This product provides “save and edit” instruction that can help the students write, edit and save their writing safely.

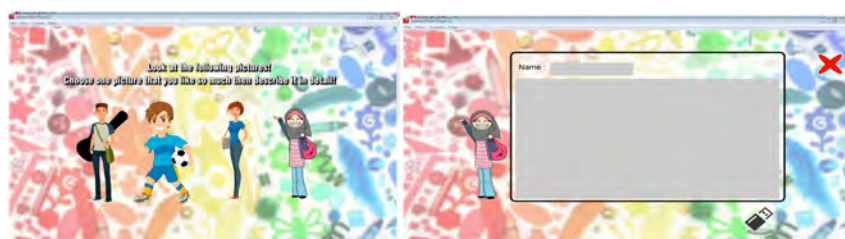


Figure 2. Elaboration tasks and activities

(c) **Net** is a style in writing the essay that exists in the game. It has phenomena to enrich knowledge, experience and new vocabulary. Tasks and activities in NET provide games. Here is an example of net activity:

- a) The students choose the number given (1,2 or 3).
 - b) There is a reading text that relates to five text types. In this research, the reading text only discusses descriptive text.
 - c) Next, the students can answer by clicking the picture and then the score will appear.
- In this step, students can identify how to write descriptive text through reading game.

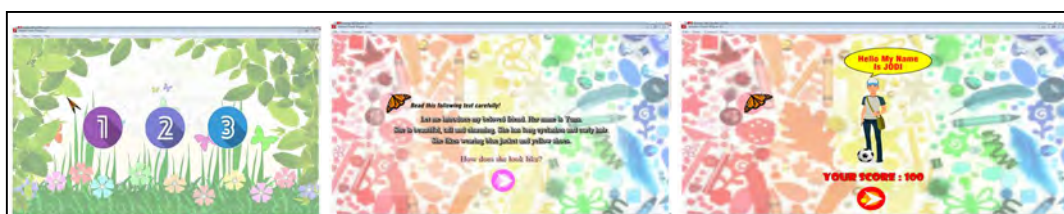


Figure 3. Net tasks and activities

In evaluation cycle, the product had been validated by the Focus Group Discussion (FGD) with three expert judgments, two teachers and four students. They filled the instruments about the I-PEN product that relate to content, writing skill developed: tasks and activities and graphics. Based on the analysis of the data from the expert judgments, the media were evaluated and improved. There were some revisions, such as revisions in tasks and activities. First, Point, for example this step only using pictures as a clue, it should use word as a clue. It can encourage the students' creativity. Then, the researcher revised, the researcher added the five senses activity. It uses a word as a clue. Second, Net, for example, the slide is so colourful. Then, the researcher revised. The researcher made the elegant and concise slides.

Finally, the results of this research were as follows: a). Every tasks and activities in I-PEN can give detail explanation to students to create sentences and texts easily. b) It provides games to develop the students' creativity in creating descriptive text.

Conclusion

From the needs analysis, it can be concluded that students got difficulties to create a sentence and descriptive text. The teacher also got problem in selecting English digital media that related to students' needs. Therefore, the researcher decided to develop tasks and activities to teach writing skill. The use of digital in the development of the writing process is important to complete tasks and activities to improve students' motivation and enthusiasm in writing.

The I-PEN media for teaching writing for the seventh grade students of junior high school serve their functions in developing students writing skills in three steps namely Point, Elaboration and Net. It had been validated through Forum Group Discussion (FGD) and the results were as follows: a) Every tasks and activities in I-PEN can give motivation to students to create sentences and texts easily. b) It provides games to develop the students' creativity in creating descriptive text. This research constitutes an innovative Pedagogy in a Changing World.

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INTRODUCTION TO *MATLAB* FOR SOLVING AN ORDINARY DIFFERENTIAL EQUATION WITH INITIAL VALUE PROBLEM

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Abstract

One of the courses that existed in the mathematics education's lecture is the Numerical Method. The Numerical Method is a method of approach to finding approach solutions, and commonly used if an analytic problem problem is difficult to find. To introduce *MATLAB* to students, a learning activity plan based on problem-based learning method was developed. Stages in the learning activity plan include problem recognition, analytic solution search, numerical method introduction, manual numerical solution search, naumeris solution search using computer help, including use of *Microsoft Excel* as the introduction and *MATLAB*, and the meaning of the solution. The result of this planning is an example of ordinary differential equations with the initial value problem sought by the solution using the stages in the plan. The conclusion of this research are *MATLAB* is introduced to students because its use is more effective when compared to *Microsoft Excel* or manually ways, and *MATLAB* can be collaborated with problem based learning to create a new design of learning.

Keywords: *MATLAB*, ordinary differential equation, initial value problems, problem-based learning.

Introduction

Technology can be a powerful tool for transforming learning. It can help affirm and advance relationship between educators and students, reinvent our approaches to learning and collaboration, shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all learners (U.S. Department of Education, 2017). There are so many product of technology that has been created with the purpose to make a better experiences in learning. One of these product is *MATLAB*. There are some research that explain about *MATLAB*, one of them is in a research from GAO Feng (2011) about application of *MATLAB* in mathematical analysis, that presents several cases of *MATLAB* applications in mathematical

analysis and the conclusion of this research is *MATLAB* can be a significant tool in mathematical analysis. One of the subjects taught to students of mathematics education at bachelor level is numerical method. Learning in the numerical course teaches the students to solve a case using a variety of ways. Mathematical problems can be solved by numerical methods such as systems of linear equations, systems of differential equations, and other systems of equations. Not all mathematical problems can be easily resolved analytically. Numerical methods are used to find solutions to a problem, especially one that is difficult to solve using analytical methods. Numerical calculations can be done manually or with the help of computers. Numerical calculations often require precision so that computer programming help such as *Microsoft Excel* or *MATLAB* is required. *Microsoft Excel* is a fairly simple and easy-to-use application for calculation, but the use of *Microsoft Excel* become less effective if iteration is too much, not to mention if iterative schema is complicated. One other application that can help numerical calculation is *MATLAB*. In this paper we want to answer about the question why using *MATLAB* to solved the problem and we also want to know if *MATLAB* can be collaborated with problem based learning to make a new design of learning.

Theory

A. Ordinary Differential Equations with Initial Value

Ordinary differential equations (ODE) is an aquation for a missing function (or function) in term of derivatives of those functions. Recall that the detivative of a function $y(t)$ is denoted either by $y'(t)$ or by dy/dt . Then the derivative $y'(t_0)$ gives the slope tangent line to the graph of the function $y(t)$ at the point (t_0, y_0) (Devaney, 2011). The best-known differential equation (and essentially the first example of a differential equation) is Newton's second law of motion. Drop an object from the rooftop. If y measuresthe position of the

center of mass of the object, then we would like to know its position at time t , that is, $y(t)$. Newton's law tells us that mass times acceleration is equal to the force on the object. So, if m is the mass, then we have $my'' = F(y)$, where F is the force acting on the object when it is in position $y(t)$. So we have a differential equation for $y(t)$ (Devaney, 2011).

A differential equation with additional terms to the unknown function and its derivatives, all given to the same value for the free variables, is an initial value problem (Nugraha, 2011). For example, we look at the unlimited population growth model from biology. Suppose we have a species living in isolation (with no predators, no overcrowding, and no emigration) and we want to predict its population as a function of time. Call the population $y(t)$. Our assumption is that the rate of growth of the population is directly proportional to the current population. This translates to ODE $y' = ky$. Here k is constant (a parameter) that depends on which species we are considering. We wish to find the solution of an initial value problem, that is, a specific solution of the ODE that satisfies $y(0) = y_0$ where y_0 is given initial population.

B. *MATLAB*

MATLAB is an interactive system for doing numerical computations. *MATLAB* relieves we of a lot of the mundane tasks associated with solving problems numerically. This allows you to spend more time thinking, and encourages we to experiment. *MATLAB* makes use of highly respected algorithms and hence we can be confident about our results. Powerful operations can be performed using just one or two commands. We can build up our own set of functions for a particular application (Griffiths, 2015). *MATLAB* stands for *MATRIX LABORATORY* (Matrix Laboratory), which was first used by Dr. Cleve Moler in New Mexico University United States to teach courses of linear algebra. The basic data unit is a

matrix without dimension restriction. In *MATLAB*, computing become extremely easy. Dr. Moler in 1984 launched the official version of the software, in the later editions, he also gradually added to the control system, system identification, signal processing and communications, more than a toolbox, so *MATLAB* became to be widely used in automical control, image signal processing, biomedical engineering, signal analysis, optimization and other fields (Feng, 2011).

In pure mathematics, since *MATLAB* is an integrated comuter software which has three function: symbolic computing, numerical computing and graphic drawing, *MATLAB* is capable to carry out many functions including computing polynomials and rational polynomials, solving equations and computing many kind of of mathematical expression. One can also used *MATLAB* to calculate the limit, derivative, integral and Taylor Series of some mathematical expressions. With *MATLAB*, the graph of functions with one or two variables can be easily drawn in selected domain (Feng, 2011).

C. Problem Based Learning

Problem-based learning has often been understood simply as a method of learning. Correspondingly, many kinds of pragmatically based pedagogical applications and development project are described as PBL. Problem-based learning has also been investigated within the context of education, although the theoretical basis of problem-based learning is closely connected with learning at work (Poikela, 1998; Karila & Nummenmaa, 2001; Poikela & Jarvinen, 2001; Poikela & Poikela, 2001 in Poikela & Nummenma, 2006). Problem-based learning as an educational methodology started at the McMaster University, Canada in 1969. Problem-based on actual clinical cases were used as focl points in a medical program (Ee, 2009). The problem-based learning process essentially consists of the

following stage: (1) meeting the problem; (2) problem analysis and generation of learning issues; (3) discovery and reporting; (4) Solution presentation and reflection; and (5) overview, integration, and evaluation, with self-directed learning bridging one stage and the next (Tan, 2003 in Tan, 2009).

Methods (Design for The Learning Activity)

Broadly speaking, the activity design composed includes 6 stages, which are:

1. Problem Introduction

The problem recognition process aims to provide a context of problems to students, so that their purpose of learning a method becomes clearer. In the process of introducing this problem, students are expected to know what is really a problem in a case. At this stage students analyze the problem, then determine a hypothesis related problems.

2. Search for Analytic Solutions

This stage is the stage where students are invited to find a suitable strategy to solve the problem analytically. Students are then expected to apply the strategies they have to find an analytical solution.

3. Introduction of the Approach Methods

The next stage is the introduction of approach methods. At this stage students are introduced to alternative methods that can also be used to find solutions to the problems. Students then analyze the methods until finally making a plan to find a solution of the problem. The draft strategy is generally an iterative scheme.

4. Search for The Approach Solutions Manually

In the next stage students are expected to apply strategies they have designed manually. The goal is to make the students really understand the iterative schemes they have previously obtained.

5. Search for The Solutions Using Computer Help

This stage involves searching the approach solutions using *Microsoft Excel* and *MATLAB* applications. In using the approach method, generally iteration required quite a lot of number. When the required iteration and iterative scheme used are quite complicated, then the process of finding solutions will take quite a long time and requires considerable accuracy. Therefore, in order for the process of finding solutions to work more effectively, computer assistance is required.

First, students are expected to use Microsoft Excel to find an approach solution, by applying iterative schema into the application. To compare, an analytic solution scheme (exact solution) is provided, so we can look for errors at each point (the corresponding per-cell error).

The next stage, students are introduced to MATLAB, because in some cases, often the use of Microsoft Excel is considered less effective. To use MATLAB students must have already understood the basic algorithms in programming. Since this process involves an iterative schema, the algorithm that must be mastered is a repetition algorithm.

6. The Meaning of Solutions

In the last stage of the learning activities, students are expected to review the problems that have been previously given. Students are then asked to link the solutions that have been obtained with the context of the problem, to see whether the results match or not with the hypothesis that has been proposed at the beginning of the learning process.

Result and Discussion (An Example of ODE with Initial Value Problem)

A. Problem Introduction

An object that made from metal, 0.5 kg heavy and the initial temperature is 300^0 (573 K) dipped in water that have temperature at 25^0 (298 K), where there is a natural conventionally cooling process occurs.

$$\frac{dT}{dt} = \frac{A}{\rho cv} h_c (298 - T) \quad (1)$$

In the equation (1), the temperature is in K (Kelvin) unit, with the constants:

density, $\rho = 300 \text{ kg/m}^3$

volume , $v = 0,005 \text{ m}^3$

surface area, $A = 0,25 \text{ m}^2$

Heat, $c = 900 \text{ J/KgK}$

Heat transfer coefficient, $h_c = 300 \text{ W/m}^2\text{K}$

From the problem, we will look for the temperature plot of the object for 5 minutes (quoted from Kosasih, 2006).

Hypothesis: Logically, when a metal cools, then the plot temperature for 5 minutes will decrease from the initial temperature to a certain temperature.

B. Analytic Solutions

From the given problem, then we can obtain the analytic solution from that problem like this:

From the given problem we obtaining a system for an ordinary differential equation (ODE) with initial value problem:

$$\begin{cases} \frac{dT}{dt} = \frac{A}{\rho cv} h_c (298 - T) \\ T(0) = 573 \end{cases} \quad (2)$$

(3)

For $0 \leq t \leq 5$.

Where:

t = time (in minute)

T = temperature

Analytical solution for the equation system (2) and (3) as follows:

$$\frac{dT}{(298-T)} = \frac{A}{\rho_{cv}} h_c dt \quad (4.a)$$

$$\int \frac{dT}{(298-T)} = \frac{A}{\rho_{cv}} h_c \int dt \quad (4.b)$$

$$-\ln |(T - 298)| = \frac{A}{\rho_{cv}} h_c t + C \quad (4.c)$$

$$T = 298 + e^{-\frac{A}{\rho_{cv}} h_c t} \cdot e^C \quad (4.d)$$

From equation (3) was known that $T(0) = 573$, then e^C can be found by this information:

$$573 = 298 + e^{-\frac{A}{\rho_{cv}} h_c \cdot 0} \cdot e^C \quad (5.a)$$

$$\text{So that:} \quad e^C = 275 \quad (5.b)$$

By substituting (5.b) to (4. d) we get the analytic solution:

$$T = 298 + 275 e^{-\frac{A}{\rho_{cv}} h_c t} \quad (6)$$

C. Introduction of the Approach Methods

At this stage, using the problem in equation (1), two approach methods are considered suitable to find the solution, that are Euler Method and Heun Method. Students are invited to actively communicate the two methods. One of the alternatives for the introduction of these two methods of approach is counselors with some discussion with the students describe the Taylor Series to get an iterative scheme of Euler Method for the solution completion. After that students are asked to discuss the iterative scheme obtained for Heun Methods based on

the information they have gained about the Euler Method and the idea of Method Heun. Here is one form of Euler Method description and Heun Method (Aminuddin, 2006).

1. Euler Method

Euler Method is a method for solving the ODE using the Taylor series.

$$y' = \frac{dy}{dx} = f(x, y) \quad (7)$$

The iterative scheme for Euler Method is :

$$y_{i+1} = y_i + \Delta x f(x, y) \quad (8)$$

From the equation (8) can be concluded that the scheme of the solution for the previous problem, using the Euler Method is:

$$T_{(i+1)} = T_i + hf(t_i, T_i) \quad (9)$$

Note that $h = \Delta t$, for $i = 0, 1, 2, 3, \dots$

2. Heun Method

This method estimates two gradients at intervals, that is at the beginning and end points. The best value is obtained from averaging between the gradient at the beginning and end points. The gradient at the earliest end of the interval obtained by the Euler Method is expressed in the form of equation (7). Then linear extrapolation is applied to the value of y_{i+1} .

$$y_{i+1}^* = y_i + \Delta x f(x, y) \quad (10)$$

$$y_{i+1} = y_i + \frac{1}{2} \Delta x (f(x_i, y_i) + f(x_{i+1}, y_{i+1}^*)) \quad (13)$$

From the equation (10) and (13), obtained the scheme of resolving the initial value problem that already described above using Heun method, that is:

$$T_{i+1}^* = T_i + hf(t_i, T_i) \quad (11.a)$$

$$T_{(i+1)} = T_i + \frac{1}{2}h[f(t_i, T_i) + f(t_{i+1}, T_{i+1}^*)] \quad (11.b)$$

Note that $h = \Delta t$, for $i = 0, 1, 2, 3 \dots$

D. The Approach Solutions Manually

Consider $h = 1$, which mean that the interval of time for predicting the temperature every minutes. So that, in the 5 minutes, we need 5 numbers of iteration to get the temperature at the 1st, 2nd, 3th, 4th, and 5th minute (in this stage we are not solve the all of the problem yet, because the problem ask the plot for 5 minutes). Here is one form of solution using the Euler Method and The Heun Method.

1. Using Euler Method

Using the iterative scheme (9), we get the solutions for $h = 1$ are:

$$T_i = T_0 + hf(t_0, T_0)$$

$$T_1 = 573 + \frac{3500 \times 0.25}{900 \times 0.005} \times (298 - 573) = 394.7593 \quad (\text{The object temperature at the first minute is } 394.7593 \text{ K})$$

$$T_2 = T_1 + hf(t_1, T_1)$$

$$T_2 = 557,72 + \frac{3500 \times 0.25}{900 \times 0.005 \times 300} \times (298 - 394.7593) = 332.0449 \quad (\text{The object temperature at the second minute is } 332.0449 \text{ K})$$

The iteration process is done until the 5th minute.

2. Using Heun Method

Using the iterative schemes (11.a) and (11.b), we obtained the solutions for $h = 1$, which are:

$$T_1^* = T_0 + hf(t_0, T_0)$$

$$T_1^* = 573 + \frac{3500 \times 0,25}{900 \times 0,005 \times 300} \times (298 - 573) = 394.7593$$

$$T_1 = T_0 + \frac{1}{2} [f(t_0, T_0) + f(t_1, T_1^*)]$$

$$T_1 = 573 + \frac{1}{2} \times \frac{3500 \times 0,25}{900 \times 0,005 \times 300} [(298 - 573) + (298 - 394.7593)] = 452.5225 \text{ (the object temperature at first minute is } 452.5225 \text{ K)}$$

$$T_2^* = T_1 + hf(t_1, T_1)$$

$$T_2^* = 558,15 + \frac{3500 \times 0,25}{900 \times 0,005 \times 300} \times (298 - 452.5225 \text{ K}) = 352.3690$$

$$T_2 = T_1 + \frac{1}{2} h [f(t_1, T_1) + f(t_2, T_2^*)]$$

$$T_2 = 543,697 + \frac{1}{2} \times \frac{3500 \times 0,25}{900 \times 0,005 \times 300} [(298 - 558,15) + (298 - 352.3690)] = 384.8262$$

(the object temperature at second minute is 384.8262 K).

The iteration process is done until the 5th minute.

E. The Approach Solutions Using Computer Help

There is some calculation results using *Microsoft Excel* for Euler Method and Heun Method, and the comparison of error from both of that method.

Table. 1. Calculation results for $h = 1$

N	t(i)	Euler	Analytic	Error	t(i)	T*	Heun	Analytic	Error
0	0	573	573	0	0		573	573	0
1	1	394,7593	441,8287	47,0694	1	394,7593	452,5225	441,8287	10,6938
2	2	332,0449	373,2243	41,1794	2	352,3690	384,8262	373,2243	11,6018
3	3	309,9788	337,3433	27,3646	3	328,5499	346,7876	337,3433	9,4443
4	4	302,2148	318,5771	16,3623	4	315,1660	325,4137	318,5771	6,8367
5	5	299,4830	308,7621	9,2791	5	307,6456	313,4038	308,7621	4,6417

Table. 2. Calculation results for $h = 0.25$

N	t(i)	Euler	Analytic	Error	t(i)	T*	Heun	Analytic	Error
0	0	573	573	0	0		573	573	0
1	0,2	528,439	531,862	3,422	0,2	528,439	532,050	531,862	0,187

	5	8	7	9	5	8	0	7	3
		491,100	496,879	5,779		494,125	497,197	496,879	0,318
2	0,5	0	1	1	0,5	2	9	1	8
	0,7	459,810	467,128	7,318	0,7	464,920	467,535	467,128	0,406
3	5	7	7	0	5	4	5	7	8
		433,591	441,828	8,237		440,064	442,290	441,828	0,461
4	1	4	7	3	1	5	1	7	4
	1,2	411,620	420,313	8,692	1,2	418,909	420,804	420,313	0,490
5	5	5	3	8	5	8	0	3	7
		393,209	402,016	8,806		400,905	402,517	402,016	0,501
6	1,5	8	4	6	1,5	2	4	4	0
	1,7	377,782	386,456	8,674	1,7	385,581	386,953	386,456	0,497
7	5	3	6	3	5	7	8	6	2
		364,854	373,224	8,369		372,540	373,707	373,224	0,483
8	2	6	3	7	2	0	8	3	4
	2,2	354,021	361,971	7,949	2,2	361,440	362,434	361,971	0,462
9	5	7	5	8	5	3	2	5	7
		344,944	352,402	7,457		351,993	352,839	352,402	0,437
0	2,5	1	0	9	2,5	5	4	0	4
	2,7	337,337	344,264	6,926	2,7	343,953	344,673	344,264	0,409
1	5	4	0	6	5	4	3	0	3
		330,963	337,343	6,380		337,110	337,723	337,343	0,379
2	3	3	3	0	3	5	2	3	9
	3,2	325,622	331,458	5,835	3,2	331,286	331,808	331,458	0,350
3	5	0	0	9	5	6	1	0	1
		321,146	326,453	5,306		326,329	326,773	326,453	0,320
4	3,5	2	0	7	3,5	9	7	0	8
	3,7	317,395	322,196	4,801	3,7	322,111	322,489	322,196	0,292
5	5	7	7	0	5	3	1	7	4
		314,252	318,577	4,324		318,520	318,842	318,577	0,265
6	4	9	1	2	4	9	4	1	3
	4,2	311,619	315,499	3,879	4,2	315,465	315,738	315,499	0,239
7	5	3	0	7	5	2	8	0	8
		309,412	312,881	3,468		312,864	313,097	312,881	0,216
8	4,5	5	3	8	4,5	5	3	3	1
	4,7	307,563	310,655	3,092	4,7	310,651	310,849	310,655	0,194
9	5	2	2	0	5	0	2	2	0
		306,013	308,762	2,748		308,767	308,935	308,762	0,173
0	5	6	1	5	5	2	8	1	7

From both tables above obtained that the approach solution using Euler Method and Heun Method for $h = 1$ and $h = 0.25$. From that tables we can see that for the smaller value of h then the approach solutions become more accurate to the analytic solutions. The

temperatures plot for the metal object can be created using *Microsoft Excel* or using *MATLAB* (in this case we will using the *MATLAB*'s programs to make the temperatures plot for the problem)

This is one of the examples for the programs which can be made by the students using *MATLAB* application.

1. *MATLAB*'s program for the function

```
function z=fk(t,T) % function on the right hand of ODE
    z=0.25*3500*(298-T)/(300*900*0.005); % Equation
end
```

2. *MATLAB*'s program for the Euler Method

```
clear all;
clc
a=0; % initial time
b=5; % the end time (in minutes)
h=1/60 % time interval (delta t)
t=a:h:b;
N=length(t); % the number of points t
for i=2:N
    t(1)=0; % initial value of t
    T(1)=573; % initial value of T
    T(i)=T(i-1)+h*fk(t(i-1),T(i-1)); % Euler Method scheme
end
TE= 298+275*exp(-((0.25*3500)/(300*900*0.005))*t); % Analytic T
plot(t,TE,'k', t,T,'b-') % solution graph
legend('TEksak','TNumeris')
xlabel('t')
ylabel('T')
Error=(1/N)*sum(abs(TE-T)) % error calculation
tabel=[T' TE']; % making a table
disp(tabel) % display the table
```

3. *MATLAB*'s Program for Heun Method

```
clear all;
clc
a=0; % initial time
b=5; % the end time (in minute)
h=1/60 % time interval (delta t)
t=a:h:b;
```

```

N=length(t);           % the number of points t
for i=2:N
    t(1)=0;           % initial value of t
    T(1)=573;         % initial value of T
    % Scheme of Heun Method
    Tib=T(i-1)+h*fk(t(i-1),T(i-1)); % T(i) star
    T(i)=T(i-1)+0.5*h*[fk(t(i-1),T(i-1))+fk(t(i),Tib)];
end
TE= 298+275*exp(-((0.25*3500)/(300*900*0.005))*t); % Analytic T
plot(t,TE,'k', t,T,'b-') % Solution graph
legend('TEksak','TNumeris')
xlabel('t')
ylabel('T')
Error=(1/N)*sum(abs(TE-T)) % error calculation
tabel=[T' TE']; % making a table
disp(tabel) % display the table

```

We can change the function depends on the problem. Other than that, in the program for Euler and Heun Methods, the a, b and h variables can be customized with the given problem.

F. The Meaning of Solutions

1. Euler Method

Using the example of the program in the previous stage, we obtain the solution graph like this.

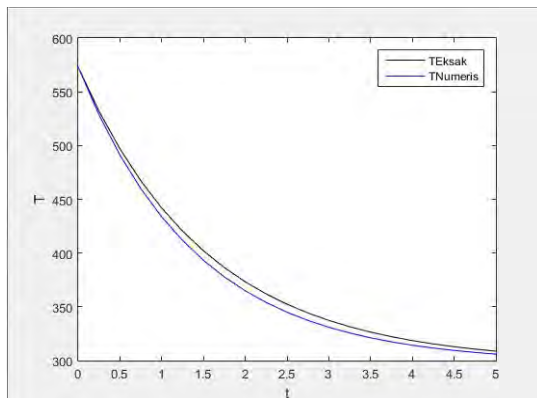


Figure 1. Euler's solution graph for $h = 0.25$

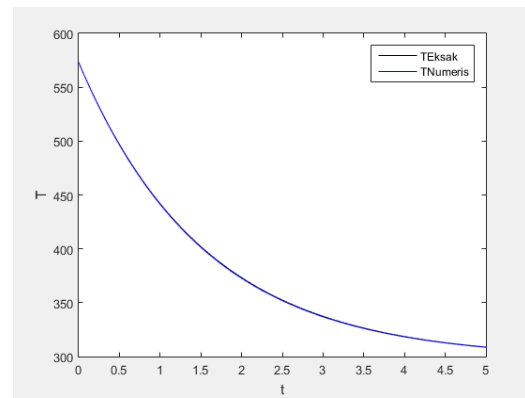


Figure 2. Euler's solution graph for $h = \frac{1}{60}$

By looking at Fig. 1. and Fig. 2. we can see that a smaller h value will give us more accurate approximation solutions (using the program obtained the total error for $h = 0.25$ is 5.7844 while the total error for $h = \frac{1}{60}$ is 0.3825)

2. Heun Method

Using the example of the program in the previous stage, we obtain the solution graph like this.

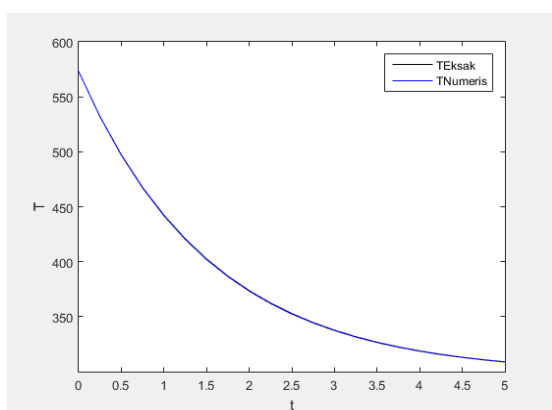


Figure 3. Heun's solution graph for $h = 0.25$

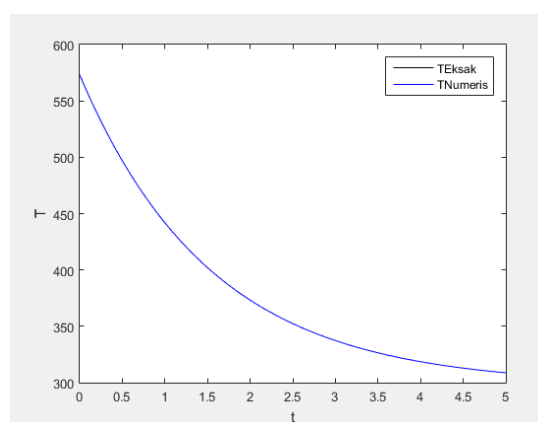


Figure 4. Heun's solution graph for $h = \frac{1}{60}$

From Fig. 3. and Fig. 4. we can see that the two approach graphs are quite accurate when compared to the previous method for each of the same h values (from the program the total error is 0.3375 for $h = 0.25$, while the total error for $h = \frac{1}{60}$ is 0.0014). Overall, we can see from the solution graph (both in Euler Method and Heun Method) that the metal temperature decreased from the initial temperature of 573 K to close to 300 K within 5 minutes (from the temperature calculation after 5 min about 308 K). In addition we can see that in this case, the use of Method Heun is more effective than the use of Euler Method, since the error obtained from Method Heun is less than the error obtained from the Euler Method, for the same time interval.

Conclusion

MATLAB is introduced to students because its use is more effective when compared to manual or using *Microsoft Excel*, especially when iterations are needed in large numbers and iterative schemes are quite complicated. The use of *MATLAB* can minimize errors caused by inaccuracy in calculations. To use *MATLAB* students are required to master basic programming algorithms, especially repetition algorithms, and fully understand the iterative scheme of the approach method to be used. Also, we can see that *MATLAB* can be collaborated with problem based learning to create a new method of learning.

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MATHEMATICAL ASPECTS OF KASONGAN POTTERY ART

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Abstract

The purpose of this research is to know what activities of the pottery craftsmen in Kasongan. Bangunjiwo, Kasihan, Bantul in the process of making pottery and to know the mathematical aspects that exist in the activities of the craftsmen in the process of making pottery in Kasongan. The subjects of this study consist of traditional pottery craftsmen, modern pottery craftsmen, carving craftsmen, land entrepreneurs, household furniture entrepreneurs, and representatives of Kasongan residents. Object in this research is activity of pottery craftsman, carving artisans activity, and data obtained from interview result to other research subject.

The type of this research is qualitative descriptive research and analyzed based on qualitative data analysis techniques according to Sugiyono (2010). Data obtained in the form of interviews of research subjects and research documentation. Validation of data in this research is done by using source triangulation, triangulation time and triangulation technique. The data are then analyzed by qualitative data analysis steps according to Sugiyono (2010).

The result of the analysis shows that the activity of Kasongan craftsmen in general pottery making process in Kasongan, Bangunjiwo, Kasihan, Bantul, covers; 1) soil preparation, 2) the formation of pottery, 3) drying, 4) combustion and 5) marketing. Each activity is described to look at the mathematical aspects contained therein by using the six basic mathematical aspects of guidance according to Alan J Bishop (1988). Overall, the mathematical aspects of each craftsman's activities include; calculations in the production process of the materials used, estimates to determine the time of completion of production with pottery products that can be produced, explanation of the generated pottery, determining the location used to obtain soil to make pottery, making pottery by way of imagining of real activity, or the right ratio for good soil to be used for making pottery, using a strategy to determine the amount of pottery produced in order to obtain optimal profit and make pottery production with a pleasant taste.

Some of the benefits of this research include development to become contextual issues adapted to Basic Competency in the 2013 curriculum, and can be used for character learning. Examples of the application of mathematical concepts contained in the art of pottery, among others, through the making of problems that can be used in top-level mathematics learning as in SMP, on the material 1) Two-variable linear equation system, 2) Algebra Operation, 3) Build Room and in SMA in material 1) Space geometry, 2) Integral Calculus, 3) Three Variable Linear Equation Systems, 4) Linear Programs, 5) Mathematical Logic, 6) Statistics. In addition, the results of this study can also be used as knowledge or information to the community to see the art of pottery and history Kasongan region through the angle of the field of mathematics.

Keywords: Mathematical Aspect, Art of Kasongan Pottery.

Introduction

Too many monotonous, theoretical, less contextual and abstract acutely. The learning models used are less varied, this is directly proportional to the low interest of students to learn more math. In school environments students often gain formal mathematics teaching so that students will have difficulty finding mathematics when students are in the daily environment. This is because of differences in situations and conditions received by students. In addition, in solving the problem of mathematics students will be guided in the form of a mathematical sentence. This indirectly makes students feel must memorize the formula in order to determine the completion, because students are still lacking in understanding the application of mathematics in the form of a contextual matter or about its application.

It is therefore important to convey to students the examples of mathematical applications and close contextual content in daily life. In the process of learning this can be delivered at the beginning of the learning process to foster the spirit and attraction for students in learning mathematics. Examples of this math application can be seen from various fields. One area that uses the science of mathematics is the art that is manifested in the form of craft. In the beginning the craft is done as a pleasure, a habit or a side job. But over the times and cost of increasing needs of the craft is used as one way to earn an income. Initially one considers crafts as a hobby and a side job. But over time the view then changed.

Now art is not only used as a hobby or a side job but becomes the main livelihood for some people in a certain area. Areas that most people use craft as one of the family income is Kasongan area. Kasongan is a hamlet of Bangunjiwo Village located in the Special District of Yogyakarta where most of its citizens work as a craftsman art craftsmen. The handicraft that is synonymous with hand preparation has many kinds and types of art craft, weaving, painting and

others. Crafts is one of the mainstay products of Yogyakarta Special Region. Many various companies that produce handicraft products are widespread in various Daerah Istimewa Yogyakarta. One of them is a pottery company in Kasongan. Kasongan is administratively located in Bangunjiwo Village, Kasamat District, Bantul District, Yogyakarta. Located approximately 7 km from the center of Yogyakarta City to the southwest.

The rapid development of the number of business units and the reputation of kasongan pottery to encourage the government of Bantul District to establish the center of Small and Medium Enterprises (SMEs) Gerongan Pottery into a leading SME region as well as a tourist area under the name of Kasongan Pottery Industrial Center Kasongan. The scope of SMEs developed along with the increasing economic value of tourist village location. In this kasongan area, there are many varieties of pottery products made by kasongan craftsmen in processing clay. The result of handicraft products in the form of high quality pottery and competitive in local and global markets. The production of the business owned by almost all citizens of this kasongan region in the form of pottery or pottery in various forms such as jars, vases, statues of animals and humans, cool, cauldron, tempayang and candle holder. Various production is about 80% marketed abroad such as Korea, Japan, Singapore, Malaysia, the United States and the Netherlands. Starting from a talent owned by the community in the area that produces an art pottery from clay.

Kasongan then became a tourist area famous for its pottery. This is due to the enthusiasm, diligence and hard work of these pottery craftsmen to develop the preparation of the artistic talents possessed by most of the Kasongan community to become their main livelihood to provide for daily survival. An art which is then developed and manifested in the form of the work of pottery and increasingly expanded by its citizens in the area in the end become a typical

culture of a region. Making pottery in Kasongan Bantul area is inseparable from the involvement of mathematical sciences used in the manufacturing process such as geometry of space, calculation by using integral volume for a product and others. Seeing that there is a link between pottery with the science of mathematics became the basis of researchers to examine more deeply about the process in making pottery Kasongan with relation to the science of mathematics. This will then be discussed further and deeper by researchers in the study entitled MATHEMATIC ASPECTS ON ARTS CRAFTS KASONGAN GERABAH.

Theory

Ethnomatematics is a mathematics that grows and develops in a particular culture. In Ethnomatematics contained elements of society, history and mathematics. These three elements can be said to be a major component of Ethnomatematics. The object of Etnomatemtika is an activity or a mathematical idea that exists in society. Ethnomatmatic ideas will be able to enrich existing mathematical knowledge. Therefore, if the development of ethnomatics has been much studied then it is not impossible math is taught modestly by taking the local culture. According to Bishop (1994), mathematics is a form of culture. Mathematics as a form of culture has actually been integrated in all aspects of community life wherever located. Thus a person's math is influenced by his or her cultural background, because of what they do based on what they see and feel. Culture affects individual behavior and has a major role in the development of individual understanding, including mathematics learning (Bishop, 1991).

Ethnomatmatologists argue that basically the development of mathematics until whenever will not be separated from the culture and values that already exist in society. In learning the formation of new schemes in students should start from the students themselves. Therefore it is appropriate if in teaching mathematics should use elements of mathematics that are often found

in the daily life of students in the student's residence area. For example to convey the material of building the space or calculate the volume of the puppets are invited to the artisans pottery vessel kasongan to see the process of making pottery, and various forms of building pottery space. Then directs and guides the students to write down the various elements that students can derive from the information they have acquired and they observe in making the pottery associated with the math material being discussed.

Art is a human effort to imitate, complement, change or work "against nature" and is a skill achieved through the study of practice and observation. In addition art is a set of artfull, stratagem, and artful discovery (According to Alo Liliweri in New Oxford American Dictionary, 2010; Merriam-Webster Dictionary, 2011). Art is a craft, skill, talent, knowledge, technique that shows the skill in doing what the study, practice, observation or the art of rhetoric ranges from working on pottery, the ability to teach and so on. A village that has a large area of land with the majority of its citizens work as craftsmen this over time showed a fairly rapid development in a tourist area of kasongan pottery. This situation encourages Bantul District Government to establish this business as a Small Medium Unit (UKM) of kasongan pottery into a flagship area under the name of Kasongan Pottery Industrial Center of Kasongan. Along with the development of SMEs, the coverage of the region is also growing along with the increasing economic value of this tourist village location. The area coverage of this area includes the hamlets of Kajen, Tirto, Kali Pucang, Gedongan, Sembungan and Kasongan.

Among other hamlets Kasongan hamlet is a hamlet that still retains the traditional patterned pottery. But along with the growing needs and interests of tourists, the craftsmen began to innovate from traditional pottery into art items that are more attractive, modern and new look compared to the type of pottery that is generally produced and displayed in the area. This makes

the Tourism Region of Kasongan Pottery into a tourist area that has a diversity of art products that are more interesting land. The products of pottery produced have high quality and competitive enough in local and global market. Through the road Bantul from the north of Yogyakarta City on the right side of the road there is a gate as the entrance of Kasongan Tourism area where the gate there are two statues of horses with opposite directions and pottery as a distinctive feature of existing products in the Kasongan

Kasongan village is a residential area of the kundi, which means a pitcher or whistle. In ancient times people who make a kind of pitcher, gendi, cauldron and others belonging to kitchen items, pottery, as well as ceramic decorative goods is referred to as kundi. The Kasongan pottery is a jar with various motifs (peacock, dragon, rose, elephant, bamboo, and many others), pots of various sizes, ceramic ornaments, small statues, frames, bamboo furniture, even masks made of clay. The results of the Kasongan village tourism handicrafts are of excellent quality so that the marketing done for these products is not only local but exported to many countries such as Europe and America is also widely done.

Kasongan pottery is a clay processing that has been going on for centuries and able to maintain until now because systematically in this area there is a skill transfer process that is done for generations. This is used by citizens of this kasongan so as to be able to maintain its existence as a regional pottery industry until now. Natural processing environment by the pottery craftsmen is an activity that mutual profitable. This is because the interaction made by artisans not only use but also preserve and keep nature and environment to remain in a balanced state.

Kasongan was originally a rice field owned by villagers in the south of Yogyakarta. During the Dutch colonial period in Indonesia, a rice field belonging to one of the residents was found by a dead horse, it was thought the horse belonged to a Dutch official. Because then the Dutch

colonial period, the people who own the land is afraid and immediately release the land rights so as not to be prosecuted by the Dutch. Similar fears also occur in other residents who have rice fields in the vicinity who eventually also release the rights of land ownership. The amount of free land, making other villagers immediately recognize the land. Residents who relinquish the rights of the land and then turned the profession into a ceramic craftsman who initially just to throw the ground that does not break if put together. At first the land was only used for children's toys and kitchen furniture only. However, due diligence and tradition that is done for generations, finally Kasongan region became known as a pottery clay pottery area which until now a fairly famous Tourism Village.

Pottery is a product made from red clay or clay called quartz (body earthenware). The process of making is done by mixing the soil and water sufficiently then twisted to become clay and easily formed. After getting the appropriate shape then the next stage is drying. The drying stage is carried out by drying the processed products in the previous stage under the sun for 2 - 3 days or adjusted to the size and thickness of the formed object and weather conditions until the object is obtained dry. After that the next stage is burning. Burning is done in a haystack for approximately 8 - 12 hours. The end result is strong, hard and reddish vessels. The techniques commonly used by pottery or ceramic craftsmen include plate techniques, spinning techniques, rotary techniques, press printing techniques and casting techniques. At first ceramics made with clay base material, but over time the manufacture of ceramics began to use the raw materials in the form of white porcelain stirred then filtered until smooth. The process of drying and combustion is carried out at almost the same stage in a closed furnace with a heat temperature of 1200 degrees Celsius with a time of 8-12 hours. Manufacture of porcelain material is more complicated and uses more power.

Methodology

The research is included in this type of qualitative research, so the paradigm of this study according to Capra (1996) in Research Methodology (Lexy J.Moleong 2009) as a constellation of concepts, values of perception and practice shared by the community that formed a special vision reality as the basis of how to organize it self.

1. Place of study

The research was conducted in Kasongan, Bangunjiwo Village, Kasihan District, Bantul Regency, Yogyakarta.

2. Time of study

Research carried out in some time:

- a. The observation stage begins in December 2016.
- b. The first phase of research starts in January 2017
- c. The second phase of research begins in May - June 2017

The object in this research is the process of making pottery by artisans, pottery sales and pottery craft businessman, as well as statistical data of Desa Bangunjiwo, Kasihan, Bantul.

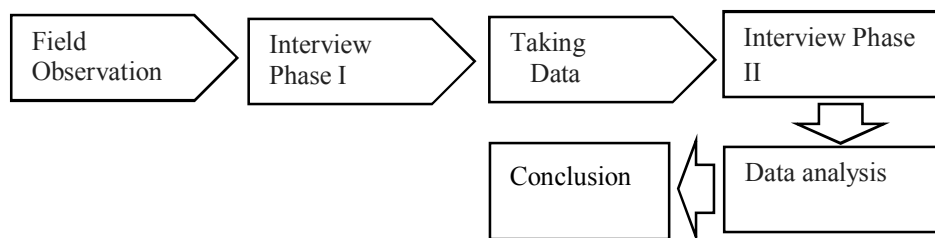


Figure 1. Scheme of data collection steps

Results and Discussion

Initially the land used to make this pottery comes from the land belonging together but over time the soil on the land has decreased the quality, so it is not good if used to make pottery. Therefore the land used for making this pottery by the craftsmen brought in from Tirta region. Land from Tirta has been processed so that by the artisans the land can be directly formed. Apart from Tirta this land is also taken from Godean. In the sale of clay units used are cabbage. The price of one colony of land is 400,000 rupiah. The price of land purchased by craftsmen to produce pottery every day about $\frac{1}{4}$ cup cabin with a price of 100,000 rupiah.

Marketing made by this artisans is by traveling around Sleman by riding a bicycle and bringing pottery produced approximately 20 pottery. The marketing done by these craftsmen include Sleman, Tempel and Minggir. In addition to marketing various regions conducted by cycling marketing is also done by way of entrusted to the market. If both sales results are compared between sales in the market with sales made around the results will be better if done alone by going around.

This can happen because if the craftsmen make their own sales then he will immediately get the results without any pot or sharing the results with any party. However, if the sale is done by way of goods goods marketed then the acquisition of the proceeds from the goods will be divided a percentage with the resellers who became intermediaries so that the goods can be sold. When the artisans began to make a sale is from 07:00 to 17:00 pm. Craftsmen give a unit price of goods produced ranged between Rp 5000 to Rp 6000 for each product which produced.

The process of making pottery made by craftsmen is presented in scheme 4.2. In scheme 4.2 the process is initiated from the formation of clay with a technique of striking. The soil used in

the making is red and brown soil with a mixture in such a way as to produce a reddish clay color if it is burned. Initially the clay used is black soil that originated from the local area but over time, climate and conditions resulted in soil structure began to change so that if still used to make the pottery is not good results because it will be easily damaged. Then for the next land used to import from the Tirta region already in the form of clay such as clay and ready to be processed. Then by the craftsmen the soil is processed with a dose that has been adjusted to obtain the desired form results. Craftsmen will only make cool (traditional stoves using fuels in the form of wood and dried leaves) and braziers (stoves that use charcoal as fuel).

Conclusion

Mathematics and local culture have a very close relationship. Many mathematical elements can be found in the process of making pottery. Starting from the processing of raw materials to the delivery of goods there are some parts that could associated with mathematical elements. The relationship that can be obtained from the process of making this pottery is a contextual mathematical problem making it easy for students to be able to understand the mathematical problems found in social life.

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THE ABILITY OF MATHEMATICAL CONNECTIONS ON THE SUM OF TRIANGLE ANGLES BY USING PROBLEM-BASED LEARNING FOR JUNIOR HIGH SCHOOL STUDENT

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Abstract

Mathematical connection ability has a strong relation in connecting mathematics problem with our daily life. For an example, the students will be asked to recalling the previous topic to understand the recent topic. In fact, some of them still have a low understanding in connecting mathematics. Based on the researcher's teaching practice experience, 13 out of 32 students have not understood in connecting to topic with other topics in mathematics. Therefore, the researchers want to know students' mathematical connection ability toward the sum of angles in a triangle by using problem-based learning models. In this research, the researchers used a qualitative descriptive method. Then, the research participants were 5 students of academic year 2016/2017 from SMP BOKPRI class VII A. Furthermore, the researchers used three instruments such as learning achievement test, observation and interview. The learning achievement test was used to know the student's mathematical connection ability. Then, observation and interview were used to reinforce the results of the analysis. Based on the results of this research, the researchers concluded that 2 out of 5 students have a good mathematical connection ability. In the other hand, the 3 of 5 students have a bad mathematical connection ability.

Keyword: connection ability, problem-based learning.

Introduction

National Council of Mathematic Teachers (NCTM, 2000) formulate that the purpose of mathematics learning consists five basic mathematics skills such as the standard of problem solving, reasoning and proofing, communicating, connecting, and representing. Kusuma (2008) said that the mathematical connection ability is one of the internal and external relationships in mathematics, connections between mathematical topics, connections with other disciplines, and connections in our daily life. Therefore, it can be said that one of the mathematics objectives subject is students are able to explain the interconnection between the concept and applying the

concept appropriately to solve the problems in our daily life. Nevertheless, the problem that happened in the school environment is students had difficulty in learning a material. It is because, they are unable to connect the materials that they have learned.

Based on the researcher's teaching practice experience, 13 out of 32 students have not understood in connecting to topic with other topics in mathematics. Astiati (2016) suggest that students' mathematical connection ability still need to be improved. However, Permana and Sumarmo (2007) solved the problems how to make a simple way for the students in mathematical learning ability by using problem-based learning.

According to Fathurrohman (2015: 113), Problem-Based Learning (PBL) is a learning model that involves learners to solve a problem through the stages of scientific method so that learners can learn the knowledge related to the problem and also have the skills to solve problems. Therefore, PBL has strong relation to the mathematical connections ability, because mathematical connection ability has a strong relation in connecting mathematics problem with our daily life. In this case, the researchers want to know the students' mathematical connection ability. The researcher will use a topic about the sum of angles in a triangle and PBL models.

Theory

A. Definition of Mathematical Connections Ability

Mathematics consists of various topics that are related to each other. These linkages is not only between topics in mathematics, but also the relationship between mathematics with other disciplines and the relevance of mathematics in everyday life. One's ability to relate between topics in mathematics, associate mathematics with other sciences, and the daily life of so-called mathematical connection ability. This is in accordance with the opinion of Kusuma (2008) said that the mathematical connection ability is the ability to show the internal and external relations

of mathematics, include: the connection between math topics, connections with other disciplines, and connections with everyday life. The connections of this aspect are also reinforced by the opinions Mikovch and Monroe (1994), which states that *"In mathematics, at least three kinds of connection are particularly subject to beneficial: connection within mathematics, across the curriculum, and with real world Contexts"*.

According to the NCTM (2000: 64), mathematics is not a collection of topics and ability of separate, despite the fact that math is often partitioned and taught in several branches. Some people say that mathematics is an integrated science. In fact, the students still difficult to connect the materials that they have learned.

B. Forms of Mathematical Connections

According to the National Council of Mathematics Teachers (NCTM) (in Rendya Logina, 2012), the mathematical connection is an important part that must get the emphasis on every level of education. Herdian (2010) states that the purpose of the connection of mathematics given the students in secondary schools. The students will be able to: (1) Recognize representation equivalent of a similar concept, (2) Recognize the relationship procedures on representing to procedure of equivalent representation, (3) Use and assess some mathematical connection topics, (4) Use and assess the connections between mathematics and other disciplines.

Based on some statements above, mathematical connections can be grouped in three aspects: the connection between multiple topics of mathematics, mathematical connections with other disciplines, and mathematical connection with the real world in everyday life.

Table 1. NCTM's Indicators of Mathematical Connection

Ability Mathematical Connections:
1. Mutually connect various representations of concepts or procedural
2. Recognizing the relationship between topics in mathematics
3. Using mathematics in everyday life
4. Seeing mathematics as a unified whole.

Ability Mathematical Connections:

5. Applying mathematical thinking skills and create a model to solve problems in other subjects such as music, science, art, psychology and business.
 6. Using mathematical ideas to understand other mathematical ideas are further
 7. Aware that an equivalent representation of the same concept.
-

Coxford (in Sugiman) suggested that indicators mathematical connection capabilities include:

Table 2. Coxford's Indicators of Mathematical Connections Ability

Mathematical Connections Ability:

1. Connecting the conceptual and procedural knowledge.
 2. Using math on another topic.
 3. Use mathematics in everyday life.
 4. See mathematics as an integrated whole.
 5. Applying mathematical thinking skills and create a model to solve problems in other subjects such as music, science, art, psychology and business.
 6. Knowing the connections between topics in mathematics.
 7. Know the various representations of the same concept.
-

Based on the table 2 above, researchers used indicators math skills of students in solving the problem as follows:

Table 3. Mathematical Connections Indicators

Mathematical Connections Indicator:

1. Recognize and use connections among mathematical ideas
 2. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
 3. Using mathematical ideas to understand other mathematical ideas are further
-

Methodology

In this research, the researchers used a qualitative descriptive method. The research participants are five BOPKRI junior high school students' grade VII A. The object of this research is the ability of mathematical connections using problem based learning. In order to determine instrument research, the researchers used three instruments. Those were achievement

test, observation and interview. Learning achievement test was used to know the student's mathematical connection ability. Then, observation and interview are used to strengthening the results of the analysis.

Result and Discussion

In this section, researchers do an analysis of student result test. The results of the analysis are strengthening by interviews and observations. At the time of the study, researchers use problem-based learning models. In the first activity, the teacher asks the students to show that the sum of the angles inside the triangle is 180° . On this activity students show it by using a bow. Some error occurred due to lack student drawing skills. Then, on the second activity the teacher asks the students to prove that the sum of the angles inside the triangle is 180° . On this activity students should strive for connecting materials previously they have learned. But not all students able to connect the material well.

A. The First Student

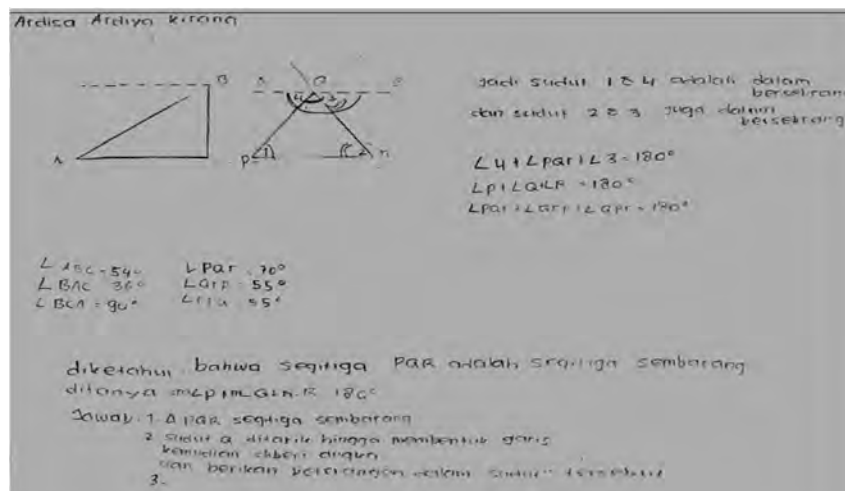


Figure 1. First Student

- Recognize and use connections among mathematical ideas

This student were able to connect various representations of concepts. She immediately understood the first given problem, and then answered correctly. Then for the proof, the researcher gave a support by asking her to draw a line, parallel to one side of the triangle. After that, she could solve the problem in a structured manner, started from seeing which angles have the same size. At the end, she can answer the second problem. Thus, this student was able to use her conceptual and procedural abilities.

- **Understand how mathematical ideas interconnect and build on one another to produce a coherent whole**

This student already knew and therefore able to connect topics in mathematics. This is the evident for how she can use angular properties to prove the sum of angles inside the triangle.

- **Using mathematical ideas to understand other mathematical ideas are further**

This student already used her mathematical ideas to understand other mathematical ideas further such as using angular properties to understand further mathematical idea, about angles inside triangle. She can prove that the sum of angels inside triangle is 180° .

B. The Second Student

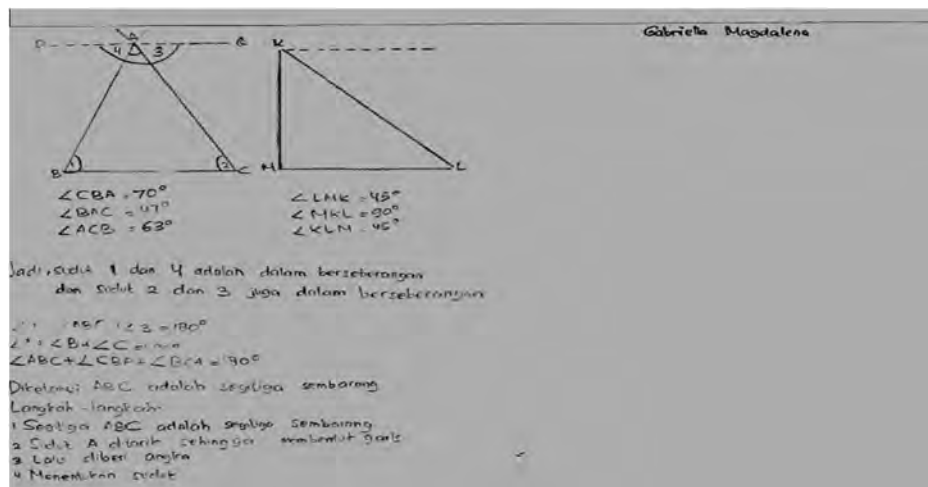


Figure 2. Second Student

- **Recognize and use connections among mathematical ideas**

This student was able to connect various representations of concepts. At first, this student did not know what to do or understand the problem, but when she received some support, she could understand the first problem and answered correctly. For the proof, the researcher gave same support to this student by asking students to draw a line parallel to one side of the triangle and description of angular properties. After that, this student can solve the problem in a structured manner. Finally students can answer the second problem. Thus, these students are able to use their procedural abilities.

- **Understand how mathematical ideas interconnect and build on one another to produce a coherent whole**

This student already knew and therefore able to connect topics in mathematics. This is the evident for how she can use angular properties to prove the sum of angles.

- **Using mathematical ideas to understand other mathematical ideas are further**

This student already used her mathematical ideas to understand mathematical ideas further such as using angular properties to understand further mathematical idea, about angles inside triangle. She can prove that the sum of angles inside triangle is 180° .

C. The Third Student

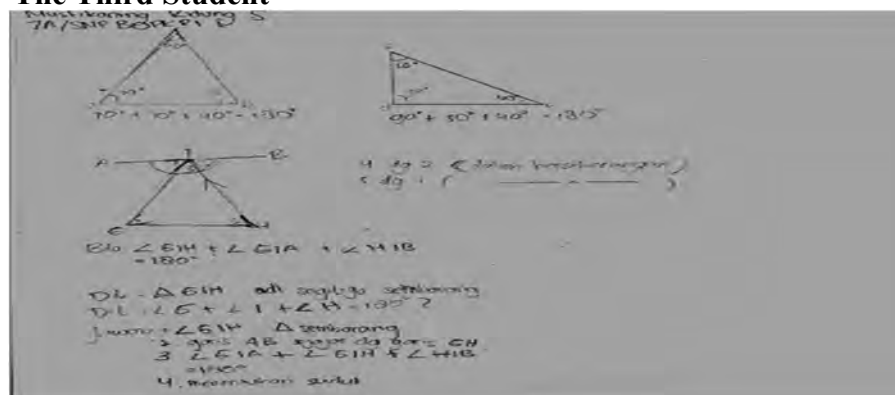


Figure 3. Third Student

- **Recognize and use connections among mathematical ideas**

This student was able to connect various representations of concepts. This student immediately understood the first given problem, and then she answered correctly. This student also received the same support. After that this student can solve the problem in a structured manner, see which angle is the same. Finally, she can answer the second problem. Thus, these students are able to use her conceptual and procedural abilities.

- **Understand how mathematical ideas interconnect and build on one another to produce a coherent whole**

This student already knew and able to relate topics in mathematics. This is the evident for how she can use angular properties to prove the sum of angels inside triangle.

- **Using mathematical ideas to understand other mathematical ideas are further**

This student already used her mathematical ideas to understand other mathematical ideas further such as one student using angular properties, parallel lines to prove that sum of the angels inside triangle is 180° .

D. The Fourth Student

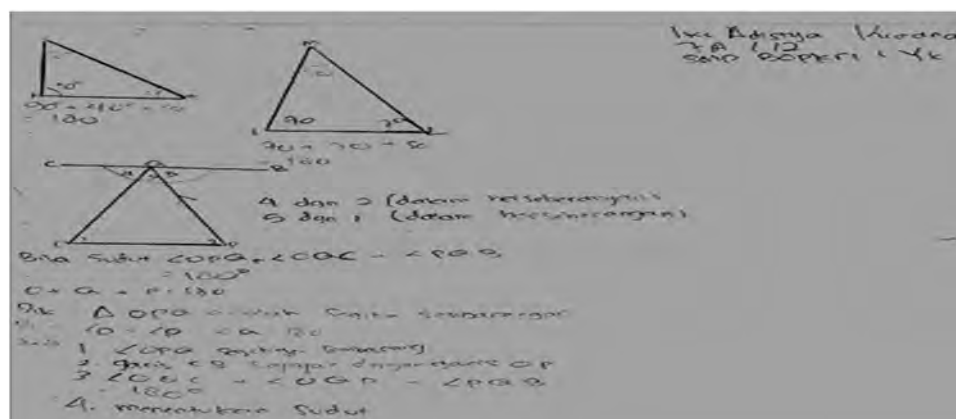


Figure 4. Fourth Student

- **Recognize and use connections among mathematical ideas**

This student was able to connect various representations of concepts. This student immediately understood the first problem given, then answered correctly. Then to prove, the researcher gives more support to this student by asking students to draw a line parallel to one side of the triangle and description of angular properties. After that this student can solve the problem in a structured manner. Finally students can answer the second problem. Thus, these students are able to use their procedural abilities.

- **Understand how mathematical ideas interconnect and build on one another to produce a coherent whole**

This student is already aware and able to relate topics in mathematics. This is evident from how he can use angular properties to prove the sum of angles inside triangle.

- **Using mathematical ideas to understand other mathematical ideas are further**

This student already used her mathematical ideas to understand further mathematical ideas such as using angular properties and parallel lines to prove that sum of the angles inside triangle is 180° .

E. The Fifth Student

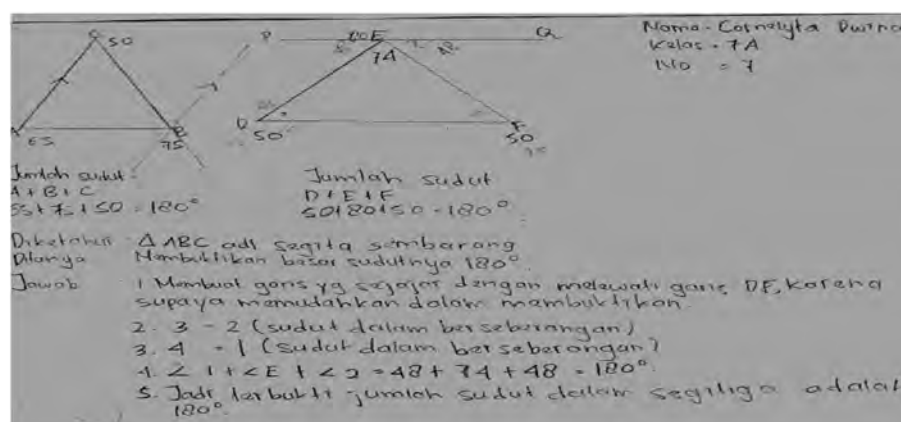


Figure 5. Fifth Student

- **Recognize and use connections among mathematical ideas**

This student could not connect the various representations of the concepts. This student did not understand the first problem, so it requires much more support from the researchers. About the proofing problem, the researcher gives more support to this student by asking the students to draw a line parallel to one side of the triangle and determine the angular properties. After that the researcher still gave her many support step by step so this student can solve the problem.

- **Understand how mathematical ideas interconnect and build on one another to produce a coherent whole**

This student is not yet aware and has not been able to relate topics in mathematics. There were so many supports given by researchers. By the help of supporter, this student can use angular properties to prove the sum of angles inside the triangle.

- **Using mathematical ideas to understand other mathematical ideas are further**

The fifth student used mathematical ideas to understand other mathematical ideas further even though with so many support. This fifth student still needs extra help and guidances.

Conclusion

Based on the result and discussion above, 2 of 5 subjects already meet the indicators of mathematical connection ability. Another 2 subjects also meet the indicators, but they still need more support to reach indicators and the last subject has not yet to reach the three indicators. This subject needs many more support from researcher to solve the problem.

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MOCOPAT OF JAVANESE POETRY, FROM ASSONANCE TO RHYME TO BE GLOBAL

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Abstract

Using qualitative and comparative study in research methodology, the research of classic poem such as Sicilian Octave (Italy), *Gurindam* (India), *Pantun* (Melayu), *Syair* (Arabic), *Complainte* (French), *Haiku* (Japan), *Wujue* (China) etc, that are already global, found that poetries generally have rhyme that can be used easily. And the other poems are using number of syllable in a line. By this finding, Mocopat of Javanese poetry as an advance poem with number of line (*guru gatra*), syllable (*guru wilangan*) and assonance (*guru lagu*), to be global, first, it can be modified in the assonance by applying rhyme, that generally knowable by students or usual people, without any breaking the Mocopat rule. This modification can be a way to globalize Mocopat, with in the second step by using Indonesia Language. And third is using English or other language. These are some results of the research in this paper in Indonesia. *Mijil* (born); *Peristiwa langka tidak sering* (10i), *Bersinar mencorong* (6o), *Kejadian yang sangat mentereng* (10e), *Sanata Dharma lahir teriring* (10i), *Tiada terbanding* (6i), *Tiada terbendung* (6u). *Maskumambang* (floating gold); *Generasi muda yang sedang menyingsing* (12i), *Guru yang tertantang* (6a), *Profesi telah disunting* (8i), *Tugas mulia disandang* (8a).

Keywords: poetry, mocopat, javanese.

Introduction

The global classic poems from Europe and Asia (Mid East) generally used rhyme, such as Sicilian Octave (Italy), *Gurindam* (India), *Pantun* (Melayu), *Syair* (Arabic), *Complainte* (French). On the other side, poems from Japanese and China that used syllable can go globally such as *Haiku* (Japan), *Wujue* (China) even not so popular comparing from its peer from Europe and “Asia”. Mocopat as Javanese poetry used assonance (*guru lagu*), syllable (*guru wilangan*), and number of line (*guru gatra*) almost combination with West and East poetry. Rhyme is more popular comparing to assonance. This research related to the structure of the poem, not the content, therefore the language of poem is irrelevant to be understood in this research.

The research question is, can Mocopat apply the rhyme instead of syllable without breaking Mocopat rule, in order to go internationally?

Theory

The basic theories of poem in this research consist of rhyme, assonance, syllable and number of line. Mocopat applies assonance instead of rhyme.

Rhyme

“A rhyme scheme is the pattern of rhymes at the end of each line of a poem or song. It is usually referred to by using letters to indicate which lines rhyme; lines designated with the same letter all rhyme with each other”. (https://en.wikipedia.org/wiki/Rhyme_scheme, 6:23am, 7/20/2017)

“Perfect rhyme, also called full rhyme, exact rhyme or true rhyme, is a form of rhyme is the stressed vowel sound in both words must be identical, as well as any subsequent sounds. The articulation that precedes the vowel in the difference words, for example, "bean" and "green" is a perfect rhyme. Half rhyme or imperfect rhyme, sometimes called near-rhyme or lazy rhyme or slant rhyme, is a type of rhyme formed by words with similar but not identical sounds. In most instances, either the vowel segments are different while the consonants are identical, or vice versa”. (https://en.wikipedia.org/wiki/Perfect_and_imperfect_rhymes, 6:39am, 7/20/2017)

This is a section from Shelley's Ode to the West Wind that contains perfect and imperfect rhyme:

O wild West Wind, thou breath of Autumn's **being**, (a)

Thou, from whose unseen presence the leaves **dead** (b)

Are driven, like ghosts from an enchanter **fleeing**, (a)

Yellow, and black, and pale, and hectic **red**, (b)

Pestilence-stricken multitudes: O **thou**, (c)

Who chariotest to their dark wintry **bed** (b)

The winged seeds, where they lie cold and **low**, (c)

Each like a corpse within its grave, **until** (d)

Thine azure sister of the Spring shall **blow** (c)
Her clarion o'er the dreaming earth, and **fill** (d)
Driving sweet buds like flocks to feed in **air** (e)
With living hues and odours plain and **hill**: (d)
Wild Spirit, which art moving everywhere; (e)
Destroyer and preserver; hear, oh, **hear!** (e)

(https://en.wikipedia.org/wiki/Terza_rima, 10:07pm, 7/12/2016)

This is another type poem that is syair with combination Malay and Arabic language, using rhyme as (aaaa).

Mulamma by Hamzah

Mutu qabla an tamutu (a)

Pada la ilaha illa hu (a)

Laut dan ombak sedia satu (a)

Itulah arif da'im bertemu (a)

(https://books.google.co.id/books?id=3pbwgOLcwTYC&pg=PA367&lpg=PA367&dq=syair+arabic+example&source=bl&ots=TDO4WxE7_3&sig=1T4YdizttLh0W9cNd3i51NARtC8&hl=id&sa=X&ved=0ahUKEwiO_OLwzIXWAhXMvY8KHaZCAbgQ6AEIUjAK#v=onepage&q=syair%20arabic%20example&f=false, 11:00am, 9/2/2017)

Assonance

“The other type of basic rule is assonance. Assonance is a repetition of vowel sounds in nearby words. It is used to reinforce the meanings of words or to set the mood”.

(<http://examples.yourdictionary.com/assonance-examples.html#uwbj6UQQ7yOEZPC4.99>, 6:11pm, 7/15/2017)

William Wordsworth employs assonance in his poem *Daffodils*:

“I wandered lonely as a cloud
That floats on high o’er vales and hills,
When all at once I saw a crowd,
A host, of golden daffodils;
Beside the lake, beneath the trees,
Fluttering and dancing in the breeze...”

(<https://literarydevices.net/assonance/>, 7:06am, 7/20/2017)

Syllable

“A syllable is a unit of organization for a sequence of speech sounds. For example, the word *water* is composed of two syllables: *wa* and *ter*. A syllable is typically made up of a syllable nucleus (most often a vowel) with optional initial and final margins”.

(<https://en.wikipedia.org/wiki/Syllable>, 7:43am, 7/20/2017)

“Syllabic verse is a poetic form having a fixed or constrained number of syllables per line, while stress, quantity, or tone play a distinctly secondary role or no role at all, in the verse structure. It is common in languages, such as Japanese or modern French or Finnish”.

(https://en.wikipedia.org/wiki/Syllabic_verse, 7:42am, 7/20/2017)

The example of Japanese haiku is Bashō’s of "old pond" that uses syllable :

Basho’s

fu-ru-i-ke ya (5)

ka-wa-zu to-bi-ko-mu (7)

mi-zu-no-o-to (5)

ha-tsu shi-gu-re (5)

sa-ru mo ko-mi-no o (7)

ho-shi-ge na-ri (5)

(<https://en.wikipedia.org/wiki/Haiku>, 7:38am, 7/20/2017)

The five-syllable form is called wujue in Chinese poem. The example as below

Chun yuan by Jin Changxu

Da qi huang ying er (5)

Mo jiao zhi shang ti (5)

Ti shi jing qie meng (5)

Hu de dao liao xi (5)

(<https://books.google.co.id/books?id=KYXGAgAAQBAJ&pg=PA204&lpg=PA204&dq=Wujue+chinese+poetry+example&source=bl&ots=s9WOeX0s8K&sig=PMCbOlRunTA6ZF9KRlj3yTc7g&hl=id&sa=X&ved=0ahUKEwiTwcrwwlFWAhVMYo8KHdIYDg8Q6AEIYzAG#v=onepage&q=Wujue%20chinese%20poetry%20example&f=false>, 5:16am, 9/3/2017)

Number of line

“Generally speaking, structure has to do with the overall organization of lines and/or the conventional patterns of sound. Based on the number of lines (*guru gatra*) can be classified a basic poem as follow: couplet (2 lines), tercet (3 lines), quatrain (4 lines), cinquain (5 lines), sestet (6 lines), septet (7 lines), octave (8 lines)”

(<http://learn.lexiconic.net/elementsofpoetry.htm>, 4:18 pm, 8/20/2017)

For example, the epitaph of Giulia Topazia in a Sicilian octave using Italian language and number of line 8 (abababab)

Giulia Topazia

Qui, d'Atropos il colpo ricevuto (a)
giace di Roma Giulia Topazia (b)
dell'alto sangue di Cesare arguto (a)
discesa, bella e piena d'ogni grazia (b)
che, in parto, abbandonati in non dovuto (a)
modo ci ha: onde non fia già mai sazia (b)
l'anima nostra il suo non conosciuto (a)
Dio biasimar che fè sí gran fallazia (b)

(https://en.wikipedia.org/wiki/Sicilian_octave, 11:26pm, 7/12/2016)

The French poetry, that is complainte, combines the rhyme and syllable. An example as below

Complainte Remede de Fortune

Tieus rit au main qui au soir pleure (8a)

Et tieus cuide qu'Amours labeure (8a)

Pour son bien, qu'elle li court seure (8a)

Et ma l'atourne (4b)

Et tieus cuide que Joie acqueure (8a)

Pour li aidier, qu'elle demeure (8a)

Car Fortune tout ce deveure (8a)

Quant elle tourney (4b)

Qui n'atent mie qu'il adjourne (8b)

Pour tourner; qu'elle ne sejourne (8b)

Ains tourne, retourne et bestourne (8b)

Tant qu'au desseure (4a)

Met celui qui gist mas en l'ourne (8b)

Le seurmonté au bas retourne (8b)

Et le plus joieus mat et morne (8b)

Fait en po d'eure (4a)

This can be summarized as a8 a8 a8 b4 a8 a8 a8 b4 b8 b8 b8 a4 b8 b8 b8 b4. The poem apply syllable and rhyme simultaneously.

(<https://www.scribd.com/document/56805655/Machaut-and-the-Remede-de-Fortune>, 11;21, 9/2/2017)

Below is the pantun with rather different rule, using syllable as 10 and mono rhyme in one stanza (aaaa) instead of (abab).

PANTUN IMLEK

By Yanto Sidik Pratiknyo

1. *Makan bakmi pedas dengan capcai (10)*
2. *Kue ranjang nya berjantai jantai (10)*
3. *Tahun baru imlek Gong Xi Fat Cai (10)*
4. *Banyak rejeki akan dicapai (10)*

5. *Makanan lumpia beserta bakpau (10)*
6. *Tarian monyet sangat memukau (10)*
7. *Menerima amplop merah Ang Pau (10)*
8. *Semua senang wajah kemilau (10)*

9. *Makan bakpia sangat dinikmati (10)*

10. *Lumpia Semarang sangat bergizi (10)*

11. *Terima ucapan Wan Se Ru Yi (10)*

12. *Agar sehat selalu diberi (10)*

13. *Besok imlek beli bandeng pindang (10)*

14. *Ortu dan mertua biar senang (10)*

15. *Kita sejahtera Sen Thi Cien Khang (10)*

16. *Rumah tangga damai serta tenang (10)*

17. *Perutnya buncit pantas taoke (10)*

18. *Penonton barongsai banyak bule (10)*

19. *Melimpah rejeki Xin Nian Kuai Le (10)*

20. *Selalu makmur tokonya rame (10)*

Methodology

Research approach applied is qualitative research and using comparative study among the global classic poetries from Europe and Mid West, India, Arabic, Melayu which are using rhyme and number of line generally without syllable, more over Japan and China which are using syllable and number of line without rhyme, comparing with Mocopat as classic Javanese poetry which are using assonance, syllable and number of line. Because qualitative research used, the researcher is the instrument. Data collection used is from Google. Analysis techniques are structures of the poem these consist of rhyme, assonance, syllable, and number of line. The content or the meaning of the poem is irrelevant in this research.

Guru lagu is not exactly the same as assonance. Repetition of the vowel in mocopat occurs in every stanza, is not in a line of the poem like in real assonance. This is example of Pocung 4(12u6a8i12a) that is a type of mocopat. Pocung has 4 lines, vowel as assonance in a stanza (uaia) and syllables (12, 6, 8, 12). It can be seen that repetition occurs in every stanza.

TEMBANG POCUNG

Gusti Pangeran Adipati Arya Sri Mangkunegoro IV

Ngelmu iku, kelakone kanthi laku (12u)

Lekase lawan kas (6a)

Tegese kas nyantosani (8i)

Setya budya pangekese dur angkara (12a)

Angkara gung, neng angga anggung gumulung (12u)

Gegolong nira (6a)

Triloka lekere kongsi (8i)

Yen den umbar ambabar dadi rubeda (12a)

Beda lamun, wus sengsem rehing asamun (12u)

Semune ngaksama (6a)

Sasamane bangsa sisip (8i)

Sarwa sareh saking mardi martotama (12a)

<http://lontarswatantra.blogspot.co.id/2011/03/pucung-cuplikan-serat-wedhatama.html>

http://art-spiritual.blogspot.co.id/2011/12/serat-wedhatama_05.html

Mocopat of Javanese poetry as an advance poem with syllable (*guru wilangan*), assonance (*guru lagu*) and number of line (*guru gatra*) to be global.

- First, it can be modified in the assonance by applying rhyme, that generally knowable by students or usual people, without any breaking the Mocopat rule. This modification can be a way to globalize Mocopat.
- The second step by using Bahasa Indonesia, therefore, second step for Indonesia Mocopat should be developed intensively.
- And third is using English or other language for globalization, or promotion and socialization in the International forum.

Result and Discussion

Mocopat is a Javanese poetry consist of 15 types, follow strict rules of poetic construction that are syllables number of line (*guru gatra*), (*guru wilangan*) and assonance (*guru lagu*)

1. *Dhandhanggula* 10(10i10a8é7u9i7a6u8a12i7a)

2. *Maskumambang* 4(12i6a8i8a)

3. *Sinom* 9(8a8i8a8i7i8u7a8i12a)

4. *Kinanthi* 6(8u8i8a8i8a8i)

5. *Asmarandana* 7(8i8i8é8a7a8u8a)

6. *Durma* 7(12a7i6a7a8i5a7i)

7. *Pangkur* 7(8a11i8u7a12u8a8i)

8. *Mijil* 6(10i6o10é10i6i6u)

9. *Pocung* 4(12u6a8i12a)

10. *Jurudhemung* 7(8a8u8u8a8u8a8u)

11. *Wirangrong* 6(8i8o10u6i7a8a)

12. *Balabak* 6(12a3é12a3é12u3é)

13. *Gambuh* 5(7u10u12i8u8o)

14. *Megatruh* 5(12u8i8u8i8o)

15. *Girisa* 8(8a8a8a8a8a8a8a8a)

(<https://id.wikipedia.org/wiki/Macapat>, 6:9am, 7/21/2017)

The description of the code in Mocopat for example number 13. *Gambuh* 5(7u10u12i8u8o)is

- Gambuh is one of a name of Mocopat from 15 types
- 5 is number of line in a poet (*guru gatra*)
- 7, 10, 12, 8, 8 in the parenthesis are syllable (*guru wilangan*)
- u, u, i, u, o in the parenthesis are assonance (*guru lagu*)

As an example, consider the following Kinanthi 6(8u8i8a8i8a8i) verse from the Serat Centhini

Ki Jayèngraga agupuh (8u)

anggamel rebab respati (8i)

rebabé langkung prayoga (8a)

watangan pinonthang gadhing (8i)

kosok pinatra pinrada (8a)

batok jamangan balenggin (8i)

(https://en.wikipedia.org/wiki/Javanese_poetry, 8:38, 7/14/2017)

The modification used by applying perfect or near perfect rhyme instead of assonance, however, the assonance rule or Mocopat rule is strictly followed. Rhyme can be applied because it is already knowledgeable by students or usual people, which used in the other classical poem learnt at school.

These are the Javanese poems with applying new version Mocopat in rhyme and assonance simultaneous in Indonesia language. First result is Mocopat of Sanata Dharma using complete 15 Mocopat and second is Sekar Gambuh Wisuda.

MOCOPAT OF SANATA DHARMA

By Yanto Sidik Pratiknyo

1. Mijil (born)

1. Peristiwa langka tidak sering (10i)

2. Bersinar mencorong (6o)

*3. Kejadian yang sangat mentereng
(10e)*

4. Sanata Dharma lahir teriring (10i)

5. Tiada terbanding (6i)

6. Tiada terbendung (6u)

2. Kinanti (awaited)

7. Mendidik guru diusung (8u)

8. Tugas berat yang dijinjing (8i)

9. Harapan besar disandang (8a)

10. Senyum dibibir teriring (8i)

11. Institusi telah datang (8a)

12. Anak yang terus dibimbing (8i)

3. Maskumambang (floating gold)

*13. Generasi muda yang sedang
menyingsing (12i)*

14. Guru yang tertantang (6a)

15. Profesi telah disunting (8i)

16. Tugas mulia disandang (8a)

4. Dandanggula (praised)

*17. Guru yang mengajar dan
membimbing (10i)*

18. Semua murid menjadi senang (10a)

19. Pendidik menjadi tameng (8e)

20. Segalanya tersanjung (7u)

21. Disiapkan tanpa berpaling (9i)

22. Jadi sebuah ajang (7a)

23. Mengalun membubung (6u)

24. Penyambutan dengan riang (8a)

*25. Dalam dunia baru telah terpampang
(12i)*

26. Pendidik yang tertantang (7a)

5. Sinom (still young)

27. Dari malam sampai siang (8a)

28. Belajar yang sangat penting (8i)

29. Usaha tidak terbilang (8a)

30. Agar otak makin **runcing** (8i)
 31. Banyak ilmu dijin**ing** (7i)
 32. Agar suksesnya melamb**ung** (8u)
 33. Bibit harus disi**ang** (7a)
 34. Agar tumbuh daun rant**ing** (8i)
 35. Belajarnya keras agar sukses dat**ang**
(12a)
6. Asmarandhana (love)
 36. Belajar menjadi gent**ing** (8i)
 37. Jalannya kisah terbil**ang** (8a)
 38. Lurus janganlah tercore**ng** (8e)
 39. Ilmu menjadi ti**ang** (8a)
 40. Datangnya cinta yang ri**ang** (7a)
 41. Masuk hati dalam rel**ung** (8u)
 42. Janganlah jadi bercab**ang** (8a)
7. Jurudemung (happy musician)
 43. Sekolah telah tergal**ang** (8a)
 44. Segala daya dius**ung** (8u)
 45. Dari sedikit ditab**ung** (8u)
 46. Hasil yang telah menjel**ang** (8a)
 47. Diharap sambung menyamb**ung** (8u)
 48. Rajin serta banting tul**ang** (8a)
 49. Sekolahnya bisa ramp**ung** (8u)
8. Balabak (charity)
 50. Mendidik mahasiswa dalam
gelangg**ang** (12a)
 51. Menter**eng** (3e)
 52. Mendidik murid diluar dan diru**ang**
(12a)
 53. Tergel**eng** (3e)
 54. Kebaikan dan panutan yang
terngi**ang** (12a)
 55. Ditent**eng** (3e)
9. Gambuh (arrogant)
 56. Tampilan baju digul**ung** (7u)
 57. Menyebarkan aroma melamb**ung**
(10u)
 58. Tebarkan pesona yang indah kelil**ing**
(12i)
 59. Jaga nama yang membub**ung** (8u)
 60. Jangan jadi guru somb**ong** (8o)
10. Durma (impolite)
 61. Dunia berubah dengan cepat us**ang**
(12a)
 62. Lokasi yang meramp**ing** (7i)
 63. Sukar dapat ru**ang** (6a)

64. Gadget banyak yang datang (7a)
65. Sopan santun yang berpaling (8i)
66. Gawat terpampang (5a)
67. Guru jangan terasing (7i)
11. Pangkur (regret)
68. Kekuatan yang berkurang (8a)
69. Kekunoan tidak lagi bertaring (11i)
70. Otak tertinggal tergulung (8u)
71. Rasa gelisah datang (7a)
72. Pikiran juga sudah menjadi murung (12u)
73. Guru yang membanting tulang (8a)
74. Serasa menjadi puing (8i)
12. Girisa (horrified)
75. Orang miskin yang berjuang (8a)
76. Meski kurus tinggal tulang (8a)
77. Cari sebuah peluang (8a)
78. Kemiskinan yang melintang (8a)
79. Belajar harus digalang (8a)
80. Agar kemiskinan hilang (8a)
81. Kesuksesan yang digadang (8a)
82. Derita tidak membayang (8a)
13. Megatruh (stretching)
83. Dari hari ke hari telah terhubung (12u)
84. Banyak tantangan membanting (8i)
85. Hambatan datang menyandung (8u)
86. Hancurnya buruk berkeping (8i)
87. Hari yang baru menyongsong (8o)
14. Pocung (rest in peace)
88. Bapak pocung prestasi telah diusung (12u)
89. Doa yang didendang (6a)
90. Pengagum datang mengiring (8i)
91. Jasa guru yang tiada pernah hilang (12a)
15. Wirangrong (burying the bad)
92. Hal buruk jangan disanding (8i)
93. Kebaikan yang diborong (8o)
94. Terdengar keras seperti gaung (10u)
95. Sekolah bertaring (6i)
96. Jasanya untuk orang (7a)
97. Hal yang jelek masuk liang (8a)

SEKAR GAMBUEH WISUDA

5(7u10u12i8u8o), Pelog

By Yanto Sidik Pratiknyo

1. Perguruan yang mahsy**ur** (7u)
2. Menggelegar bagai bunyi gunt**ur**
(10u)
3. Menghasilkan sarjana yang sangat
mah**ir** (12i)
4. Banyak alumni memba**ur** (8u)
5. Masa depannya yunior (8o)
6. Mata sudah melunt**ur** (7u)
7. Mengantuk karena kurang tid**ur**
(10u)
8. Belajar sampai malam terus berpik**ir**
(12i)

9. Ujian besok melunc**ur** (8u)
10. Janganlah menjadi hor**or** (8o)
11. Hasil ujian gug**ur** (7u)
12. Pikiran stress sampai badan hanc**ur**
(10u)
13. Hatinya susah sedih menjadi akh**ir**
(12i)

14. Hatinya sudah terbent**ur** (8u)
15. Badan bau sudah kotor (8o)
16. Otak tidak terat**ur** (7u)
17. Diajar dosen yang sudah uz**ur** (10u)
18. Kadang diajar dosen killer yang
had**ir** (12i)
19. Bisa lulus tak tersung**kur** (8u)
20. Dari sekolah tersoh**or** (8o)
21. Wisuda yang diat**ur** (7u)
22. Anugerah yang akan ditab**ur** (10u)
23. Demikian lama sekolah berakh**ir**
(12i)
24. Air matanya bercamp**ur** (8u)
25. Menjadi sebuah paspo**r** (8o)
26. Kita telah bersyuk**ur** (7u)
27. Kami berdoa dengan tepek**ur** (10u)
28. Para mahasiswa menyimak berpik**ir**
(12i)
29. Para dosen yang bertut**ur** (8u)
30. Terima kasih Profes**or** (8o)

Conclusion

Concluding remarks, that mocopat of Javanese poetry as an local content can be leveled up to the global with in the first by modificating from syllable to rhyme that more knowledgeable by students or usual people. Secondly, Mocopat can use Indonesia Language and third using other global language such England, Italy, Japan, China or other in the near future.

Research implication is socialization for teacher to apply Mocopat in their class at least using Indonesia language, if we want to promote local content to global. Gamelan music can be applied to motivate the students.

Suggestion is to expand Mocopat using English Language. Thesis or paper for mocopat should be facilitated by university or faculty. Events or conferences in University should be done to develop the Mocopat as local to be national and international.

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SCAFFOLDING: HOW IT WORKS FOR STUDENTS WITH LEARNING DIFFICULTIES

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Abstract

The current educational developments begin to place children with special needs with regular children or children who have not special needs to learn, understand and appreciate each other. As a teacher, teaching diversity is a challenge in itself. In addition, teachers also need to teach the independence of students, especially students with special needs. Children with learning difficulties are one of the categories of children with special needs. Learning difficulties refer to a group of difficulties experienced by children where the difficulty can cause children experience problems in learning. Children with learning difficulties need remedial to help them in the learning situation. The use of various media with various methods and strategies can be used to assist teachers in providing remedial. The problem is how effective remedial methods can be applied. Scaffolding is a way to provide assistance or mentoring to students during the early stages of learning then the student takes over responsibilities gradually increasing as soon as he or she can do so. Assistance can be guidance, warning, encouragement, problem-solving into learning steps, etc. so as to enable students to grow independently. This research is a literature study where the researcher collects data through literature study theory, journal, and research article until conical at a conclusion.

The purpose of this article is to introduce teachers to scaffolding methods that can be an alternative learning in the classroom especially for children with learning disabilities.

Keywords: scaffolding, learning difficulties.

Introduction

Education is now beginning to pay attention to the concept of inclusion. Where children with special needs can be admitted to regular schools and join children who do not experience specific needs in one class. This development, on the one hand, shows the humanist side in which children with special needs have equal rights to attend regular schools. But on the other hand, this becomes a challenge for teachers, especially teachers in elementary school level. So teachers need to add insight and knowledge to develop appropriate learning not only for regular children but also for children with special needs.

Children with learning difficulties fall into the category of children with special needs. Chairani (2015) showed that students with low learning ability took the longest time to understand the material than children with medium or high cognitive abilities. Thus they need special assistance so teachers need appropriate strategies to assist in learning. Remedial teaching is one of the most used methods by teachers in helping children with learning difficulties. Through remedial teaching, teachers can help children repeat material that has been previously given. Hopefully, children can master the material by getting a repetition. Masbur (2012) explains that remedial teaching is a teacher's effort to create situations so that students can learn more optimally. But in providing remedial teaching materials, teachers require a method that can support the child as well as motivate in learning. The same remedial teaching method as the previous teaching can make the child feel bored and less motivated because it is only repeating the material.

Scaffolding is a method of learning derived from Vygotsky's theory. This method provides a more adaptive way to the child's ability because this method uses a tiered learning method. Where the materials and questions are given begins with the easiest questions and controlled by the child while accompanied by teachers or colleagues who are more capable of cognitive. Mastery of matter or matter is a marker for obtaining more complicated material or matter.

This study discusses descriptively how the scaffolding method can be used by teachers as an alternative in providing remedial teaching in children with learning difficulties. Hopefully, through the results of this study can increase the knowledge of teachers in helping children who have learning difficulties.

Theory

Learning Difficulties

Learning difficulties can be understood as a condition in a learning process characterized by certain constraints to achieve learning outcomes (Mulyadi, 2010). Learning difficulties have a wide understanding and depth as well as learning disabilities, learning disabilities, learning dysfunction, low achievement, and slow learning. Learning difficulties are visible symptoms in the manifestations of various behaviors, either directly or indirectly and characterized by the barriers to learning.

Learning difficulties are explained as a reflection of unexpected learning problems in the child's apparent abilities. But earlier in 1966, Goldstein explained that the notion of learning difficulties itself is still not standardized. Then in 1987 the National Joint Committee on Learning Disabilities (NJCLD) describes an understanding of learning difficulties which is a general term with regard to the disturbance in heterogeneous groups experiencing barriers to understanding and using listening, speaking, reading, writing, thinking or mathematics. Based on some understanding which has been submitted, hence can be concluded that learning difficulties itself are the mismatch between learning achievement with the ability of the child in learning and opportunity to learn. Learning difficulties are a condition where students can not learn properly.

Some of the characteristics of learning difficulties (Mulyadi, 2010) are: low learning outcomes, results obtained are not in accordance with the efforts undertaken, showing a less reasonable attitude such as indifferent, showing behavior who has less reasonable as alienated or not cooperate with other colleagues, exhibit less emotional symptoms such as irritability or irritability. Learning difficulties are an instructional or pedagogical problem as well as a psychological problem. This is because learning difficulties are also rooted in aspects of

psychology. As a psychological problem, learning difficulties require psychological solutions and solutions. Then the assistance provided is also given that is therapeutic.

The cause of learning difficulties can be attributed to two factors: internal and external factors. Internal factors are neurological problems while external factors are problematic in learning such as less suitable learning strategy, less motivational learning management until the giving of less matching (Abdurrahman in Mulyadi, 2010). Neurological dysfunction in the form of genetic factors, brain injury due to physical trauma or lack of oxygen, biochemistry, environmental pollution, inadequate nutrition, psychological and social influences that affect child development.

The steps of the problem-solving learning process (Mulyadi, 2010) include: estimating the possibility of assistance, establishing possible ways to cope, and follow-up. Remedial teaching is seen as one of the problems solving that can be done by teachers to help children who have learning difficulties. The purpose of remedial teaching is to improve some or all of the learning difficulties faced by children. These improvements are directed towards achieving optimal learning outcomes that match their abilities. In providing remedial teaching, teachers need to have a strategy that fits and matches the child's difficulty level. So teachers need to have different teaching variations when teaching in the classroom.

Vygotsky Theory

Vygotsky is one of the psychologists who introduced important points about the child's mind. Her ideas on child cognition began to recognize and flourish into the early twentieth century. Some of Vygotsky's ideas point to language and thought, as well as the culture of society. In addition, know the concept of ZPD (Zone Proximal Development) and Scaffolding which is currently widely known.

The proximal development zone (ZPD) is a term used by Vygotsky for tasks that are too difficult for the children to master themselves, but which can be mastered with guidance and assistance from adults or more skilled children (Santrock, 2002). Then in the ZPD also appears the lower limit and upper limit. The lower limit is a level of problem-solving that can be solved alone by the child, while the upper limit is the level of problem-solving that can be solved by the child but with the help of others. ZPD is conceptualized as learning potential. That is, ZPD learning is a social event that combines at least 2 (two) thoughts where one is more trained to produce a learning achievement.

Vygotsky argues that to achieve optimal knowledge, children need to get sufficient help. If left to learn without help at all then the child will be at the level of actual cognitive abilities. Vygotsky explores the concept of scaffolding, which provides a gradual amount of assistance to the students and then reduces aid and provides opportunities for students to take on greater responsibilities (Slavin, 2009). Scaffolding is a term derived from ZPD theory. This method is a process that adults use to help children through their ZPD. The purpose of this theory is that children are given complex and complex tasks. But in the completion of the task, they are assisted by a more mature person or colleague who has more ability in completing the task. The use of scaffolding can motivate and enhance children's learning interests. For children can learn in stages with assistance in accordance with its ability.

Methodology

The type of research used is literature study. Methods in literature study is an activity of library data, reading and taking notes, as well as managing research materials. The main purpose of this method is to find or build a theory or treat the theory and the results of research that

conical to a decision. The results of this study can be used as a basis for conducting more in-depth research.

Discussion

Scaffolding for Children Learning Difficulties

Often in providing learning especially in remedial teaching, teachers distinguish between students who are able to learn with disadvantaged students in learning into specific groups. The hope of teachers will be easier to handle and focus on handling groups who are less able to learn and release the group is able to learn to be more independent. But basically, all the good students who are able to learn or who in dire need of attention and mentoring teacher. It is not impossible if what happens is that students are able to learn to feel neglected while students with learning disabilities increasingly feel inferior because of the focus of attention from teachers. The long-term consequences are class inclusiveness due to the attention gap and jealousy that arise amongst the students themselves. So teachers need appropriate strategies and in accordance with the needs of students so that attention and assistance can be more equitable.

Scaffolding is a method that teachers can use in the remedial teaching process. Several studies at the secondary level indicate that this method gives good results to both students. Through this method, students can learn in stages so that the mastery of learning materials becomes easier. At the primary school level, scaffolding is limited to children with no special learning difficulties. So it is only given to certain materials such as math lessons. Learning difficulties are the inability of children to master certain materials within the time period specified. This difficulty resulted in the difficulties of children in learning other materials so that the child becomes less confident to lazy to learn because they feel less able to catch up the material. Scaffolding is a method by which teachers provide materials in stages with their help or with other children who are more

capable of mastering the material. The use of scaffolding in children with learning difficulties begins with a child-friendly attribute (with teacher or group mentoring). After the child has successfully solved the most easily mastered problem, the teacher gives a slightly more complicated problem. At some stage, the child is asked to try to solve more complex problems.

A number of studies conducted to determine the effect of scaffolding methods. Chairani (2015) discusses this method in Mathematics learning in high school and mentions that this way can be used by teachers as an effort to help students with learning difficulties. In the study explained that the use of scaffolding can use explaining, reviewing, restructuring, and developing conceptual thinking. Several other studies are more directing scaffolding on mathematics learning so there need to step on applying scaffolding at the primary school level.

The important thing in the application of scaffolding is the guidance of teachers gradually given. 3 Vygotsky's main ideas that support scaffolding are: cognitive evolve as new ideas emerge and it is difficult to link the idea to what is known, interaction with others enriches the cognitive power, the teacher's role as a mediator (Chairani, 2015). The use of scaffolding in primary schools, in general, can pay attention to measures tailored to the child's condition as well as taking into account the school situation. Here are some steps that can be used as teacher references:

1. Prepare the tiered material starting from the material that is easiest to master. This is done because the scaffolding approach starts from the easiest material to then tiered into the more complex material. The easiest material can be started with the subject of material basics.
2. In learning, students are combined with groups that are more cognitively capable. This is done so that students are motivated and assisted by students with more capable cognitive abilities.

3. Ask the group to help each other with teacher supervision and assistance. In the group, students are asked to discuss and help other students who have difficulties such as re-explain the material that has been submitted.
4. Providing assistance in solving problems while encouraging students to cultivate their Work. Here students are assisted to solve problems that are difficult to solve while encouraged and motivated to feel more confident and confident to be able to solve problems independently.
5. Students try to solve the problem independently. After through the mentoring of both teachers and other students, students are given the opportunity to try to solve the problem independently. In case of difficulties, it will be done back mentoring.
6. Summarize material done by teachers and groups. Taking conclusions can be done in clusters or classically depending on the ability and situation of class conditions.

Conclusion

Based on the previous discussion supported by the theory and some research results, it can be concluded that scaffolding is a method that can be given as an alternative to providing remedial teaching in children with learning disabilities. Through the method of scaffolding, the child is not only helped master the material gradually but also can foster motivation and confidence. This is possible because every child successfully solves the problem and the material well, then arises a sense of pleasure for the achievement he got. So the child becomes more excited and interested to learn the material and solve more complicated problems. The thing that should be considered by primary school teachers is to make an assessment first to find out how far the ability of children with learning difficulties in the class so that the scaffolding method that is given also in

accordance with the ability of the child. Scaffolding enables children to acquire skills using their capabilities and potential optimally.

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SOME ASPECTS ON STUDENTS' MATHEMATICAL REASONING IN EXPLORING GROUP THEORY

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Abstract

Mathematical reasoning can be used to understand mathematics thinking process as axiomatic system. Mathematical reasoning can identify students' logical thinking and mathematical creativity. There are two aspects in mathematical reasoning i.e. formal and informal aspects. The students' mathematical reasoning can be examined by using mathematical tasks in which the students justify and communicate mathematics ideas. The aims of this study are to describe 1) formal aspect of students' mathematical reasoning and 2) informal aspect of students' mathematical reasoning when they solved the tasks. The mathematical tasks used in this study are on the topics group theory. We found that the students still lack reasoning in explaining the connection on premises that were used in formal proof. The power of students' intuition also still low in choosing the best strategy to solve the problem.

Keywords: mathematical reasoning, intuition, mathematical task, group theory.

Introduction

Group theory is one of the topics in modern algebra. Characteristics Group theory emphasizes on the abstract thinking aspect. Classical algebraic concepts at the secondary school level are generalized through abstraction. This process require more logical thinking than arithmetic skills. The ability to think logically involves more mental activity to reason, justifying and verifying mathematical ideas. The most popular illustration is basic of operations and the cardinality of sets. The structure of all set of integer with addition is group. By the property of inverse element, the notion of subtraction comes later. Eventually, the group structure of nonzero real number with multiplication introduces us the notion of division. So, the students are introduced with the notion of addition, subtraction, multiplication and division by abstract concept in group theory. The next illustration about cardinality of sets. As we know in the concept of finite set,

two sets have same cardinality if and only if the number of their element are equal. Something that little difference occurs in infinite sets. Consider the set of all integer number $Z = \{..., -3, -2, -1, 0, 1, 2, 3, ...\}$. If we take all the even number then we have $E = \{..., -4, -2, 0, 2, 4, ...\}$. Now, we have set E is a subset of set Z and make sense that the number of E is less than Z . But, the last statement is not true that set E and Z have difference cardinality. The student must generalize the definition of the sets cardinality. This concept in group theory is called isomorphism.

The previous illustrations show us that the student's ability to give reasons in every argument becomes very important in the abstraction process. Supporting statements they can use to justify a mathematical idea. These arguments can be either abstract or factual concepts directly related to the student's experience. The process of building the ability to provide a logical reason for concluding mathematical ideas is one of the main objectives of learning activities in the topic of group theory. The term of mental activities in reasoning skill for mathematical ideas in this paper is mathematical reasoning.

The mental activity of reasoning, justification and verification of mathematical ideas begins after students understand the problem. Students start to think about how strategies to solve the problem and then execute in the form of formal proof. Selection of strategies to solve problems is not always easy. The strategy chosen by the students was not always able to find the solution of the problem. The selection of an efficient strategy depend on each student's experience in doing something similar previously. The choice of strategy usually appears subjective, direct and specific. Furthermore, students provide formal arguments to solve the existing problems. This argument can either be written or expressed by providing logical reasons. The mental process in determining the strategy in solving mathematical problems is an informal aspect in mathematical

reasoning. The activity is still very subjective and sudden. Meanwhile, the activity in giving arguments logically is a formal aspect in mathematical reasoning. These two aspects determine the ability of students to provide reason, justification and verification of abstract concepts in mathematics.

Abstract mathematical problems are given to students to know the extent of students' mathematical reasoning. These concept (problems) can be assembled in mathematical tasks. These tasks are constructed in such a way as to accommodate all students' abilities. The tasks are designed by considering the number of strategies that can be used to solve the problem, visual interpretation of the problem, connectivity in procedures and quality of explanation requirement. Based on the above explanation, this paper will point out the description of aspects of students' mathematical reasoning abilities through an analysis of their reasons presented in writing to solve their problems and responses in the interview.

Theory

A. Aspects of Mathematical Reasoning

Mathematical reasoning is as vehicle to justify any mathematical ideas. This ability is needed by students considering that mathematics is a mental activity. Each mathematical idea is connect to other ideas, requiring an ability to verify the ideas. Students' mathematical reasoning involves the informal and formal aspects.

1. Informal Aspects of Mathematical Reasoning

Before ideas, concepts, and mathematical proofs are formally presented, there is first a mental process in the framework of an initial understanding of the problem. This initial process is very important for students to find the most suitable strategy to solve the problem or to relate the concepts related to the concept being studied. This activity is highly subjective. Each student will

have varying views on the problem. This view depends on their experience. These experiences will form a cognitive system. When students encounter a mathematical problem, the knowledges are related to the problem can be brought up directly. Based on Farmaki and Paschos (2014), the idea that emerged after the process was called intuition. Intuition is defined as a cognition that appears subjectively by itself, immediately, erratically (Fischbein, 1999). In addition, according to Nickerson (2010) mathematical ideas essentially arise intuitively before being exposed to logical arguments. It shows that intuition has a fundamental role in determining students' mathematical reasoning abilities. Intuition is highly subjective and influenced by the level of one's cognitive development. Intuition has an indirect role in students' mathematical reasoning. Intuition is not explicitly visible in the process of providing an explanation of mathematical ideas. Therefore, intuition is an informal aspect of mathematical reasoning

2. Formal Aspect of Mathematical Reasoning

After students use their intuition to define a problem-solving strategy, they then attempt to solve the problem using mathematical concepts. Abstract ideas make students difficult to solve problems. Therefore, students need help to be able to communicate the concept. The symbols and notations in the question will be more easily understood if the students visually represent the ideas through diagrams or graphics. Representation of abstract ideas into visuals will help them to solve problems. Nickerson (2010) states that the power of representational systems as a vehicle of thought. Representation aids to reasoning and seeing relation on mathematical ideas. In addition to representation, provide a logical reason in every important statement in mathematical reasoning. Therefore, students' premises should have strong in power to making an argument. In addition, the ability in the inference method should also be well understood by the students when they have several premises. In some instances, often the premises that can be used

only appear implicitly. Students must have the ability to locate the premise so that it can be used in proof. The basic concept of understanding of the relationship between the premises and the method of proof has an important role in mathematical reasoning.

B. Task Design

The examination of instruction and thinking processes was framed by concept of mathematical tasks, a close relative of academic tasks, a construct that has been extensively employed to study the connection between teaching and learning (Stein, et al, 1996). Mathematical tasks will give information about students cognitive development. Chapman (in Jonsson et al, 2016) appropriately designed mathematical tasks will (1) promote students' conceptual understanding of mathematics, (2) retain their interest in the task and (3) optimize their learning. Mathematical tasks are designed to have some features with certain purpose. These features will give information toward procedural and conceptual understanding of students.

Methodology

This study aims to describe the mathematical reasoning abilities of students reviewed based on informal and formal aspects. Intuition is an informal aspect that is described in this paper. Meanwhile, the formal aspect emphasizes the logical way of thinking in solving mathematical problems. We performed an analysis of the student's test results during the study of group theory to find out the descriptions of those aspects. Researchers compiled 12 items given in 3 different time periods. The informal, intuitive aspect can be described through the problem solving strategy. After that, the interview will provide a more detailed description of the informal aspects. Meanwhile, visual interpretation, connectivity in procedure and quality of explanation criteria are used to describe the formal aspects of students' mathematical reasoning.

Results and Discussion

We have prepared 12 task to describe students' mathematical reasoning. These task have 4 characteristics i.e. the number of possible strategy to solve, visual interpretation, connectivity in procedure and requirement of explanation to each task. Detail of characteristics task can be shown in table 1.

Table 1. Characteristics of Task

Characteristic of Task	Category	Number	Percentage
The number of strategy to solve the problem	Single	3	25
	Multiple	9	75
Visual interpretation	Possible	6	50
	impossible	6	50
Connectivity in procedure	No or few	2	17
	required	10	83
Explanation required	no or few	2	17
	Required	10	83

The table above shows that the characteristics of the task that are prepared more emphasized on the aspect of formal explanation by students. The tasks assigned to the students are more multi-strategy in its completion. It is intended to challenging in student cognitive activity. Thus we can detect about how student intuition. Problems that can be modeled visually and not arranged in equal in number. It aims to connect students' cognitive toward formal abstraction. Some problems are directed so that students can directly provide abstract ideas without making visualization in solving the problem. Most of the problems are structured to determine how students' mathematical reasoning abilities are. Any problems that require more explanation and interconnectedness in the procedure are the implicit premises that will be used to give a conclusion at every step.

The results show students' ability in mathematical reasoning is lacking. This is supported by some facts below.

1. Misconceptions in understanding the problem.

Understanding the problem is the first step in solving the problem. Misrepresentation of the problem will have a negative impact on clarification, justification and validation of mathematical ideas. Students try to connect some notation or symbol that are not related to the problem. One of students' problems is interpretation of group of integer modulo 3 ($\mathbb{Z}_3$) and permutation group with 3 elements (S_3). The student was asked to find the operation of permutation grup, but he did for the operation on $\mathbb{Z}_3$. So, his argument and the conclusion are not matching.

Jadi, permutasi dari himpunan semua permutasi dari himpunan A

b. Relasi komposisi pada himpunan semua permutasi dari himpunan A

	0	1	2	1	2	3
0	0	1	2	1	2	3
1	1	2	0	2	3	1
2	2	0	1	3	1	2
1	1	2	3	0	3	1
2	2	3	1	3	0	2
3	3	1	2	1	2	0

$\mathbb{Z}_3 = \{0, 1, 2\}$
 $S_3 = \{1, 2, 3\}$
 $\mathbb{Z}_3 \neq S_3$
 $\therefore$ tidak komutatif.

terbukti bahwa relasi komposisi pada himpunan semua permutasi dari A adalah tertutup dan tidak komutatif.

Figure 1. Students' answer about Permutation Group

2. Misconceptions in understanding the problem.

Mathematical reasoning skills rare depended on the strength of the premise used in the conclusion. Students have problems in determining which premises are involved to make a conclusion. As a result, students immediately write a conclusion without giving a logical reason. The student was asked to proved subgroup in two groups which are isomorphics. The argument of the student was very lack in premiss. He just wrote the proposition in the problem and then he arranged it to make an conclusion.

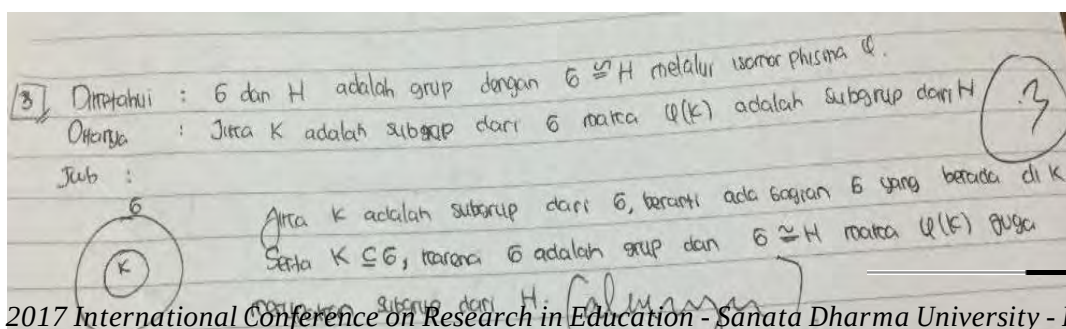


Figure 2. Students' Answer about Subgrup of Isomorphism Groups

3. Using incorrect argument in explaining.

The problem involves the implicit premise also often make students mistaken in giving arguments. The premises are actually more aimed to determine the ability of students in relating mathematical ideas. Understanding the concept of clasics algebra is a prerequisite in order to make implicit premises become to explicit. There was a mistake to proved two groups are isomorphics about property of logarithm i.e. $\log(a + b) = \log a \cdot \log b$.

jadi, tidak komutatif.

4). Diketahui : $(\mathbb{R}, +)$ dan $(\mathbb{R}^+, \cdot)$ grup dimana $\mathbb{R}^+$ adalah himpunan semua bilangan real positif.

$\phi : \mathbb{R}^+ \rightarrow \mathbb{R}$
 $\phi(a) = \log a$

akan dibuktikan ϕ merupakan isomorfisma grup.

Bukti:

akan • akan dibuktikan bahwa ϕ merupakan homomorfisma grup.

definisi homomorfisma = $(\forall x, y \in \mathbb{R}) (\phi(x+y) = \phi(x) + \phi(y))$

ambil sembarang $x, y \in \mathbb{R}$

akan dibuktikan bahwa $\phi(x+y) = \phi(x) \cdot \phi(y)$ *teori dari mana?*

$\phi(x+y) = \log(x+y)$
 $= \log x \cdot \log y$
 $= \phi(x) \cdot \phi(y)$

∴ jadi terbukti bahwa ϕ merupakan homomorfisma grup

Figure 3. Student's Answer about Proofing Isomorphism in Groups

4. Sense of mathematical logic is still poor.

Students' cognitive structure take an important rule in mathematical reasoning. Logic is a basic fondation in mathematical reasoning. The most basic problem observed by the

students is how to give an argument for an implication. Students usually begin to prove the form of implications starting from the antecedents of the statement. In fact, students should use antecedents as a known assumption. This can be seen in the student proof in the following picture. Students were asked to prove that if K is subgroup of G and φ is isomorphism from group G to H then $\varphi(K)$ is subgroup of H . Students should start from the consequent of the proposition i.e. $\varphi(K)$ is subgroup of H . But, student did it from the antecedent. Logically, it is not true.

The image shows a handwritten student proof on lined paper. The text is as follows:

ambli syarat $a, b \in K$ karena $K \leq G$ maka berlaku $a \times b^{-1} \in K$
 $\varphi(a \times b^{-1}) = \varphi(a) \circ \varphi(b^{-1}) \rightarrow$ karena φ isomorfisma.
 $= \varphi(a) \circ (\varphi(b)^{-1}) \rightarrow$ syal homomorfisma.
 $\varphi(a \times b^{-1}) = \varphi(c) \rightarrow$ dengan $c = a \times b^{-1} \in K$.
 maka $\varphi(a) \circ (\varphi(b)^{-1}) = \varphi(c) \in \varphi(K)$

Figure 4. Students' Answer about Proofing Structure of Image of Isomorphism

Some results above indicate that the mathematical reasoning of the students is still poor. Formal aspects can be seen from the results of student answers to each given question. Characteristics for formal aspects that include connectivity and explanation characteristics have not adequately cleared by students.

Furthermore, a more in-depth investigation of the mathematical reasoning abilities of students. Interview aims to get more specific information on the characteristics of the problem, especially to get an overview of the informal aspects of the students' mathematical reasoning. Interview conducted on 3 students. The number of solving strategies and visual interpretation of the problem becomes the focus of the interview. The results obtained in the interview are given by the following table.

Table 2. Interviews' Result on Informal Aspect of Mathematical Reasoning

Student	Process of Answer the test	
	Multiple strategy	Visualize
A	3	1
B	0	1
C	4	2

Most students get stuck with the formal definition of some topics in group theory. Consequently, they always try to provide arguments with formal definitions they have understood. There are two conditions that arise based on this situation. First, the creativity of students in building an argument becomes impeded by focusing only on formal definitions that are very abstract. Second, the abstractions they use as supporting arguments tend to go wrong due to the inadequate logic of thinking in understanding the formal definition. The first impact is visible in determining possible strategies for solving a problem. Students focusing only on a formal definition tend to result students didn't think of alternative solutions to solve the problem. Of the nine questions that are expected to have many solutions to solve, the result is less than 50% of students are aware of it. The discussion bellow describe that students still have problems to get alternative strategies for the concept of generator elements in a group.

R : How do you find the generator of $\langle a^{21} \rangle \cap \langle a^{10} \rangle$ for a is a element of group G and

$$|a| = 24?$$

S : First, I count all the elements of $\langle a^{21} \rangle$ and $\langle a^{10} \rangle$. Then find the intersection

R : Oh, its to long procedure. Do you have any alternative?

S : Hmm, I don't know. I think that is only one possible answer.

Based on the above interview, the students focused only on the formal definition of the generator and the intersection. They do not apply their experience during practice in doing on similar problems. The concept of LCM or GCD may can also be used to solve the problem.

Abstraction in group theory requires a great deal of learning experience over classic algebra concepts. The experience will form a cognitive structure gradually. Learning experiences that have been recorded in the cognitive structure will help students determine alternative possibilities in solving problems. This is then referred to as intuition. Intuition is a necessary aspect of mathematical reasoning. Intuition is not directly related to the expected logical explanation in mathematical reasoning. Intuition appeared naturally, straightforward, self-evidence (Fischbein, 1999). Therefore, it can be said that intuition is an informal aspect for mathematical reasoning. This aspect will be very useful for students in building an abstract concept. Intuition will formulate the initial steps in resolving issues such as the use of strategy and problem interpretation. Students do not have good intuition yet. Students have not been able to restate learning experiences that are already structured in their cognitive structure. But intuition is very local. This means that student intuition in group theory may will be different from intuition in calculus. Therefore, it is natural that we state intuition is an informal aspect of mathematical reasoning.

Conclusion

Aspects of Students' mathematical reasoning are informal and formal aspect. Intuition is a informal aspect which are related to mathematical reasoning indirectly. Intuition takes role in choosing the alternative strategies to solve mathematical problems. Formal aspect takes role in justifying and verifying mathematical concept. Explanation of arguments by using logical premises taking place at the heart of mathematical reasoning. Students' mathematical reasoning in exploring group theory still poor. At most student have not been able to connect between abstract concept of group with their experience in learning classic algebra.

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STUDENTS' LEARNING OUTCOMES AND PERSISTENCE AT THE FIRST CYCLE OF IMPLEMENTATION OF PEDAGOGI IGNASIAN IN ORDINARY DIFFERENTIAL EQUATIONS COURSE

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Abstract

This study aims to explore the results of the implementation of Ignatian pedagogy in Ordinary Differential Equations course in terms of learning outcomes and persistence. This research is descriptive quantitative approach. The instruments used are the persistence questionnaire sheet, and the test sheet. The subject of this research is students of Mathematics Education of Sanata Dharma University, who is taking a course of Ordinary Differential Equations on class C. The results obtained are: 1) Students' learning outcomes are in good category; 2) Students' persistence are in high category.

Keywords: learning outcomes, persistence, ordinary differential equations.

Introduction

Ordinary Differential Equations is one of the compulsory subjects for Mathematics Education 6th semester students. This course studies the forms of differential equations and how to solve them. Based on the experience of the researchers, the problem is there are many forms of differential equations. The number of forms of solving differential equations causes students to be confused in solving problems related to differential equations, making them back and forth in solving them. Yet if further examined, the characteristics of each equation is clearly written, it just takes a lot of practice to more easily distinguish it. Talking about the need for lots of practice questions is tantamount to talking about persistence. The more diligent a student, the more training questions are tried so that it is easier to understand the subjects of Ordinary Differential Equations. However, seeing the recent phenomenon, students prefer to wait to be explained in the classroom rather than by self-study with full perseverance. Researchers' experience shows

that preparing for learning before their lectures is very rare. This is indicated when in a few lectures, when they have been studied or not, most have answered yet, even though they have been told that sometimes they will be given an impromptu quiz.

Theory

A. Understanding Persistence

According to KBBI, persistence means diligent, hard-hearted, and earnest. Persistence can show the ability to stimulate us to attention to a person, a thing or activity, or something that can have an effect on the experience which has been stimulated by the activity itself (Lester and Alice, 1984). In terms of learning to teach, persistence can be defined as a serious effort to achieve optimal results. Persistence can not be classified as innate but its nature can be cultivated and developed (Rohiat, 2008). According to Lester and Alice (1984) there are several factors that influence the growth and development of a persistence, among others:

1. Internal factors
 - a. Motivation
 - b. Needs
 - c. Pleasure Against An Object
2. External Factors
 - a. Family
 - b. Facilities
 - c. Friendship

B. Ignatian Pedagogy

Ignatian pedagogy is usually called the Reflection Pedagogy. Suparno (2015) states that the Paradigm of Reflection Pedagogy (PRP) is a pedagogy to support the needs of a whole and comprehensive education. PRP is expected to foster student development, not only to be smarter in their knowledge, but to be a sensitive person, and sensitive to the needs of others. Even expected, with the help of PRP, students can develop into human beings for others and with others. The main elements of PRP are three, namely experience, reflection, and action. The three main elements are assisted by the element before learning, which is to see the context, and assisted by the element after learning with evaluation. So in outline, PRP has the following dynamics: (1) context, (2) experience, (3) reflection, (4) action, and (5) evaluation. (Gallagher et al in Suparno, 2015). Suparno (2015) also stated that one of the approaches and methods that fit the Reflection Pedagogy Paradigm is the constructivism approach with the working methods of the group.

C. Learning outcomes

Learning outcomes are the abilities possessed by students after carrying out learning activities, both cognitive, affective and psychomotor aspects. In addition, results learning is the change or output of the students after experiencing the experience in learning both quantitatively and qualitatively. Evaluation of learning is the way to find out whether the learning outcomes have achieved the desired goals. Likewise Sunal proposed (in Susanto, 2013: 5) that evaluation is a tool to obtain information how effective a program has met the needs of students. According to Wasliman (in Susanto, 2013: 12), student learning outcomes are the result of continuity between factors affect, including:

1. Internal factors are factors that originate from within the self include intelligence, interest and attention, learning motivation, attitude perseverance, study habits.
2. External factors are factors that come from outside the self includes family, school and community.

Methodology

The research used is descriptive quantitative research. To answer the problem formulation of this research, and to achieve the purpose of this research, the researcher took the subject of the subjects of Equal Differential Equation class C Mathematics Education of Sanata Dharma University, Yogyakarta, academic year 2016/2017. The instruments that will be used are the persistence questionnaire sheet and the learning ability evaluation sheet.

Data analysis is done as follows. For the evaluation sheet of the persistence questionnaire, the researcher quantifies the Likert scale and then categorizes it and presents it descriptively quantitatively. The questionnaire contained 8 positive and negative statements. Data from this questionnaire was transformed based on Likert scale with score 1,2,3, and 4. Persistence score of each student is defined as the total score of students divided by 8. Furthermore the final result of the persistence score are grouped as follows:

Table 1. Predicate of The Persistence score

Score	Predicate
$3 \leq x \leq 4$	High
$2 \leq x < 3$	Medium
$1 \leq x < 2$	Low

The first step that researchers do is explore the context of students. The second step is to finalize the prepared lesson plan, and implement it. The learning process uses group discussion methods. For the latter the researcher will see the learning outcomes for one semester, through the evaluation result, the reflection sheet, and the final value.

Results and Discussion

Suparno (2015) states that one of the approaches and methods that match the Paradigm of Reflection Pedagogy is a constructivism approach with the method of working groups. Therefore the method of learning done in 1 semester is the method of working group. Viewed from the process of reflection, the learning process is divided into 2 cycles. The first cycle is done from the beginning of the lecture to UTS, the second cycle is done afterwards to UAS. Cycles consisting of context, experience, reflection, action, and evaluation will be explained as follows.

Context

The course of Ordinary Differential Equations is a compulsory 6th semester course that weighs 3 credits. This lecture is conducted every Thursday at 14.00 - 16.30. This course was taken by 44 students consisting of 2 students of class of 2015, 28 students of class of 2014, 13 students of class of 2013, 1 student force 2010. Another thing that also need attention is that lecturers have known most of the students who take the courses the. This ultimately makes it easier for lecturers to interact in the classroom.

In addition, in the context of the context of the lecturer asked the students to write down their learning experiences. Some things that are obtained are:

- a) The student realizes his mistake in the past and begins to make up for it by studying hard
- b) Students look for other references (books, internet, friends, lecturers)
- c) Students learn when they need (exam preparation, quiz, presentation, task)
- d) Students learn to depend on mood
- e) Students take time to learn
- f) Students study together
- g) Students do not know how to learn

Here are some examples of reflections on student learning experiences

"My learning experience is somewhat unique. In a day, I always take the time to read and write for about 3 hours outside normal college hours on campus. Whatever I read and write does not always remain in the memory of the tetatpi at a certain moment will appear in the memory when meeting the same experience. "

"At first fitting junior high school and senior high school, I use the method of learning to read and practice questions. Often feel like the same difficulty friend. In high school I began to feel that learning can not be alone. I need friends to help understand the material and so should we. "

"I never learned, never went to college. But now I study 26 hours during the day to make amends for me. "

Experience

After the context excavation, the lecturer asks students to write the value of Integral Calculus and Differential Calculus courses. It serves as the basis for the division of the group because the two courses are closely related to the subject of ODE. Groups are formed by seeking cognitive abilities between groups flat. The point is that there is no dominant cluster dominant or dominant group. Furthermore they will be given the task of preparing the discussion for further material. The hope of the next learning process is that they prepare the next material in the group discussion outside class hours and then in the class there is a discussion. However, in reality group discussions independently do not take place outside the hours of the lecture. Therefore, the lecturers take the initiative to give the task of the group so that they learn the group outside the hours of the lecture.

In the process of learning in the classroom, students sit in groups that have been formed to discuss about the materials given. Furthermore, the lecturer gives an opportunity to some groups

to share their learning experience according to the given material. Other groups were asked to ask or respond. Furthermore, the lecturers provide reinforcement on some concepts that are still under-understood. Although not as dynamic as expected but the processes that occur in the classroom are quite good. In that sense, discussion can occur in the process.

In this first cycle, the materials provided include the types of ODE I order and how to solve it, order reduction methods for high-order ODE, and ODE settlement constant coefficients. The material of the types of ODE I order and how to solve it is actually not difficult, it's just a lot of different forms of settlement. For the material of order reduction method tends to solve only the differential equations in accordance with the systematical way given. While the material of ODE settlement coefficient constant is a topic that tends to be easy because it is identical to the root search of the polynomial.

Reflection

In cycle I is done 2 kinds of reflections, namely large reflections and small reflections. Large reflections are done before UTS in writing on paper, whereas small reflections are done every 2 weeks through exelsa. On the big reflection, lecturers only ask students to reflect on how they feel about the lectures, whether from the learning model, the material, or anything else.

Action

After reflection on this cycle I, the lecturer asked the students to silence for a moment and make intentions to improve the next learning process. In addition, lecturers also provide strengthening. These intentions become action for the next student.

Evaluation

1. Learning Outcomes (Competence)

The evaluation used in cycle I is several types shown in the following table.

Table 2. Type of Evaluation

No	Type of Evaluation	Form	Weight (%)
1.	Presentation	Oral	20
2.	Ujian Sisipan 1	Tertulis	20
3.	Task I	Tertulis	7
4.	Task II	Tertulis	7
Amount			54

The final result is as follows.

Table 3. Final Result

Grade	Amount	Percentage
A	10	22,73%
B	29	65,91%
C	5	11,63%
D	0	4,55%
E	0	0,00%
F	0	0,00%

From the result, it can be concluded that 44 students (100%) minimum have C grade. So Students' learning outcomes are in good category.

2. Persistence

The evaluation of persistence used is to use a self-assessment questionnaire. This questionnaire is given in the middle of a semester that already contains a statement before they follow the ODE lecture and when they follow the ODE lectures. The results of the questionnaire scores are grouped into 2, i.e.

- b) average persistence score before attending ODE lectures,
- c) average persistence score when lecturing ODE,

Of the 44 data, 3 data is invalid because there are items not filled so that only 41 data remaining.

Here are the results of data processing using Excel and SPSS.

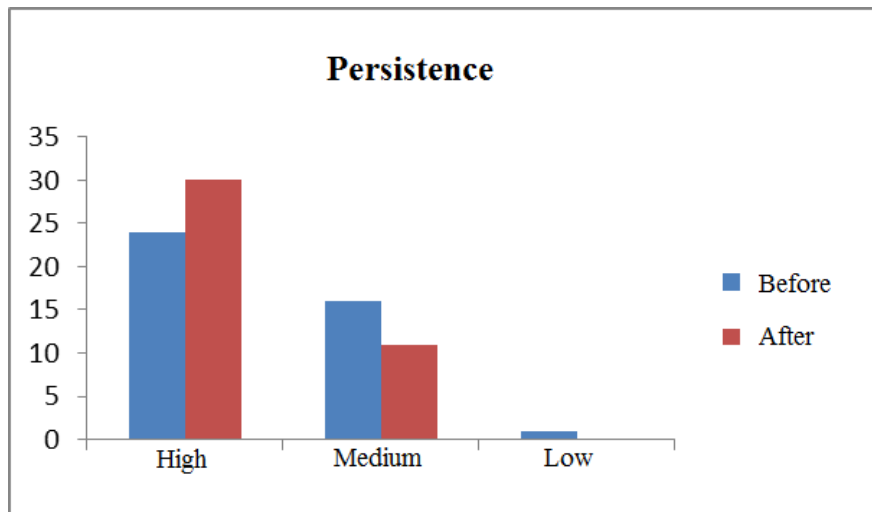


Figure 1. Amount of Persintence Category

The data shows that in the high category, there is increasing persistence from 24 students (59%) to 30 students (73%), in the middle category there is decreasing persistence from 16 students (39%) to 11 students (27%), low decreased persistence of 1 student (2%) to 0 students.

Table 4. Descriptive Statistics Result for Persistence

	N	Minimum	Maximum	Mean	Std. Deviation
Pers_Before	41	1,75	3,88	2,9421	,39637
Pers_After	41	2,25	4,00	3,1372	,37791
Valid N (listwise)	41				

From these results it can be concluded that on average there is an increase in student persistence after learning with PI from score 2.9421 to score 3.1372. This means that on average there is a change of persistence from the moderate category to the high category.

Conclusion

From implementation Ignasian pedagogy in the course of Equal Differential Equations this can be obtained conclusion as follows:

1. Judging from the results of the evaluation in competence, 42 students have graduated (at least worth C), only 2 students who did not pass.

2. There is increasing persistence in ODE lectures.

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STUDY OF PROJECT BASED LEARNING WITH SCIENTIFIC APPROACH OF ETHNOMATHEMATIC TO IMPROVE PROBLEM SOLVING ABILITY

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Abstract

This research aims to determine the problem-solving ability of students using learning model based project learning with a scientific approach containing ethnomatematics. The subjects of the study were students of class VII.A, VII.B and VII.C at Junior High School Negeri 1 South of Tanimbar, Southeast Maluku Regency. The research method is a development method with pretest-posttest, design group dick. The experimental group was treated in a project based learning model with a scientific approach containing ethnomatematics and control group with expository learning. Data were collected through syllabus, RPP, LKS and test result of student learning. The result of data analysis shows that the problem solving ability of the students applied by project based learning model with the scientific approach of ethnomatematics is better than the expository learning.

Keywords: ethnomathematic, problem solving skills, project based learning, scientific.

Introduction

Education is an important key in the development of a nation. According to Carter in Siswoyo (2007: 54) education is the process of developing human capabilities and behavior as a whole. The development step is always strived in tune with the demands of the times. The development of the times always raises new problems that never thought before.

One of the subjects that has a role in building student competence is mathematics. According to Wardhani (2010: 10), the standard content of mathematics subjects in 2006 stated that the subjects of mathematics are studied with the aim that learners have some ability, namely; ability to understand mathematical concepts, using reasoning, problem solving, communicating ideas,

and having an appreciative attitude to the usefulness of mathematics in life. Problem solving skills are necessary in everyday life to overcome the problems that exist. Therefore it is necessary to teach that can spur students' ability in solving math problems.

Facts that exist, the problem solving ability of junior high school students / equivalent in West Southeast Maluku regency is still low. The low ability of problem solving is shown from the result of problem-solving test by the researcher in the preliminary research with the average value of problem solving ability of class VII students on triangle and quadrilateral material is 58.67 less than KKM that is 70. Low ability of problem solving of students caused by some errors, such as can not understand the problem and can not design problems.

Culture math learning will contribute greatly to school mathematics, because schools are different social institutions with others that enable socialization between different cultures (Shirley, 2008). Learning that links material to the cultural environment will encourage students to make connections between their knowledge and application in everyday life. According to Rosa (2011: 48) the application of etnomatematika in learning can develop a mathematical understanding and can improve the absorption of mathematical concepts.

Model project based learning is very appropriate in overcoming the existing problems. The main activity in this model is to solve problems through a series of group activities based on the project so that students can be actively involved in learning. The main focus of this learning model is student activity, learning activities will be more leverage with an appropriate approach is the scientific approach. Steps on a scientific approach that observes, asks, gathers information, associate, and form a network / communicate (Kemendikbud, 2013).

The purpose of this study is to determine the problem solving ability of students through project-based learning model with a scientific approach containing ethnomatematics and expository learning.

THEORY

Project-based learning by Yusoff (2006: 22) has the first six stages of "Starts With the Essential Question". Learning begins with an essential question. This question can come from teachers or from students or collaboration between the two. This essential question will be the center of the Project Based Learning. The second stage is "Design a Plan for the Project". At this stage, students work collaboratively together with teachers to plan a project to solve the questions that have been formulated in the first stage. To be precise in the design of the project, then digging information related to the question.

The third and fourth stages are "Creates a Schedule" and "Monitor the Students and the Progress of the Project". At this stage, students create a project execution schedule and simultaneously run projects under the teacher's monitor. The essence of project implementation is done at this stage. Students make observations / experiments in ways that have been designed in the previous stage. The fifth stage of "Assess the Outcome". Outcome can be interpreted as the overall result (product) during project activity. Thus, this stage is done after the project is completed. Outcomes are assessed to assist teachers in measuring competency standards, knowing each student's progress, providing feedback on the level of understanding students have achieved, and assisting teachers in developing future learning strategies.

The last stage is "Evaluate the Experiences". At the end of the learning process, teachers and students reflect on the activities and outcomes of the projects already obtained and their feelings

and experiences during project completion. Teachers and students develop discussions in order to improve performance during the learning process so that a new inquiry can be found to answer the problem posed at the first stage of learning.

Permendikbud No. 65 Year 2013 on the Standard Process of Primary and Secondary Education has hinted at the need for a learning process guided by scientific / scientific approach principles. The application of a scientific approach to learning involves process skills such as observing, questioning, experimenting, associating, networking (Kemendikbud, 2013). Teacher guidance is necessary in carrying out the scientific process.

Observing activities aim to make learning closely related to the context of real situations encountered in everyday life. The process of observing facts or phenomena includes seeking information, seeing, hearing, reading, and or listening. In observing activities, the teacher opens opportunities for learners to broadly and widely observe through viewing, listening, listening and reading activities. Activity of questioning is done as one of the process of building student knowledge in the form of facts, concepts, principles, procedures, law and terori. In this activity the teacher guides learners to be able to ask questions about concrete object observations to abstract results relating to facts, concepts, procedures, or anything else more abstract.

Experimental activities try to improve students' curiosity in strengthening the understanding of facts, concepts, principles, or procedures by collecting data, developing creativity, and scientific work skills. These activities include planning, designing, and conducting experiments, presenting data, processing data, and drawing conclusions. Activity of association aims to build the ability to think and be scientific. The information (data) result of the activity tries to be the basis for the next activity that is processing information to find the interconnection of one information with other information, find the pattern of the information linkage and even take the

conclusions from the pattern found. The results of try and associate activities allow students to think critically high level (higher order thinking skills) to metacognitive thinking. The next activity is to write or tell what is found in information seeking activities, associate and find patterns. The results are presented in the classroom and assessed by the teacher as a result of learning the learners or groups of learners.

Learning with a scientific approach has the following characteristics; (1) student-centered; (2) involve the skills of the process of science in constructing concepts, laws or principles; (3) involves potential cognitive processes in stimulating the development of the intellect, especially the students' high-order thinking; and (4) can develop student character.

Ethnomatematics is the implication of culture characteristics in learning mathematics (D'Ambrosio, 2008: 94). Ethnomatematics was originally pioneered by Ubiratan D'Ambrosio 1985, etnomatematics can be referred to as "math in the environment" or "math in the community. Bishop (2004) explains that the ethnomatmatic implications should take account of the following; (1) Human interaction, ethnomatics relate mathematical activities in society; (2) Social values, involving mathematics with values, beliefs in society; (3) Language, mathematical and cultural interactions, because language as the main carrier of mathematical ideas; (4) The history of mathematics, developing mathematical ideas in the cultural diversity of society; (5) Cultural Roots.

Methodology

Research and development methods according to Sugiyono (2013: 407) is a research method used to produce a specific product and test the effectiveness of the product. Research and

development (R & D) by Borg & Gall (2003) is a research method used to develop or validate products used in education and learning.

According to Ibrahim the learning tools needed in managing the teaching and learning process can be: student book, syllabus, learning implementation plan (RPP), student activity sheet (LKS), evaluation instrument or learning result test and instructional media (Trianto, 2013: 68). In this study the researcher limits the learning device only on: syllabus, learning implementation plan (RPP), student book, student activity sheet (LKS), and problem solving ability problem.

Borg and Gall's research and development stages are simplified into four main steps: preliminary study, planning, testing, validation, and dissemination.

1. Preliminary study phase, is a research and information collecting activity has two main activities, namely literature study (literature review and previous research results) and field studies.
2. The planning stage, as a combination of the planning and development stage of the preliminary form of product contains activities; determining the objectives, determining the qualifications of the parties involved in research and development, formulating the participation of the parties involved in research and development, determining the working procedure, and the feasibility test.
3. Field test phase contains preliminary field testing, main product revision, main field testing, and product revision have main activities that are test, both preliminary field test and broad field test. At this stage it also contains revising the results of the product trial. This pilot activity is cyclical (design, implementation, evaluation, and refinement) until a product is ready to be validated. The next activity is validation, consisting of operational field testing and final product revision with the aim to test the product through the

experimentation of device product in school. The results of this experimentation are taken into consideration in making recommendations on the effectiveness and adaptability of learning tools.

4. The dissemination stage, defined as the dissemination and implementation stage contains socialization and distribution activities. This activity is realized in the form of socialization of the products of development to prospective users and related parties in the field of education

Subjects and Objects

This research was conducted at Junior High School Negeri 1 South of Tanimbar in academic year 2016/2017. The experimental subjects in this study were grade VII students of 3 classes from 4 classes. 1 class as an experimental class (experimental) class VIIA with total number of 37 students, 1 class as control class using expository learning that is class VIIB with total 35 students and 1 class of test instrument of problem solving test that is class of VIIC. Subjects in the experimental class were selected 6 students, each of which 2 students representing the upper group, 2 medium group students and 2 lower group students for further analysis purposes.

Data Collection Instruments

Learning device validation sheet, Observation sheet, Test Question, Sheet Questionnaire

Data analysis technique

Data analysis techniques on research instruments developed to support learning tools in this study are as follows. Data obtained from validator of learning device development for each aspect of each device including: syllabus, RPP, teaching materials, LKS and problem solving test developed were analyzed based on score average. Assessment criteria consist of 5 criteria that is

very low (value 1), low (value 2), medium (value 3), high (value 4), and very high (5). Describing the average score from the assessment of the experts using the assessment criteria in Table 1.

Table 1. Validity Rating Criteria

NILAI	KATEGORI
$1,0 < x \leq 1,8$	Not Good
$1,8 < x \leq 2,6$	Less good
$2,6 < x \leq 3,4$	Quite Good
$3,4 < x \leq 4,2$	Good
$4,2 < x \leq 5,0$	Very Good

Description: x = Average total score

Learning devices are said to be valid, if each device is in the "Good" or "Very Good" category

Results and Discussion

The syntax of learning-based project learning with an ethnomatmatic-charged scientific approach is described in Table 2.

Table 2. Project Based Learning Syntax with Scientific Approach Being Ethnomatematics

Stages of Project Based Learning	Learning process
1. Prepare project questions or assignments	Teachers form groups and then give problems about triangular matter. Examples of students are asked to determine the angle of furniture objects / crafts in the form of triangle and its properties, the teacher prepares the student worksheet to be filled according to the activities to be done.
2. Design project planning	Students discuss how to solve problems encountered, and prepare the necessary materials and tools such as rulers, bows, scissors, adhesives etc.
3. Develop Schedule	Teachers together with students make up the

Stages of Project Based Learning	Learning process
	schedules and tasks of each group member.
4. Monitor project activities and developments	Implementing the schedule that has been made in the previous stage, the teacher monitor the activities of the students.
5. Test results	The teacher measures the progress of the student with the understanding that has been gained as well as the feedback member on the student's work.
6. Evaluate activities / experiences	Each group presents the results that have been obtained in front of the class.

A. Analysis of the Effectiveness of Implementation of Learning Devices

The application of learning tools is said to be effective if: (1) more than 75% of students taught using project-based learning models with ethnomatematically charged approaches have a value of problem solving skills of at least 70 (achieving KKM), (2) Student-solving skills taught using the model of project based learning with a scientific approach containing ethnomatematics is better than the students taught by the expository method, (3) the proportion of students' problem solving abilities taught using project based learning model with a scientific approach containing ethnomatematics is better than the students taught by the method expository, (4) the influence of process skills and attitudes on the local culture on students problem solving skills, (5) the improvement of problem solving skills of students who are taught using project based learning model with ethnomatematics-charged scientific approach, (6) work on process skills and student attitudes toward culture.

B. Complete Test

Table 3. SPSS Output One-Sample Test

Test Value = 70

	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TKPM	4.149	36	.000	5.83784	2.9842	8.6914

Table 3 shows t count = 4,149 and $t_{\alpha/2}$ (table) with dk = 36 and a significant level used 5% = 1,688. Because t count = 4.149 > $t_{\alpha/2}$ = 1,688, then H_0 is rejected and H_1 is accepted. It can be concluded that the average problem solving ability of students who were taught by project based learning model with a scientific approach containing ethnomatematics more than 70.

The classical thoroughness test is used to find out if more than 75% of students achieve a minimum score of 70 in the problem-solving test. The value of the test results of problem solving skills of students who were taught using a project based learning model with a scientific approach containing etnomatematics then tested its classical mastery. Obtain a value of $z_{count} = 1.67 > z_{table} = 1.64$. Because $z_{count} > z_{table}$ (0,5 -0,05) then H_0 rejected means H_1 accepted. It can be concluded that more than 75% problem solving skills of students who were taught using project based learning model with a scientific approach containing ethnomatematics reached or above 70 (KKM).

C. Appeal test

Tabel 4. *Output SPSS Independent Samples Test*

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower Upper
TKPM	Equal variances assumed	1.411	.239	3.296	70	.002	6.00927	1.82340	2.37261 9.64592
	Equal variances not assumed			3.317	67.847	.001	6.00927	1.81147	2.39440 9.62414

Calculation using SPSS obtained t count of 3,296. While the t table value with a real level of 5%, obtained ttable of 1.67. Because t count > t table, then H0 is rejected and H1 accepted. It can be concluded that the average problem solving ability of students who are taught by project based learning model is better than the average problem solving ability of students who are taught by expository method.

D. Influence Test

1. Linieritas Test

Tabel 5. *Output SPSS ANOVA^b*

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1383.984	2	691.992	18.776	.000 ^a
	Residual	1253.043	34	36.854		
	Total	2637.027	36			

Tabel 5. Output SPSS ANOVA^b

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1383.984	2	691.992	18.776	.000 ^a
	Residual	1253.043	34	36.854		
	Total	2637.027	36			

a. Predictors: (Constant), X2, X1

b. Dependent Variable: Y

From Table 5, the sum of squares for regression is 1383,984; the residual is 1253,043; and the total is 2637,027. The mean squared deviation (mean square) for regression is 691,992 and the residual is 36,854. $F_{table} = 18,776 > F_{table} (0,05: 2: 34) = 3,28$ and $sig = 0,000 < 0,05 (5\%)$, meaning H_0 is rejected and H_1 accepted. So it can be concluded that there is a linear relationship between Process Skills (X1) and Attitude (X2) with Problem Solving Ability (Y).

2. Significance Test

Tabel 6. Output SPSS Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	52.022	4.569		11.385	.000
	X1	7.392	1.380	.671	5.357	.000
2	(Constant)	17.633	15.530		1.135	.264
	X1	6.687	1.337	.607	5.000	.000
	X2	8.806	3.820	.280	2.305	.027

a. Dependent Variable: Y

From Table 6 we get the sig value for $X1 = 0,000 < 0,05$ so H_0 is rejected and accepting H_1 , it means that the diversity of Y value can be explained by the diversity of X1 value (process skill) by itself. The sig value for $X2 = 0.027 < 0.05$ so H_0 is rejected and accepting H_1 , meaning that the value of Y can be explained by the diversity of X2 values (student attitudes) by itself.

E. Improvement Test

Tabel 7. *Output SPSS Independent Samples Test*

		Levene's Test for Equality of Variances		t-test for Equality of Means					
		Sig.		95% Confidence Interval of the Difference					
		F	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Selisih	Equal variances assumed	.777	2.874	70	.005	4.16216	1.44833	1.27355	7.05077
	Equal variances not assumed		2.890	68.529	.005	4.16216	1.44012	1.28885	7.03548

Based on Table 7 obtained significant value = $0.381 > 0.05$, means that both groups have a homogeneous variant. Table 6 shows a tcount of 2.874. While the ttable value with a real level of 5%, obtained ttable of 1.67. Because t count $>$ t table, then H_0 is rejected and H_1 accepted. It can be concluded that the difference of student problem solving ability after being taught using project based learning model with scientific approach is better than the average problem solving ability before being taught using project based learning model with scientific approach.

The result of the experimental learning of mathematics learning model of project based learning with scientifically charged approach of ethnomathematics shows: 1) problem solving ability which is taught using project based learning model with scientifically-charged approach of ethnomathematics reaches classical completeness; 2) the problem solving skills of students who are taught using a project based learning model with a scientific approach containing ethnomatemantics is better than students being taught by expository methods; 3) the proportion of students' problem solving abilities taught using project based learning model with a scientific approach containing ethnomatemantics is better than the students taught by expository method; (4) there is influence of process skill and attitude on local culture to student problem solving ability 52,5%; (5) the improvement of problem solving skills of students who were taught using a project based learning model with a scientific approach containing ethnomatemantics. Based on the description can be concluded that the application of learning devices mathematics model of project based learning with a scientific approach containing ethnomatemantics effective

Conclusion

Implementation of learning-based model of project-based learning tools with scientifically-charged approach of ethnomatemantics is effective, because the problem-solving abilities that are taught using project-based learning model with a scientifically-charged approach to ethnomatemantics achieve classical mastery, problem-solving skills of students who are taught using a project based learning model with an ethnomatematically charged scientific approach better than the students taught by the expository method, the proportion of students' problem solving abilities taught using a project based learning model with a scientific approach containing ethnomatemantics is better than that of students taught by expository methods, there is an influence of process skills and attitudes on local culture to the problem solving ability of

students equal to 52,5%, the improvement of problem solving ability of students who taught using project based learning model with ethnically charged approach of sincerity atematics, an increase in process skills and attitudes toward culture.

Suggestion

1. The result of research of development of learning device of mathematics model of project based learning with scientifically-charged scientific approach has fulfilled valid, practical, and effective criteria so that learning device can be used as an alternative of learning in school, especially on triangle material.
2. For teachers it is advisable to apply project based learning model learning with scientific approach and using learning tools that have been developed through this research, with note that necessary modification is necessary to adjust to local situation and condition.

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THE ANALYSIS OF LEARNING IMPLEMENTATION AND LEARNING RESULT WITH PROBLEM BASED LEARNING METHOD

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Abstract

Education is a planned effort to provide the atmosphere or clues for the learners to be able to develop their potential. In this process, there is a transformation of knowledge, technology, and skills. However, Indonesia still has one major problem in education, especially in mathematics education, that is the students' ability to solve the problems, especially for the application of the mathematics concepts. Hans Freudenthal says that mathematics is the result of human activity. The purpose of this research is to see the learning process that has been planned using problem based learning method and the result of analysis from the planned learning. Barrow (in Abdul) says "the problem based learning is the learning that results from the process of working towards the understanding of a resolution of a problem. The problem is encountered first in the learning process". The learning scheme based on Yongwu Miao model. The conclusion is that the students can make a media or apparatus design for the learning activities. The teachers should be understand about PCK (pedagogical content knowledge).

Keywords : problem based learning, learning result, PBL, media of mathematics learning.

Introduction

Education is the one of the most important aspects of the basic needs for human beings. Education is a planned effort to provide an atmosphere or clues for learners to be able to actively develop their potential. Education itself takes place or occurs in a process called learning process. In this process there is a transformation of knowledge, technology, and skills. The purpose of the process is none other than to prepare the students into a better person.

The learning process plays a very important role in education. We do hope that the learners can get some experiences and knowledge. In Indonesia itself, the education is beginning to enter a period of transition to a better direction, from the teacher-centered to provide more space for the students to gain knowledge and develop their own potential. However, Indonesia still has one major problem in education, especially in the mathematics education, it is about students' ability

to solve the problems, especially for the application of the mathematics concepts and also their understanding about the problems that become the application of the concept that has been given.

This problem (actually) is including the role of the teacher's teaching method. There are (still) many teachers who give the concept of mathematics directly to the students without give any examples or give the concrete problems, nor the problems that can be reached by students. Hans Freudenthal says that mathematics is the result of human activity. Mathematics must be linked to real circumstances, close to the child's experience, and relevant to people's lives.

Teachers as the facilitators are required to provide, to develop, and to present the real problems of the mathematics concepts from the students' life to the classroom. In the presentation, teachers can use some methods that support the learning process, call it problem based learning (PBL). In this study, we will discuss about the application of learning and analysis of learning outcomes using the method.

Theory

A. Problem Based Learning

Problem Based Learning is based on the results of research by Barrow and Tamblyn. Barrow (in Abdul) says that PBL is *the learning that result from the process of working towards the understanding of a resolution of a problem. The problem is encountered first in the learning process*. According to PDPT UI, problem based learning is a learning method that uses complex and real problems to trigger learning, as a first step in collecting and integrating new knowledge. The basic of the PBL is the students' collaboration; students will construct knowledge by building reasoning from all of the knowledge that they already had, as well as all things gained as a result of interacting activities. Learning with PBL is given through the assignment of the relevant tasks or issues, and it's represented in a context. It aims to enable

students to have experiences, which is essential for effective learning, to gain a concrete experiences.

Problem based learning's characteristics, such as :

1. PBL is a series of learning activities
2. Learning activities are directed to solve the problems
3. Solving problems is done by using a scientific approach of thinking
4. Teachers are more as the facilitator, mentor, and motivator.

Barrow, Min Liu (2005) in Saleh, 2013 mentioned the characteristics of PBL are as follow:

1. Learning is student centered

The learning process with the PBL method emphasizes the learning center in the students. In this process of learning, there is a constructivism theory that encourages students to develop their own knowledge.

2. Authentic problems from the organizing focus for learning

The problems presented in the lesson are presented in an authentic and concrete form.

3. New information is acquired through self-directed learning

In learning, it is possible students do not know the required prerequisites for learning, so that students are expected to find their own through the existing sources.

4. Learning occurs in small groups

In an effort to build collaborative knowledge, the assignment is done in small groups.

5. Teachers act as facilitators

In this method the teacher only acts as a facilitator who monitors the development of student activities, and it is possible to provide assistance to students who encounter obstacles in order to keep reaching the target or desired goal.

Problems or tasks which are given during the learning process by the method of PBL will have several criterias, such as:

1. Does not have a clear structure

It aims to motivate students and the opportunity to freely seek as much information as possible from various sources.

2. Quite complex and ambiguous

It aims to encourage students to use solving or problem solving strategies as well as to develop high-level thinking skills. In addition, the existing problem is also intended for students to experience interaction and cooperation in groups to solve problems.

3. Meaningful and there is the connection with the real life

Requires the students to make information, logical, and rational decisions or judgments.

Problem based learning method has some steps to do, such as :

1. Students are given problems by the teacher (the problem is revealed from the student experience).
2. Students conduct small group discussions.
3. Students conduct study independently.
4. Students return in groups and exchange information.
5. Students present the solutions they find.
6. Students are assisted by the teacher to conduct an evaluation related to all learning activities.

According to Yongwu Miao (Abdul), PBM scheme can be seen as follows :

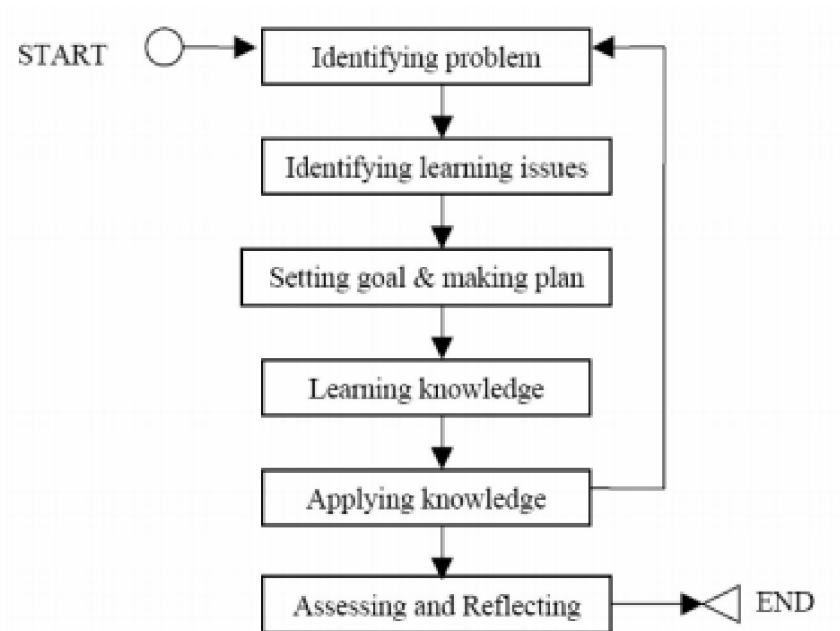


Figure 1.

B. Learning Result

Learning result are the abilities that the students get after they have received their learning experience. According to Benjamin Bloom, learning results are classified into some aspects :

1. Cognitive aspect

This aspect is related to the ability of thinking, knowledge competence (C1), understanding (C2), application (C3), analysis (C4), synthesis (C5), evaluation (C6), conceptual and reasoning.

a. Knowledge (C1)

At this level, the learners can answer some questions based on memorization.

b. Understanding (C2)

At this level, the learners are required to state problems with their own understanding, modeling a concept or principle.

c. Application (C3)

The students are asked to apply principles in a new situation.

d. Analysis (C4)

The students are expected to develop information in sections, find opinions, distinguish between facts obtained with previous opinions, and find cause and effect relationship

e. Synthesis (C5)

In this stage, the students are expected to be able to generate theories in their own language.

f. Evaluation (C6)

In this aspect, the learners are expected to be able to evaluate the information that he got.

2. Psychomotor aspect

This aspects shows the learning activities in terms of body movement or physical movement. According to Bloom, the levels in this affective aspect are showing, manipulating, understanding, and articulation. In this paper, we will talk about imitating and manipulating for the psychomotor aspect.

3. Affective aspect

This aspect relates to students' feelings, emotions, and attitudes about an object. According to Bloom, the levels of affective aspect are receiving, responding, judging,

managing, and living. In this paper, the level of affective aspect to be discussed is receiving, responding, and assessing.

Methodology

This is a qualitative case study to explore and understand about learning implementation and learning result with problem based learning method. The researchers act as the teacher of the participants, and the participants are the students in Media of Learning Class 2017. The data were collected through observations and also question-answer session in the classroom.

Result

A. Individual Task Number 1

1. The first type of the answer

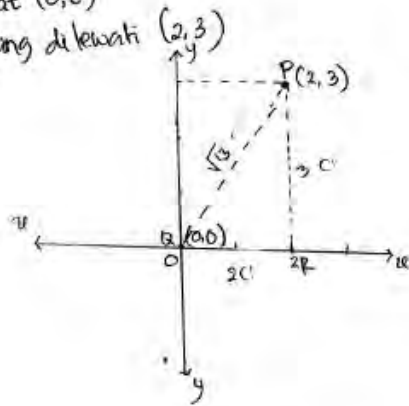
Soal:

- (1) Diketahui sebuah lingkaran dengan pusat $(0,0)$ yang melalui $(2,3)$.
Berapa luas lingkaran tersebut?

Diketahui:

Titik pusat $(0,0)$

Titik yang dilewati $(2,3)$



$$L\odot = \pi \cdot r^2$$

$$PQ = \sqrt{3^2 + 2^2}$$

$$= \sqrt{9+4}$$

$$= \sqrt{13}$$

$$L\odot = \pi \cdot r^2$$

$$= 3,14 \cdot (\sqrt{13})^2$$

$$= 3,14 \cdot 13$$

$$= 40,72 \text{ satuan luas}$$

Figure 2.

The process are as follows :

- Students made Cartesian diagram to put the points that they've known from the question.
- Students drew a point on Cartesian diagram. Then they assumed that P is a center point of circle.
- The students calculated the distance of point O to point P which is the radius of the circle.
- Students calculate the area of a circle using a circle formula that has been known before, so get the result of 40.72 unit area.

2. The second type of the answer

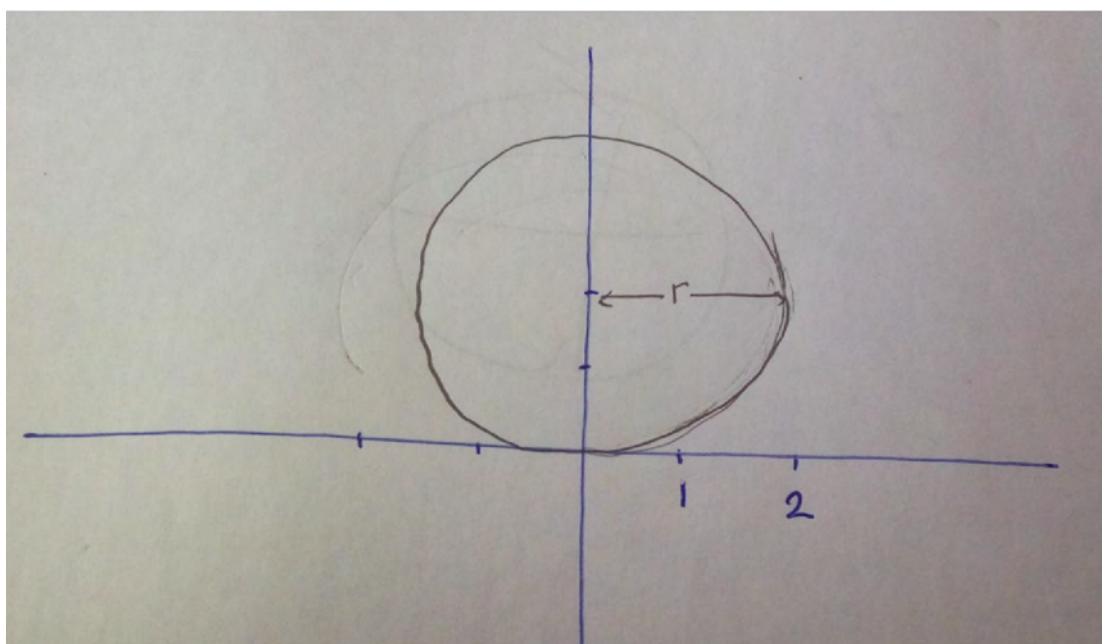
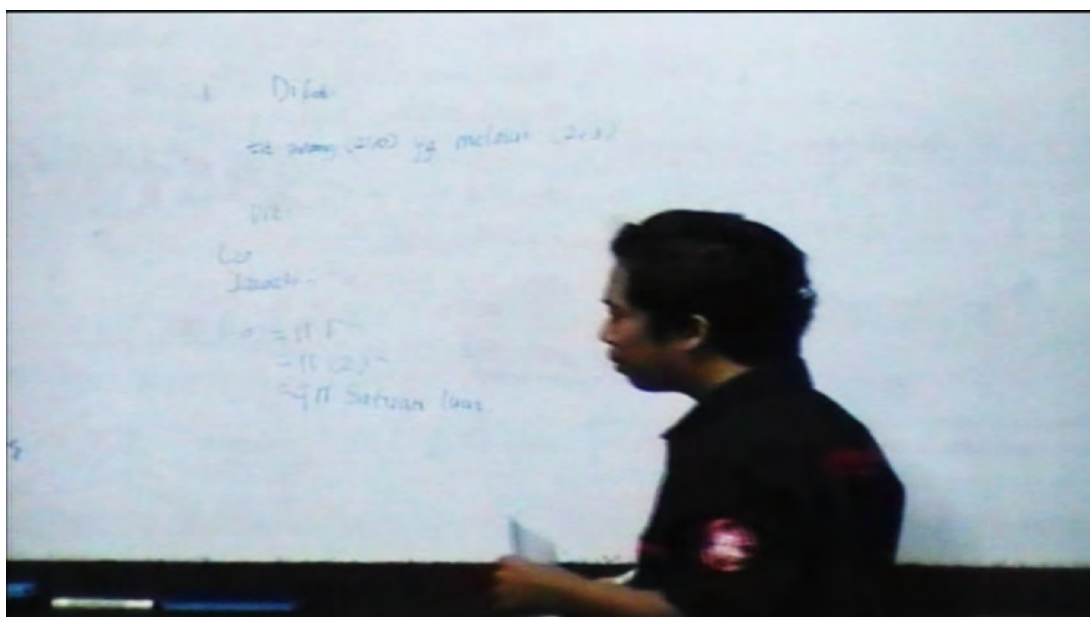


Figure 3.

The process are as follows:

- Students determine the radius of a circle along the 2 unit area. This is taken from the point P which contains $x = 2$ and serves as the radius of the circle.

- b. Students directly calculate the area of the circle using a known circle formula and get the result of 4π unit area.

B. Individual Task Number 2

1. The first type of the answer

2.) Diketahui :

radius RC = 1 km

waktu RC = 180 menit

pangang pipa = 2 m

Ditanya = luas wilayah yg ditempuh.

Jawab :

$$\begin{aligned}
 L &= \pi r^2 \\
 &= \pi \cdot 2^2 \\
 &= 4\pi \\
 &= 4 \cdot \frac{22}{7} \\
 &= \frac{88}{7} \\
 &= 11,14
 \end{aligned}$$

Jadi, luas wilayah yg dapat ditempuh adalah 11,14 m²

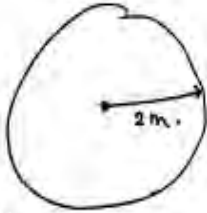


Figure 4.

The process are as follows:

- a. Students assume that the radius of the RC plane (1km) is the radius of the outermost circle of the RC aircraft range.

- b. Students assume that the length of the pipe (2m) is the radius of the inner circle that is exposed to pesticide sprays.
- c. Based on the processes (a) and (b), the students calculate the area of the field affected by the pesticide spray is the area of the inner circle. So the radius of the circle used is the radius of the inner circle.
- d. The calculation result shows that the area of paddy field that can be exposed to pesticide spray is 11,14m².

2. The second type of the answer

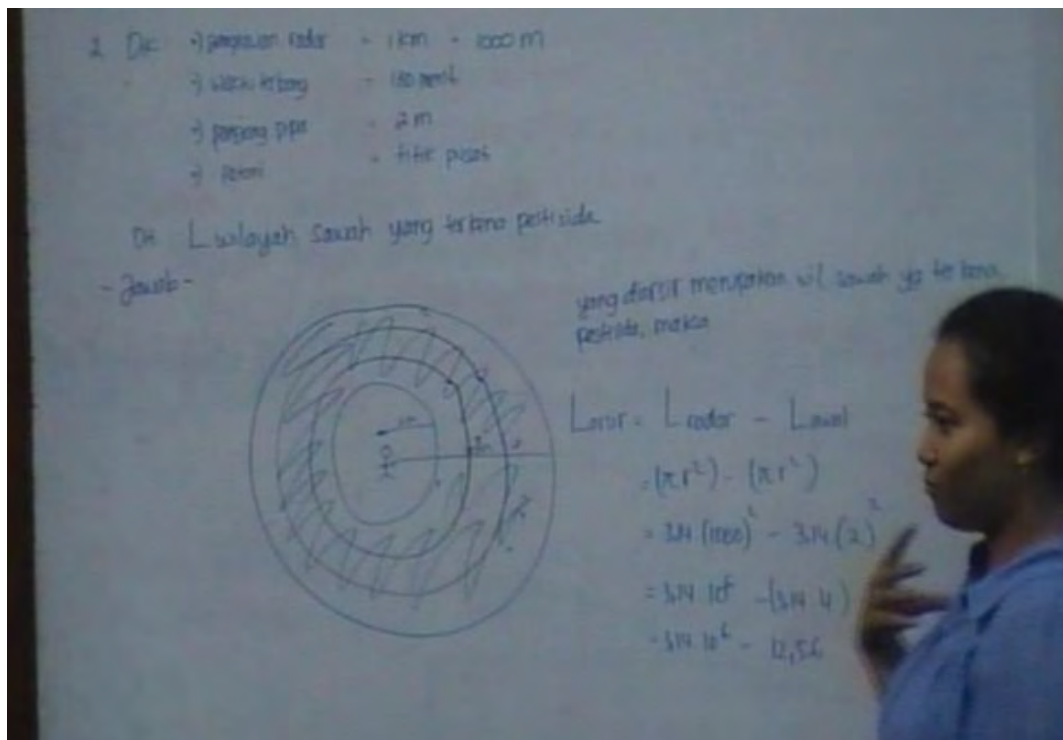


Figure 6.

The process is as follows:

- a. Students assume that the radius of an RC plane (1km) is the radius of the outermost circle of the RC aircraft range.

- b. Students assume that the length of the pipe (2m) is the radius of the inner circle that is exposed to pesticide sprays.
- c. Based on the processes (a) and (b), the students calculate the area of the field affected by the pesticide spray is the area of the outer circle less the area of the inner circle. The calculation results show that the area of rice field that can be exposed to pesticide spray is $3,14 \times 10^6 - 12,5$.

3. Group Task

π

r

$P = \frac{1}{2} K L O$

l

p

e

Diketahui :

$L_{\square r} = p \times e$

Dit : $L O$

Jawab

$L_{\square r} = p \times e$

$L O = L_{\square r}$

$= p \times e$

$= \frac{1}{2} K L O \times r$

$= \frac{1}{2} \cdot 2\pi r \cdot r$

$= \pi r^2$

Disebutkan bahwa sudah diketahui

$K O = 2\pi r$

9 Semakin banyak potongan dari lingkaran yg disusun, maka akan menyerupai persegi panjang



Figure 7.

The process is as follows:

- a. One circle is cut into 8 equal segment.
- b. They formed and taped the segments alternately to form a flat rectangular shape.
- c. The last segment is cut out into 2 equal parts, and placed on flat ends.
- d. The length of the flat wake is $\frac{1}{2}$ of the circumference, and the width of the wake is π
- e. Because the flat wake is rectangular, the area obtained is area = length $\times$ wide, so it is

$$\text{obtained area} = \left(\frac{1}{2} \times \text{circumference} \times \pi \right) = \pi r^2.$$

Discussion

A. The Implementation of PBL

The learning process happened on 30th March 2017 in the Mathematics Media Learning class (2 x 50 minutes). The topic is *proofing of the formula area of the circle*. Ongoing lesson planned and planned HLT. At the beginning of the study the researcher (teachers) explain the purposes of the learning, that students are invited to solve problems that may be

faced by students as future teachers when explaining about the formula of the circle to their (future) students.

In the first step, the teachers provide contextual problems to the students. The matter can be seen below

pemanasan

1. Diketahui sebuah lingkaran dengan pusat $(0,0)$ yang lewati $(2,3)$. Berapa luas lingkaran tersebut?
2. Sebuah pesawat remote control (RC) terbang sambil menyemprotkan cairan pestisida pada tanaman di area persawahan di Bozhou, China, pada Selasa (15 Maret 2016) lalu. Sejumlah petani di China menggunakan cara unik dengan memanfaatkan pesawat RC untuk menyemprotkan pestisida pada tanaman mereka. Dengan cara unik ini, petani di China tak lagi repot-repot membawa tangki pestisida dan mengelilingi area persawahan. Di buku manual tertulis jangkauan terjauh radar *remote control* sejauh 1 km dan memiliki waktu terbang maksimal 180 menit. Berapa besar wilayah sawah yang dapat disemprotkan pestisida menggunakan 1 Pesawat RC dalam sekali waktu penyemprotan, jika panjang pipa semprot seluruhnya 2 meter dan petani berdiri di tengah-tengah sawah?



Figure 8.

In the process, the researchers asked the students to count (1 and 2) to determine the number of questions to be done. After that, researchers give ± 15 minutes to do it or solve the problem. During the process, the teachers try to get closer to the students, so they can see how the students work, and answers some questions from them. Once considered sufficient, researchers asked two people who worked on the number 1 problem to come forward and present the answer in front. On this occasion, the researcher invites all students to see the difference, and analyze the difference, so it is stated that one of the answers is less precise in using the concept. From that opportunity also, students who make mistakes can get the right

answer thanks to the discussions conducted. After the discussion took place, the researchers also gave the correct answer analysis according to the researchers.

The discussion continues on number 2, the researchers asked two students to put forward the answer. In this activity, there is discussion and question and answer activities are quite long, because some students feel curious and confused with question number 2. In this opportunity, researchers try to provide short questions useful to improve students understanding of the given problem. From the help or support question, the students begin to understand the direction of the problem are given, even some students can give criticism and suggestion to repair the problem. Researchers appreciate by expressing admiration for the student's clarity. After a long discussion, the researchers also show the correct way of workmanship or analysis according to the researchers.

B. The Result of Learning

1. The first type of the answer of Number 1

Table 1.

Analysis' Point	Analysis
- Students make Cartesian diagram to put the points known in the problem. - Students draw a point on Cartesian diagram. Then he assumes that P is a circle point. - The student calculates the distance of point O to point P which is the radius of the circle. - Students calculate the area of a circle	- The student's answer belongs to the first HLT category, where most of the students' answers to this question 1 are like the first HLT. Based on Bloom's learning outcomes, it will be analyzed: - Cognitive aspect In this stage the students are able to reach all levels in the aspect or the cognitive aspect. It can be seen from the knowledge level (C1) where the student still remembers the formula that should be used to find the area of the circle. Then at the level of understanding (C2) students understand and understand the problem well. He is able to develop the things that are given from the problem to become the benchmark problem-solving. At the application stage (C3) the student is able

Analysis' Point	Analysis
using a circle formula that has been known before, so get the result of 40.72 unit area.	to apply the knowledge he has before to the given problem. At the stage of analysis (C4) students provide correct and precise thinking in solving existing problems, this is confirmed from transcripts of existing conversations. The analysis provided is short, and clear. • Affective aspect Students in this aspect follow the command in the matter well. The attitude of students in reporting and presentation also shows good self-esteem. Seen from the mention of the value of an appropriate variable and seen in the video description very smoothly and appropriately. • Psychomotor aspect Students in this stage can manipulate the problem in the image he made in a piece of paper. Students can also make corrections when making mistakes when presenting in front of the class. In addition, when the educator gives the sentence asked "<i>have you finished number 2, anyone? Or maybe with number 1 again? What's your name?</i>". The students responded promptly and promptly stepped forward. The description and explanation of the answers written on the board can be presented well, although there are few constraints in which he doubts the term Cartesius diagram as in the above conversation is "<i>So what is the name?</i>".

2. The second type of the answer of Number 1

Table 2.

Analysis' Point	Analysis
1. Students determine the radius of a circle along the 2 unit area. This is taken from the point P which contains $x = 2$ and serves as the radius of the circle. 2. Students directly calculate the area of the circle using a	• The student's answers are not included in the existing HLT. This is because, in the process of making HLT it is assumed that all students have mastered and understood the concept of circle that has been studied in previous level well. From that point, it is concluded that as an educator, we need to estimate the possibility of misconceptions on students or students. It is hoped that with this assumption, an educator can minimize and streamline the learning process in the classroom.

Analysis' Point	Analysis
known circle formula and get the result of 4π unit area.	Based on Bloom's learning outcomes, it will be analyzed: • Cognitive aspect Students in this realm only reach the C1 level. This is because he can only memorize the formula circle without being able to apply it to other problems. • Affective aspect Students in this field can present and demonstrate accountability of the problem solving process. • Psychomotor aspect Students in this stage are said to not fulfill. This is because, for the initial stage, that is manipulating, students make mistakes. Seen from the transcript of the above conversation that the student is less able to understand and manipulate the problem so that when translating the problem into the picture experiencing distress. Supports from the teacher: The educators provide a direct explanation, this can be seen in the following conversation transcript: <i>P: "Okay. For mas I, it was actually already a correct concept of drawing circle. But something that you need to know is to get here, it's not the radius r. So that if the picture is true, like that. So from herself it is not two mas. Considered this is perfectly round yes. It's not only from point (0,0) to 2. This one is not equal to its radius. But what about the radius? Just like what Y did. Remember the concept of the circle, when you pull a point from the center point to the side of the circle, will it be the same distance? Yeah? So from here to here, because he passed the point (2.3) right? Means this is the r. Can you get it? "</i> This teacher gave this kind of support because looking at the class situation and time, it is not possible then the decision is taken. It would be better if at the time of giving the support done in accordance with the characteristics of PML on Teachers act as the facilitator, so he or she should not explain it directly to the students but provide a clue(s) to help

Analysis' Point	Analysis
	the students.

3. The first type of the answer of Number 2

Table 3.

Analysis' Point	Analysis
1. Students assume that the radius of an RC plane (1km) is the radius of the outermost circle of the RC aircraft range. 2. Students assume that the length of the pipe (2m) is the radius of the inner circle that is exposed to pesticide sprays. 3. Based on the processes (1) and (2), the students calculate the area of the field affected by the pesticide spray is the area of the inner circle. So the radius of the circle used is the radius of the inner circle. 4. The calculation result shows that the area of paddy field that can be exposed to pesticide spray is $11,14m^2$.	• The student's answers are not included in any HLT that have been made before by the researcher. Based on Bloom's learning outcomes, it will be analyzed: • Cognitive aspect Stage of knowledge (C1) students are good, that students can remember about the broad concept of the circle that if necessary to solve the given problem. At the level of understanding (C2), students are less able to understand the problem. This can be seen from the depiction done by the students, where he mentioned that the length of the pipe (2m) is understood as the radius of the circle that will be affected by the pesticide. At the application or application level (C3), the student can perform calculations appropriately based on the things he / she obtains and knows in advance. • Affective aspect Students in this aspect can follow the instructions and request questions well. Students give a positive response when the researcher gives a problem. • Psychomotor aspect Students in this phase can correct the mistakes he made when discussing with the researcher. The discussion process can be concluded that the student has met the four psychomotor aspects of Bloom well, which is receiving, responding, assessing, managing and living. Where at the end of the discussion, the student still gives the idea of his thinking by saying "But if suppose it is used, his option is used, in fact we know it, with so much healing is still in the capacity of 180 minutes. I think it needs to be in what ya .. "It indicates that the student has lived the process done so as to form a new concept in

Analysis' Point	Analysis
	mind.

4. The second type of the answer of Number 2

Table 4.

Analysis' Point	Analysis
1. Students assume that the radius of an RC plane (1km) is the radius of the outermost circle of the RC aircraft range. 2. Students assume that the length of the pipe (2m) is the radius of the inner circle that is exposed to pesticide sprays. 3. Based on the processes (1) and (2), the students calculate the area of the field affected by the pesticide spray is the area of the outer circle less the area of the inner circle. 4. The calculation results show that the area of rice field that can be exposed to pesticide spray is $3,14 \times 10^6 - 12,5$	• The student's answers are not included in any HLTs that have been made by previous researchers. Based on Bloom's learning outcomes, it will be analyzed: • Cognitive aspect Stage of knowledge (C1) students are good, that students can remember about the broad concept of the circle that if necessary to solve the given problem. At the level of understanding (C2), students are less able to understand the problem. This can be seen from the depiction done by the students, where he mentioned that the length of the pipe (2m) is understood as the radius of the circle that will be affected by the pesticide. At the application or application level (C3), the student can perform calculations appropriately based on the things he / she obtains and knows in advance. • Affective aspect Students in this aspect can follow the instructions and request questions well. Students give a positive response when the researcher gives a problem. • Psychomotor aspect Students in this phase can correct the mistakes he made when discussing with the researcher. The student can receive, respond to and properly assess any issues. It is seen that at the time of answering the question, he is able to calmly understand the question, respond appropriately and be able to explain the assumptions used to answer the question.

5. The Group Task

Table 5.

Analysis' Point	Analysis
1. One circle is cut into 8 equal segment pieces. After the cut, segment-segment is formed and taped alternately to form a flat rectangular shape. The latter is cut into 2 equal parts, and placed on flat ends. 2. The length of the flat wake is $\frac{1}{2}$ of the circumference, and the width of the wake is π. 3. Because the flat wake is rectangular, the area obtained is area = length $\times$ wide, so it is obtained area = $\left(\frac{1}{2} \text{circumference} \times \pi\right) = \pi r^2$	- The group's answer is included in the first HLT that the previous researcher has made. In this case, most of the students give the same type of the answer.. This is because (possible) students have received this kind of material before (in other courses). Based on Bloom's learning outcomes, it will be analyzed: Cognitive aspect Stage of knowledge (C1) and understanding (C2) of students is good, that students can use concept of props given to solve existing problem. At the application or application level (C3), students can perform analysis of the manipulations they perform with the visual aids so as to get the concept or exit from the given problem. Affective aspect Students in this field receive guidance on the issues given well. Students responded almost equally in solving existing problems. Psychomotor aspect Students in this stage can manipulate and demonstrate props provided by researchers to prove or solve the problems given.

Conclusion

From the analysis of the implementation of learning (the research) that we have done, there are some things we can conclude:

1. Student who has a good understanding in mathematics concepts is able to design a good media for teaching.
2. Educators or teachers are must be really know about any possibilities that may occur during the learning process (possibly misconceptions, misunderstanding, etc.). In this case, teachers or educators are advised to really understand about the concept of PCK (Pedagogical Content Knowledge).

3. Especially for the Mathematics Media Learning class, the problem-based learning is very interesting to be implemented. This is because the dynamics of the discussion at the last presentation of students able to ask and answer in detail about the usefulness of the media produced. This is useful for preparing students as a teacher to prepare the learning process, especially making the learning media they are likely to use.
4. A good media can help the teachers to explain the concept to students. Understanding the concept through the learning of PMBM is able to construct the learner's knowledge appropriately and effectively (in accordance with the conclusion 3). This is reinforced by explanations about the media done by the students in detail and able to stimulate follow-up questions.

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THE ANALYSIS OF STUDENT THINKING IN MATHEMATICAL UNDERSTANDING OF 7TH GRADE OF BOPKRI I JUNIOR HIGH SCHOOL ON ANGLE

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Abstract

This research aimed to describe the student thinking in mathematical understanding of students from 7th grade of BOPKRI I Yogyakarta related to the line and angle topic. The method used in this research was qualitative descriptive. Data were obtained by using worksheet based on Hypothetical Learning Trajectory. There were 4 test subjects, 1 subject with advanced mathematical skill, 2 subjects with intermediate mathematical skill, and 1 subject with beginner mathematical skill. These chosen subjects were interviewed to know their thinking process.

The result shows that there are two kinds of mathematical understanding regarding subjects' understanding, which are relational understanding and instrumental understanding. 4 steps of student thinking were used by the subjects, includes problem understanding, using mathematical model, mathematical manipulation, and decision making.

Keywords: mathematical understanding, thinking process, hypothetical learning trajectory.

Introduction

Indonesian government, on Permendiknas No.22 2006 (Depdiknas, 2006:346) states that on of the goals of mathematics on secondary education is that learners have the ability to understand the concepts of mathematics, explaining the interconnection between concepts, and applying concepts or algorithms flexibly, accurately, efficiently and appropriately in troubleshooting. Understanding the concept needs to be instilled to learners from an early age, since the learner is in elementary school as well as for students of junior high school. They are required to understand about the concept, have a good grip of problem solving, and the operation of mathematics accurately, because it will be a provision in learning mathematics at higher levels of education.

The understanding of mathematical concepts is important for meaningful learning of mathematics. In the process of learning mathematics, understanding the concept is a very important foundation for thinking in solving mathematical problems and daily problems. Teachers of course expect that students' understanding will not be limited to connecting only. This is the most important part of mathematics learning as Zulkardi (2010) states that "the mathematics lesson emphasizes the understanding of concepts". This means that in learning mathematics students must understand the concept of mathematics in advance, in order to solve the problems, apply the theories in the real world (Herawati, 2010), and to be able to develop other capabilities that became the goal of mathematics learning. Similarly, Mohd Sholeh Abu states that if the understanding of concepts in learning mathematics is not achieved, it will reduce the interest of students in the learning of mathematics itself and students will consider it difficult math (Yahaya, 2010).

Mathematical understanding is important for learning mathematics in a meaningful way, where students can interwine between knowledge possessed and other circumstances of theirs, so that they can learn by understanding. However, how to optimize the learning outcomes of mathematics is certainly the task of a teacher. Therefore, we need a new paradigm in developing teaching strategies in class. Teachers are required to think critically in preparing a learning device that will support the activities of teachers as educators and support the achievement of the desired learning objectives. In preparing learning tools, it is important to consider the conjecture and anticipation of what might happen to the students who will be taught about angles. In this study, the learning device is HLT. Hypothetical learning trajectory (HLT) is a hypothesis or prediction of how students' thinking and understanding develop in a learning activity (Prahmana, 2017: 11). Based on the above statement, then in this study will be analyzed students'

mathematical understanding ability in the subject about the relationship between angles with the help of learning devices in the form of HLT.

Theory

A. Mathematical Understanding

Bloom (Sagala, 2009: 157) states that understanding (comprehension) refers to the ability to understand something after it was known or remembered and interpret the learning subject. In general, indicators of understanding of mathematics include: recognize, understand and apply concepts, procedures, principles and mathematical ideas. According to skemp (Herdian, 2010) based on his level of thinking, understanding of mathematics is classified in the following stages:

1. Instrumental understanding, which is to memorize something separately or can apply something to a simple/routine calculation, doing something algorithmically only.
2. Relational understanding, which can link something with other things correctly and aware of the process undertaken.

Instrumental understanding is defined as the understanding of mutually exclusive concepts and only memorize formulas in simple calculations. In this case one understands only the order of workmanship or algorithms. Whereas relational understanding contains schemes or structures that can be used in the explanation of the wider problem and its usage properties are more meaningful. Indicators of students 'mathematical understanding of mathematical concepts according to NCTM (2000) can be seen from the students' ability in:

1. Define concepts verbally and in writing
2. Identify concepts and create example and not example

3. Using models, diagram and symbols to represent a concept
4. Converting a form of representation to another form
5. Know the various meanings and interpretations of concept
6. Identify the properties of a concept and recognize the conditions that define a concept
7. Compare and differentiate concepts.

B. Hypothetical Learning Trajectory (HLT)

HLT is used to predict the conjecture and anticipation of what might happen to students who will get a mathematics learning that reveals the students' mathematical understanding ability, both the students' thinking processes and the things that will happen in the learning process. Gravemeijer (Charitas Indra Prahmana, 2017: 11) states that Hypothetical Learning Trajectory (HLT) consists of three components: learning objectives, learning activities and tools or media used in the learning process.

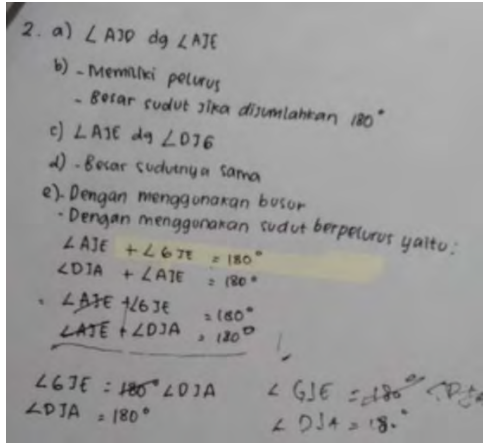
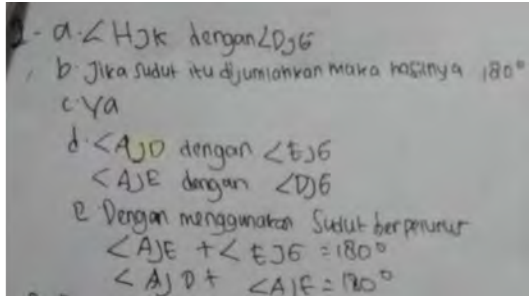
Methodology

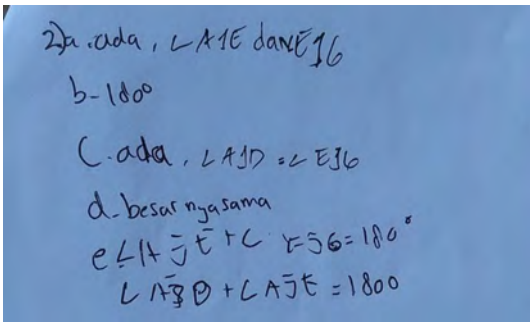
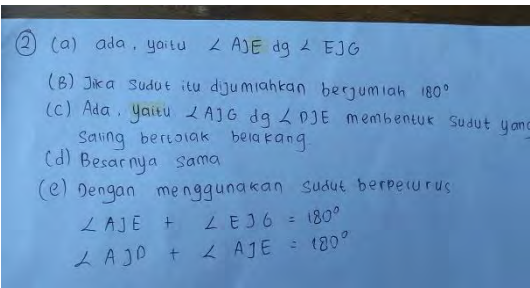
The research method in this study is descriptive qualitative. Subject and place of study are students class VIIA of SMP BOPKRI I Yogyakarta in their second semester of academic year 2016/2017. The subjects consist of 4 students and their research objective is the forms of mathematical understanding. Data collection is done by written test on mathematical problems and interviews about the forms of mathematical understanding used. The instrument used is HLT, while data collection technique is done by written test and unstructured interview. Data analysis technique used in this research is data reduction, data presentation then verification or make a conclusion.

Results and Discussion

The result of this research shows that the level of understanding of most students belongs to the level of instrumental understanding because the students can understand the concept separately and find the relation between one and another but still not able to solve them yet. Students also can understand that the property of supplementary angle can be used for proving the property of opposite angle. The analysis of students' thinking processes can be seen in the following table.

Table 1. Analysis of students' thinking processes

Student's answer	Analysis of students' thinking processes
Student A:  Handwritten work for Student A: 2. a) $\angle AJO$ dg $\angle AJE$ b) - Memiliki pelurus - Besar sudut jika dijumlahkan 180° c) $\angle AJE$ dg $\angle DJE$ d) - Besar sudutnya sama e) Dengan menggunakan busur - Dengan menggunakan sudut berpelurus yaitu: $\angle AJE + \angle GJE = 180^\circ$ $\angle DJA + \angle AJE = 180^\circ$ $\angle AJE + \angle GJE = 180^\circ$ $\angle AJE + \angle DJA = 180^\circ$ $\angle GJE = 180^\circ - \angle DJA$ $\angle DJA = 180^\circ$ $\angle GJE = 180^\circ - \angle DJA$ $\angle DJA = 180^\circ$	a) This student can understand the problem that is to find the property of supplementary angle and the opposite angle. b) This student can use mathematical models to prove the property of the opposite angle using the property of the supplementary angle. c) This student can use mathematical manipulation so that she can prove the property of the opposite angle using the property of supplementary angel. d) This student can conclude the property of supplementary angle and the property of opposite angle. Conclusion: this student' understanding belongs to the relational understanding because she understands each concepts and then find the connection between concepts and solves the problem correctly.
Student B:  Handwritten work for Student B: a. $\angle HJK$ dengan $\angle DJG$ b. Jika sudut itu dijumlahkan maka hasilnya 180° c. Ya d. $\angle AJO$ dengan $\angle EJO$ $\angle AJE$ dengan $\angle DJE$ e. Dengan menggunakan Sudut berpelurus $\angle AJE + \angle EJO = 180^\circ$ $\angle AJO + \angle AJE = 180^\circ$	a) This student can understand the problem that is to find the property of supplementary angle and the opposite angle. b) This student can use mathematical models to prove the property of the opposite angle using the property of the supplementary angle. c) This student can't use mathematical manipulation so she can not prove the property of the opposite angle using the property of supplementary angel. d) This student can conclude the property of supplementary angle and the property of opposite angle. Conclusion: this student' understanding belongs to the instrumental understanding because she

Student's answer	Analysis of students' thinking processes
	understands each concepts and then find the connection between concepts but can not solve the problem correctly.
Student C:  Handwritten notes for Student C: a. ada, $\angle AIE$ dan $\angle JG$ b. 180° c. ada, $\angle AID = \angle EJB$ d. besarnya sama e. $\angle AIE + \angle EJB = 180^\circ$ $\angle AID + \angle AIE = 180^\circ$	a) This student can understand the problem that is to find the property of supplementary angle and the opposite angle. b) This student can't use mathematical models properly to prove the property of the opposite angle using the property of the supplementary angle. c) This student can't use mathematical manipulation so he can not prove the property of the opposite angle using the property of supplementary angel. d) This student can't conclude what is the property of supplementary angle and the property of opposite angle. Conclusion: this student' understanding belongs to the instrumental understanding because he understands each concepts and then find the connection between concepts but can not solve the problem correctly.
Student D:  Handwritten notes for Student D: ② (a) ada, yaitu $\angle AIE$ dg $\angle EJB$ (b) Jika sudut itu dijumlahkan berjumlah 180° (c) Ada, yaitu $\angle AIG$ dg $\angle DJE$ membentuk sudut yang saling berelak belakang (d) Besarnya sama (e) Dengan menggunakan sudut berpelurus $\angle AIE + \angle EJB = 180^\circ$ $\angle AID + \angle AIE = 180^\circ$	a) This student can understand the problem that is to find the property of supplementary angle and the opposite angle. b) This student can use mathematical models to prove the property of the opposite angle using the property of the supplementary angle. c) This student can't use mathematical manipulation so she can not prove the property of the opposite angle using the property of supplementary angel. d) This student can conclude the property of supplementary angle and the property of opposite angle. Conclusion: this student' understanding belongs to the instrumental understanding because she understands each concepts and then find the connection between concepts but can not solve the problem correctly.

Class activity begins with observing a sketch of a total solar eclipse phenomenon. This activity is divided into several steps. The first step is that students are asked to name two angles, which form a straight line when being combined. At first, students are still confused to mention the

angle in question. Almost all students think that the angle is the same as the straight line itself.

Here is a snippet of conversation between researchers and students.

Researcher : please mention which angles form a straight line

Student : I don't know, ma'am.

Researcher : look at the line CL on the sketch. How many angle are there?

Student : two, $\angle CIJ$ and $\angle LIJ$

Researcher : those two are called supplementary angle. Now name the others

Student : so is it true that the addition $\angle CIJ$ and $\angle LIJ$ is equal to 180°

Researcher : yes, that's right, because they form a straight line.

Finally, with the help of the facilitator the student can understand the concept of the angle of the plane, and furthermore he finds the nature of the angular angle that the sum of the sideways angles is 180° .

There are also students who find it difficult to grasp the meaning of the sentence in the question, but even though there has been given explanations and even examples, this student cannot immediately find the properties. In this case, the researcher as a facilitator guides the students to reach the intended concept, starting with asking the large angles wich form a straight line.

Researchers than ask students to find the property of opposite angle. Some of them still do not understand the concept. Here's a snippet of student interview.

Researcher : can you draw lines intersect to one another?

Student : like this?

Researcher : great. Now take a look at line EI and HG , at which point they intersect?

Student : point J

Researcher : therefore $\angle HJI$ and $\angle EJG$ are opposite angle

Student : yes, ma'am. I understand

Researcher : what about their size?

Student : they have the same size

At first, students still not sure about how to find the property of the opposite angle, but the the help of researchers plays a very important role that help students to finally find the properties of the supplementary angle and opposite angle.

Furthermore in the next activity, the students are asked to prove the property of the opposite angle. Student thinking on this activity is the same as previous activity. They can understand the property of opposite angle. However, they can't afford to use supplementary angle's property to prove the property of opposite angle. The conversation is stated below.

Researcher : what is the property of opposite angle?

Student : they have the same size.

Researcher : how about the supplementary angle?

Student : the sum of the angles is 180° .

Researcher : what is the connection between the property of supplementary & opposite angle?

At the end, student can't relate the property of opposite angle to prove the property of supplementary angle.

Conclusion

Based on the result and discussion above, from total of 4 subjects, the understanding of 3 subjects belongs to instrumental understanding, while the other one belongs to relational understanding. As for their thinking process, there are 3 subjects who can use mathematical model, but only 1 of them who can do mathematical manipulation to solve problem.

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THE CLASSIFICATIONS OF LEARNING ASSESSMENT INSTRUCTIONS

(A case study at Ponorogo State Institute of Islamic Studies)

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Abstract

The aim of this study is to reveal the main ideas underlying the preparation of learning assessment instruments compiled by the lecturers of the Ponorogo State Institute of Islamic Studies as a measure of students' achievement in learning process. This paper employed qualitative research evaluation approach. The data were collected through interviews and documentation and analyzed using interactive analysis, including data reduction, data display, and verification. The results of this study were the preparation of learning appraisal instruments based on practicality and idealism. While the type of instruments included; oral and written forms; the forms were in terms of objective and non-objective. Those instructions ordinary unprinted out. The boarding guidelines were made easier to judge. The quality of education is determined by the quality of learning. The success of the student learning can be measured by standardized test. The Standardized measuring instruments must fulfill the validity and reliability. The measurements in learning in college must be made by lecturers. Lecturers must be able to make measuring instruments that meet the standards. In hence, it is not to harm for the students. Reality, many lecturers who do not have the ability to make learning measuring instruments that fulfilled the standards to the detriment of students.

Keywords: classification, practically, idealism, assessment.

Introduction

One of the efforts in improving quality process and learning outcomes is a part of improving the quality of education products. This can be done through assessment. Assessment of student learning process and outcomes cannot be separated from various aspects such selecting assessment instruments, preparing instruments to utilize the results of selected assessment. The accuracy in choosing the form of the instrument will greatly affect the student learning outcomes. Therefore, the lecturers are able to understand each indicator and determine the appropriate an assessment instruments. Understanding the above will provide additional value for the lecturers to have in-depth insight and skills in the field of assessment (Sudjana, 1995:1).

In the contrary, the academic communities against three terms that enclosed among them and have different roles. Those terms are measurement, appraisal or assessment, and evaluation then all terms have hierarchical relationship. Furthermore, each evaluation always involves assessment and it is preceded by a measurement. In other words, without measurement, it is impossible for lecturers to make an assessment. While in measuring instruments are always used a measuring tool. Measurements in education are more synonymous with instrument terms.

In education, the selection and determination of appropriate measuring instruments require in obtaining good result accurately. In other words, the usage of standardized measuring instruments will be able to measure. Therefore, measurement plays an important role in realizing goals of achievement in a program and determines a policy.

A measurement is an act in determining the number of objects systematically in order to describe the characteristics of the object. The determination of individual characteristics through measurements takes as far as possible to avoid the occurrence of major errors. In natural science, error in measurement is caused by measuring factor itself. While, measuring instruments, how to measure, and the state of the object being measured are the factors in social sciences. In other words, the measurement in social science is more complicated than natural science. Thus, the measuring instrument is used to measure an object becomes valid and reliable.

These are three terms are definitively measurements are attempts to compare observations with established criteria, the assessment closer to the effort to explain and interpret the observations, while evaluation is an act of determining the value or implications of a behavior both individual and institutional funding groups (Mardapi, 2008:1).

An important role of evaluation is preceded by an assessment should be encourage learners (Students) in better learning and educators or lecturers are also better performance. Evaluation is one of educational activities and the aim is improving the quality, performance, or productivity of an institution in implementing the established program. Through the evaluation, it will be obtained information about something that has been achieved and it will be used to perform program improvement activities yet.

Griffin & Nix (1991) in Finger explains that the evaluation is a judgment to the value or implication of the result of a measurement. This understanding indicates the existence of the assessment activity and the preceding measurement. While Tyler (1950) states that evaluation is the process of determining the extent to which educational objectives have been achieved. The two opinions above emphasize the existence of information and policies, namely information about the implementation and success of a program which furthermore to determine the policy further.

As the statement above, evaluation is always preceded by an assessment and it indicates that a person will not be able to conduct an evaluation before making an assessment. For this, the assessment determines the evaluation. Assessment is an important part of the implementation of formal education whether the basic level or in high level. Efforts to improve the quality of education can be pursued through improving the quality of learning and assessment, while the quality of assessment is determined by the accuracy in the selection of techniques and assessment instruments. In order to obtain good measurement results, it required a good instrument (measuring instrument), which has fulfilled the requirements of validity and reliability.

In the context of the provision of education in educational institutions among the primary, secondary and even in university level, the results of learners' achievement become an institutional problem. This problem demonstrates the existence of a uniform policy in the form of an assessment instrument. So that, the assessment instrument does not meet the requirements set for achieving actual learning outcomes, such problems that has varies in assessment model at the college. In the case of learning and/or lectures at Ponorogo State Institute of Islamic Studies, the assessment is a sequence of learning activities is also a problem that is quite alarming. In this case, the assessment which has a sequence of learning process becomes a problem. The question is how the assessments instrument is composed by each lecturer. As the consequence, the subjects improve learning outcomes optimally.

From the background above, it is needed conducting a research related to assessment models and instruments that are used by the lecturers of the to ensure whether the usage of an instrument model in measuring student learning achievement has been in accordance with the standards set. On the other hand, it is necessary to tell the consideration in selecting and defining assessment instruments in learning.

Theory

A. Definition of Assessment Instrument Classification

In popular scientific dictionary, the classification means classification or alignment in sections, the science of division according to the type which concerns both human and language; or the science of the types; or any arrangement of types. The term classification of assessment instruments in question is an attempt to divide or grouping various forms of assessment instruments used to measure the success rate of students studying at in the popular scientific dictionary. On the other hand, also to categorize the underlying

thoughts on decision making in determining the form of assessment instruments conducted by the lecturers.

The assessment is more popular as the assessment of a thing that is inherent in the learning activity and important both at the elementary school level up to the university, so that it becomes one of the standards of 8 (eight) national standards established by the government (PP No. 19/2007 and No. 32 The year 2013). As a form of responsibility of an educator both at the basic level or at the high level for the success of learning activities, teachers and or lecturers are required to be able to plan and conduct a good assessment so that the learning objectives set can be achieved well.

Suwandi (2010:7) said that definition of assessment is a process to know whether the process and results of an activity program have been in accordance with the goals or criteria that have been set. Therefore, the assessment process in learning needs a proper planning and systematic implementation steps. Planning and conducting the assessment is an activity that has lasted long so that the activities of the educator routine in line with the ongoing learning process. Because of the assessment becomes a routine activity for educators in this case teachers and lecturers cause standard procedures in conducting assessment activities to get the less positive response. This means that planning and implementation of the assessment become less qualified and less able to measure indicators of achievement of competencies that must be owned by learners.

Assessment is considered important to know the level of achievement of learning outcomes of learners. Baxter (1997: 78) has a reason for considering the importance of assessment. First, is to compare one learner with other, second is to know against the fulfillment of the established standards. Third is to help to learn activities of the learners.

Fourth is a control instrument in the learning program. The aspects that become an object of assessment include skill aspect, effective aspect, and cognitive aspect. Each aspect has a level from the low level up to the high level that can be measured through the measurement. The concept of level was promoted by Bloom is the first cognitive aspect includes knowledge level, comprehension, application, analysis, synthesis, and evaluation.

B. Goal-Free Evaluation

The Goal-free evaluation was delivered by Michael Scriven means: "Goal-free Evaluation after noticing side effect that sometimes had a more positive (or negative) effect than did the intended goals (Ogle, 1982:29) ". This theory based on the various effects of evaluation done than often come up outside of the goal program. Therefore, in evaluation an evaluator program no need concerns about what the goal program (Arikunto, 2008:41). A Goal-free Evaluation focuses on the real outcome of a program or activity than explained before. Goal-free evaluation increases the possibility where the outcomes that aren't be identified and listed (Subarno, 2009:20). Sukardi (2000:61) stated that to evaluation with goal-free evaluation means the evaluator need to produce two information, those are the assessment of the actual effect and an assessment of the profile of needs to be assessed. If the product has a real influence and response to needs, it means the planned product is useful and need to be developed.

C. The types of assessment

The types of assessment in curriculum 2013 includes the authentic assessment, self-assessment, assessment based on portfolio, midterm examination, final examination, national level test, competency level test, state examination, and local school test. While

the students mentioned in guidelines book of Ponorogo State Institute of Islamic Studies were separated into two terms. First is student learning evaluation and second is lectures work evaluation in learning and practice.

In this case, the meaning of t students learning evaluation is the scoring students ability and proficiency in comprehend the lesson material that given as the curriculum stated through the ability of thought, attitude and work (Tim, 2013:187), while the success of the student evaluation can be reached from the student that had already finished research test, community service or making scientific writing.

The purposes held the evaluation are 1) giving a score to the students ability and proficiency in learning of the subject in for specific duration of time. 2) Success measurement in giving goodness in college that done by the lectures: 3) grouping the students ability in several classifications as their capabilities such as group A (best), B (good) C (enough) D (minus), and E (fault). The students' evaluations are given in forms of writing test and speaking or both of them. To the subject based on competency it can be used addition evaluation to the goal incompetency that mastered by students it is needed various assessment as the type of competency.

The shape of assessment in the subject based on competency related to the competency in based, learning experience and indicator achievement. To know the achievement level and accurate outcomes needs fix assessment and variety as the competency measured by the individual test, group and practicing test. While the form of the instrument based on the competency are: 1) multiple choice; 2) objective; 3). Free; 4). Write/ Short answer 5).match 6). Portfolio and 7) performance (to work). The system that stated is to know

the quality of the success by IP as the average scores in the subject at the end of a study program.

The evaluation of student learning consists of; The final semester study evaluation; this is an assessment of the success of students conducted at the end of the semester, covering all courses programmed students last semester. Its success is expressed in the form of Temporary Achievement Index (IPS). Evaluation of the final study; this is an assessment of the success of student learning conducted after the entire student program ends. The success of learning is expressed by cumulative Achievement Index (GPA) (Muhsin, 2013:190).

While the assessment system determined by the Ponorogo State Islamic Institute using Norms Reference (PAN) and Reference Standard (PAP). The use of PAN with the provision that, the value of students is measured relative to the average performance of the group by considering the ability, academic honesty, and discipline of learning (standard deviation / standard deviation) for one semester. If there is a student that very good in achievement then he is not included in the calculation of average performance plus standard deviation. On the basis of average performance plus standard deviation set the value of A, B, C, D, and E.

The use of PAP is by comparing the students' learning outcomes with the criterion that has been determined. This criterion is usually called a pass or minimum level of mastery. The graduation limit in question is if the student obtains C with the equivalent of 2.00 in the score range 1-4 and/or 60-62 in the 10-100 score range.

D. Scoring Techniques

The Result of measurement through a test and also non-test will earn quantitative data in the form of the score. The assessment is then interpreted to be of value, they are low, medium, or high. The low height of the value is always associated with the references of the embarrassment. There are two reference scores, namely norms and reference criteria. In other words, the high and low of a value compared with the group or with the criteria that have been set.

The value is a useful tool to encourage the students to learn better. By gaining the value of learning achievement of a particular course the student will try to make a plan for improvement. The value is also as information about the success of lecturers in conducting the learning process. The success rate of a lecturer can be determined by many factors, but the main one is mastery of teaching materials, choosing skills and using teaching methods, choosing skills and using instructional media, and how to do the assessment.

In addition to the value can give a positive impact, the value will also give a negative impact if the results achieved are not in line with student expectations. In general, all students have an expectation for the course that followed. When the students choose majors, courses, and the subject they will have a hope to gain certain achievements. Such impacts can occur if the questionnaire used is lacking the correctness of the content; it is the material that only selected according to the favored course of the course (lecturer), so it does not represent the teaching materials that have been presented. For this, increasing the degree of truth content to be absolute is to improve the degree of truth content of exam questions.

The qualities of exam questions play have a role in determining the fate or career of a student. An exam problem that generates a score with many errors will give misinformation about a person's circumstances. The high score achieved by students in a course contributes to determining the success of the next because in each course of study in general courses with one another have relevance. The success of a course can be a capital to achieve subsequent success, let alone the course becomes the subject of the next course prerequisites. Therefore, assessment becomes important to be possessed by any course lecturer so as not to harm the students.

Basically, the assessment system is a communication system in which there is a symbol whose meaning must be interpreted clearly and can be understood by all related elements. The related elements are lecturers, students, and guardians. Essential assessment is part of the evaluation of the learning program. The actual assessment is limited to the interpretation of test scores or other non-test results. In order to obtain the proper assessment results, it is necessary to have the right report without proper reporting then misjudgment.

The research method

This research was evaluative research with the qualitative approach. Evaluative research is a study intended to see the effectiveness of a program's implementation (Committee, 1998:12). While in this study the program in question was a learning program that focused on assessment instruments. In order to the evaluation process that conducted systemically and comprehensively, it was necessary to frame the appropriate evaluation model according to the characteristics of the program. This research tried to see the thoughts of the lecturers in determining and classifying assessment instruments created as part of learning process.

The objects of this study included; 1) Thought on which to base the selection of assessment instruments, 2) Forms of assessment instruments. The location of this research was in Ponorogo State Institute of Islamic Studies. This was done on the reason that learning management conducted by lecturers Ponorogo State Institute of Islamic Studies shown varies assessment instruments that do not follow the guidelines for the implementation of education that have been established.

The research approach was qualitative, and then the research instrument was the researcher himself and the technique in collecting the data were unstructured interview, and supported by documentation. Interview was used to reveal the subject of the lecturer used to determine and establish the forms of assessment instruments. The documentation was directed to obtain data on the assessment instruments used to measure competence. The form of documents is a matter of midterms and final test.vThis study used an interactive data analysis introduced by Miles & Huberman. The first step is collecting data, next is performed data reduction, after reduced is done display and ended with the conclusion (Denzin, 2000:769).

In qualitative research, validation of the findings was important and necessary to ensure whether the findings are accurate from the perspective of the researcher, the participants or the report reader. This research uses peer debriefing. This step is done through discussions with colleagues who are competent in the substance of research and methodological objects. The goal is to keep researchers in the objective and openness corridor and explore the researcher's thinking. Nevertheless, researchers will still pay attention to the positions, circumstances, and processes taken in the discussion so as to obtain the expected results. The colleagues in question are the permanent lecturers STAIN Ponorogo who has the competence of evaluation.

Results and Discussion

A. The implementation of Learning Evaluation

The lecturing process will not be able to know the results when it not done of evaluated learning or assessment. The assessment of learning becomes important in order to obtain information on how much students' absorption of the material of the recovery and competence has been mastered for a certain period of time. It will not even know the learning outcomes of the students if the assessment of the lecturing process is not done.

Evaluation of learning in the lectures is by following the evaluation system of the students as is usually done regularly, there are even some assessment procedures that are not done correctly in accordance with the evaluation system applicable to the lectures. The lecturers have done the assessment through three things; the first is the assessment of learning outcomes through the Middle Examination Semester (UTS); second, assessment of the tasks assigned to the students by the lecturer; and third, assessment of learning outcomes through the Final Exam Semester Assessment is done on the Final Exam Semester and Midterm Exam. While the tasks that become part of the assessment component has been done by each lecturer. The task is partly done in every meeting and other at the end of the lecture. Meanwhile, to fulfill the assessment component is obtained by meeting attendance in the course.

Implementation of lecturer proficiency assessment is not involved in the overall supervision of the classes he taught. Giving more supervision and involves employees. This model will reduce the level of accuracy of the assessment results. The role of the supervisor is not only to share the questions and answers but also to ensure order in the implementation of the assessment. Assessment is essentially the full authority of the lecturer because the assessment is an inseparable sequence of the learning process.

Moving most of the supervisory duties from the lecturer to the other party will certainly reduce the validity of the assessment.

In conducting the assessment, the lecturers go through three stages. The first stage is to develop assessment instruments. this stage all the lecturers prepare the instrument begins with a circular letter from the Vice Chairman of the field academic section that states the date. Give the manuscript to the committee, the second stage, is the implementation of assessment, the implementation of the assessment in the middle Semester exam and last semester simultaneously by the Committee UTS and UAS. The situation of watching assessment or poor examination that repeated every time of the exam has influenced the views of the lecturers in preparing the assessment instrument as a measuring tool. The views of lecturers in formulating assessment instruments can be grouped into two. First, is the view that makes the appraisal instrument to meet the demands of the curriculum and related leadership authority. Second, the view that the compilation of instruments is done correctly is an academic responsibility and as the main duty and function of lecturers. Preparation of the instrument performed correctly becomes a necessity to meet the demands of test validity that impact on obtaining the truth of the test results so as not to harm the students.

The first view lacks idealism because. They assume that the preparation of the instrument in accordance with the rules is not important because it only complicates itself so that the way taken is to make a makeshift instrument. Groups with this view are more influenced educational background outside the education department so as not to have the competence of the preparation of the correct instrument. The impacts arising from the

results of the appraisals that compile such instruments will be detrimental to students and institutions.

The second view has the idealism and commitment to the duties and responsibilities as the lecture of the professional as meant in Law 14 The year 2005 article 3 paragraph 1. The professional attitude of a lecturer is realized through the ownership of commitment attitude to improve the quality of higher education as stated in Article 7 paragraph 1 (b) the teacher's and lecturer's laws. The commitment of the lecturers included in the second view is shown in the preparation of the assessment instruments that follow the steps of preparing the assessment instruments.

The assessment instrument data that is collected in this study is an assessment instrument in the form of a test instrument or a final exam of the semester. The assessment instrument used as data and analyzed is only used in the final exam of the semester. This determination is based on the results of the standard of several instruments from the same lecturer at the Middle Exam Semester and the end of the semester. The result of the comparison is the instrument between the Middle Semester Exam with the End of Semester found the existence of similarities both types and forms there are only differences in aspects of material substance. This distinction is certainly understandable because at each meeting in the course of different material always different. The number of instruments at the final examination Semester of the academy year 2015-2016 as much as 193, assessment instruments that have been used to measure the achievement of student competence can be divided into several aspects, namely, instrument type, instrument form, writing, and (scoring).

Instruments composed by lecturers are divided into Written and Oral. Instruments of Oral type are used by some lecturers, especially the subjects related to the mastery of English, Arabic, and speaking language skills, namely speaking skill. The use of the oral type is based on the material characteristics of the language itself, so it is not possible to use other types even if imposed procedural errors will result in low learning outcomes. Language skills are not only on the mastery of speaking orally but also in writing and listening. In the latter second case above the lecturers use the type of written assessment, because it is different from the oral. On the other hand, the competence of writing and listening has a difference from the aspects measured so that the writing and listening skills of the lecturers of the language use is written test (paper test).

In addition to language courses, there are several courses that are tested orally. The reason for oral exams for non-linguistic subjects is the originality student answers can be obtained. In addition to the originality of the answers, oral exams are able to motivate students to prepare themselves early, psychologically more ready students both mentally and materially if tested orally compared with the test in writing and simultaneously as usual in force. Nevertheless, very few do oral exams because oral exams are perceived as more difficult because it needs a long time.

Implementation of the test often leads to the problem of less objective measurement results. This is due to the oral examination process conducted by some lecturers is less attention to the less difficult test spot of examinees who have not got a turn. Students who have not got a turn are near the test being tested so they hear the questions conveyed by the lecturer and the answers from the test. On the other hand, the questions given to the initial and the last test are the same, so that the student who gets the last turn can

anticipate providing a more convincing answer to the examiner. The impact that arises is that the participants of the earlier exam are disadvantaged because they do not get the problems first as obtained by the participants who have a final test exam turn. Ideally, oral exams are conducted separately with other participants to avoid leakage of questions given to participants who get a turnover. Similarly, the oral test process involving multiple tests simultaneously becomes less objective score obtained by the examiner lecturer.

The second type of assessment instrument is a written assessment. The written assessment compiled by the great lecturers. Assessment of this type is easier to prepare the instrument as well as its implementation. The implementation also does not have to be a lecturer as a supervisor, can be other people outside the lecturers of course subjects. Supervisors and implementers simply involve other people, but the problem is how the level of accountability of implementation and objectivity assessment results.

Observing the written assessment instruments prepared by each lecturer, there is no uniformity of writing for the lecturers who have the same subject so that the material substance of the test is different. The difference is due to the less attention of the lecturer Course Outline (CO). If the course outline becomes the basis for the preparation of the assessment instrument there will be no difference in the test material contained in the assessment instrument.

B. Form of Assessment Instrument

The form of assessment instrument can be separated into two. First, the assessment instrument is objective, and the two are non-objective. The double-pieewise appraisal instrument has not fully followed the guidelines for the preparation of multiple-choice

instruments. Some of the things associated with following the guidelines are the test asked to choose the wrong answer instead of the correct one and asked to provide the selected error argument. Such exam will confuse the test participants because the answer pattern is not objective; the argument requested is not part of the requirements in the preparation of the multiple-choice instrument.

On the other hand, the compiler of the question actually gives a score of each number of 10. If attention to the math problem 1 of the form is dichotomous so that the chosen answer should be true is not the wrong. Then the score of each problem number for dichotomy is 1 and 0 are not 10. When score 10 is given for argumentation, giving is also not appropriate, considering the weight of matter with one another different matter.

The assessment instrument for the IPA 1 course also shows a lack of preparation of test instruments. On the instructions do not work properly because the test was asked to have the answer that is considered correct. The editors of this command indicate which option selected by the test does not occur because the error must match the assumption of the test.

The instrument of matching assessment basically consists of a number of premises and a number of responses. The matching test should be to measure knowledge of facts, such as the meaning of a word, chemical symbols or the like. Thus, this test measures the cognitive domain at the level of memorization and not understanding to a higher level. Preparation of the form of match-fixing instruments The premise or revelation should be homogeneous, the statement and response short enough, the number of responses more than the premise or revelation, the statements and responses sorted in alphabetical order, and the response can be used more than once.

There are several assessment instruments that use the form of matching and indication instrument is not good because it is not suitable for the criteria of writing a form of matching test instrument. Shortcomings in this test instrument, namely; a) the number of premises and responses are equal, b) the premise and response are heterogeneous, c) the premise and response are not concise, and the instructions for doing so are less clear.

A written assessment instrument that is also partially used by lecturers in measuring the achievement of student competency is a form of short answer. This form of the short answer can be a type of question, type of completion or contents, and type of identification or association.

Observing the problem using the form stuffed by some lecturers shows some things to note. The form in the instructions section is less communicative, for example, 'answer the questions below briefly'. Such an order would make the test disturbed by having to look at the revelation called the question. On the other hand, the revelation on the question of form stuff requires an answer to the description. This is not in accordance with the form of objective questions that require short and correct answers to only one, while an example of a questionnaire that demands an explanatory answer does not and impacts the answer and scoring analyst. If the answers to the latter description are scored by scoring objective questions then the test will be harmed. Mastery of the rules of writing the instrument of assessment by lecturers though becomes important for students to obtain justice.

C. Scoring

Scoring in the field of evaluation and assessment is an absolute thing, the results of the measurements that have produced quantitative data from both test and non-test scores are

scoring form. This score is further interpreted to be a value; they are medium and low heights. The high and low values are always associated with the benchmark appraisal. In the field of psychology and regular education, there are two reference judgments, namely norms and standards. This means high or low scoring statements after the scores obtained from the measurements are compared to the group or with the specified criteria.

The scoring system is essentially a communication system, in which there is a symbol whose meaning must be clearly defined and understood by all relevant elements, such as educators, learners, and parents. The scoring system should not be independently developed by an educator because if so, the meaning of the value from one educator to another can be different. This is not desirable because the value of each course is different.

Assessment is a part of the learning evaluation. The actual assessment is limited to the interpretation of test scores or other non-test measures outcome. To obtain the right result, accurate sizing is required, if not accurately measured then there will be a misjudgment. The determination of the score of the measurement results may vary according to the type of measuring instrument used. The scoring of the theoretical apparatus has the distinction between objective and non-objective questions. The difference is based on the character of each form of questions.

The assessment instrument used in the final exam of the semester by the lecturers can be separated into two. First, the assessment instrument is completed with a score on each question. Second, the scoring instrument is scoreless on each number of questions. The number of assessment instruments is completed with a score of each question as much as 42 of 193 assessments of instruments. Observing from each assessment instrument that

complete the score on each item is based on the fulfillment of the total score demands of all the items in order to be 100. This evidence comes from the scoring on each item is not seen from the weight of the material in the form of demands answers from each question about. The item in question that demands an answer to the scoring analysis is actually lower than the question items that the answer demands on the aspects of knowledge and understanding.

D. Construction of Test Questions

The attention to the guidelines for the preparation of test item construction of test becomes important to be possessed by each test compiler including lecturers. This is considered to be important because of the correct construction will guarantee the validity of the instrument itself. On the other hand, one of the criteria contributing to the correctness of the student answers is that the construction is also correct.

The question construction formed of objective and non-objective has a difference. For example, indicators that require a single or definite answer should not use non-adjectives or free descriptions. Then most free-form test questions and objective descriptions use the "what are.." question word. "Another similar instrument is the use of the word" what is ...". (Dokumen soal PAI: 5-10-2015). This problem model is almost evenly distributed on every instrument. In other words, that aspect of construction in the preparation of exam questions still lacks serious attention.

It is not less important relating to the construction of test items on the question in the form of free description or objective description is the compatibility between measuring instruments and measured indicators. The indicator in question is basically a question indicator. The indicator of this problem should be formulated in the grid matter. To recall

that in the implementation manual does not include this requirement, the final semester testers also do not make the grid, but the indicators of student achievement can be obtained from the syllabus. There are many exam questions on assessment instruments that are independent of measuring indicators on the syllabus and even it found that the subjects do not have a syllabus, there is also a subject that in the syllabus is broken down into two subjects and there is also no syllabus used as the reference of the lecture.

E. Other Assessment Instruments

In addition to the form of test questions that have been mentioned above, it is found a different form of exam question as usual. There are two assessment instruments used to measure the achievement of defined competencies using other versions, namely the sociology assessment instrument of education and Social Research Methodology.

The first form of assessment instrument (educational sociology) is the test participant is required to name the individual assignment assigned by the lecturer. Then the participant is asked to find a reason for the selection of the duties (*pesantren*) and the next demands are the exposure of the results obtained from the field assignment by watching at the sequential assignment. Observing from this instrument, it can be said that in essence, this task is not an assessment instrument that needs to be tested through a written exam activity. This is categorized because it meets task criteria. Therefore, the assessment model should use a task assessment and its implementation should be outside the written test. The instrument is also not clear the substance of the material being measured.

It is the first model, the assessment instrument for the subject of social research methodology. The instructions that start this instrument are the order of collecting the

resume tasks related to the thesis proposal. Furthermore, the participant is required to perform investigation by putting the tick sign on the column provided in the instrument. The available columns contain four columns that ranging from number columns, material columns that be resumed, columns that containing the word "exist", and the last column contains the word "none".

The second column of the material that is resumed includes; 1) background of the problem, 2) problem formulation, 3) Theoretical study, 4) literature review, 5) research methods, and 6) systematic writing. If your concern to the model of this instrument is actually a task instrument, not an instrument of writing assessment because it does not meet written criteria. This model appraisal tool is closer to the checklist model but it also cannot be said to be a checklist question. The checklist item is a checklist that contains a set of items that reflect the sequence of actions that should be performed by examinees as indicators of the skill to be measured. If the authors will use the question in the form of checklists, then the compiler should do a search of skills mastery indicators to be tested, then arrange them in order of appearance. The next step is to observe the subject being assessed to see if the indicator in question has arisen. If the indicator appears in appearance, then the tester gives a tick mark (✓) according to the option that describes the indicator's appearance.

Thus, the characteristics of the items containing descriptions or statements about the aspect of a definite act, the examiner should pay attention whether the actions in the statement appear or not. Therefore, two types of assessment instruments which, according to their authors, are regarded as a means of assessment of the written form actually enter the type of task assessment.

Conclusion

The thoughts of the lecturers in formulating assessment instruments can be grouped into two. First, is consideration of practicality, If the exam is done by the lecturer itself then it will increase the volume of work. On the other hand is to make the assessment instrument to meet the demands of the curriculum and related leadership authority. Second, is the consideration of idealism that the preparation of the instrument is done properly is an academic responsibility and as the main duty and function of the lecturer. Preparation of the instrument performed correctly becomes a necessity to meet the demands of the validity of the test which affects the acquisition of truth test results so it will not harm the students. Instrument assessment classified into three forms. First, is the instruments that follow the instructions; second, is less in accordance with the instructions and third, other forms of instruments. The third form is an instrument that is not found at all in the academic manual set by the institution.

Assessment as is an integral part of the series of learning processes. In other words, the learning process that is not followed by the assessment is a waste of learning. Given the important role of assessment as an activity to know the level of mastering the material or competencies that have been obtained by a learner or student then the assessment must be done by each lecturer. Assessment of learning outcomes is largely determined by the correct measurement results while the correct measurements determined by the measurement instruments used to meet the standards. The compilation of assessment instruments undertaken within the Ponorogo State Islamic Institute has largely not yet fully complied with standards for the preparation of standardized assessment instruments. Non-standard assessment instruments will affect the results of the assessment obtained by the students and will have implications for

the accuracy of the student's study period and the level of public confidence in the institution. Therefore, sufficient ability to develop an assessment instrument for lecturers will be a necessity.

Research Implication

Assessment of learning outcomes is not an integral part of the learning activities. The role of assessment is a measure of student learning outcomes during learning. Therefore, the assessment instrument must meet the valid and reliable criteria. The non-fulfillment of these criteria will have an impact on the outcome of the measurement and hurt the student. Thus, the knowledge and skills to make the assessment instrument must be owned by the lecturers

Suggestions

Consider to the importance of the assessment in the series of learning activities in the lecture that impact on the student's psychological condition and the level of trust of the community towards the institution caused by the lack of knowledge, understanding and experience in the preparation of the assessment instrument, to the related parties should continue to increase the various activities that support the improvement of competence lecturers in the development of assessment instruments so that the selection and determination of assessment instruments used to measure students' competence achievement that can be held accountable academically. Considering the importance of the learning assessment that impact on the student's achievement and the truth level of the institution, the institution should effort to improve the lectures' competence in the development of the assessment instruments. In order to be made instruments, it can be held accountable academically. Besides, The lecturers must also have idealism as a professional educator so as not to harm all parties.

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THE INFLUENCE OF REALISTIC MATHEMATICS EDUCATION (PMR) FOR MATTER OF INTEREST ON QUADRILATERAL INTEREST AND STUDENT RESULTS IN CLASS VII OF SMP NEGERI 1 NGAGLIK

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Abstract

The type of this research is descriptive research in quantitative and qualitative. Research subjects at this research is all students of class VIID SMP Negeri 1 Ngaglik which amounted to twenty five students. Based on the analysis of the study results, the researches obtained twenty five students were able to identify the nature of the rectangle but has not been able explain exactly one rectangle properties. And then twenty five students have been able to identify the nature of the square but can not explain exactly one square properties and questionnaires which researches obtained are twenty five students during the learning process, interest on the teachers, interest in learning, and feeling like learning.

Keywords: PMR, quadrilateral, rectangle

Introduction

The observation of the learning process in the seventh grade f that is the active students during the learning process applied with the students asked the teacher about teaching materials or teaching materials and how to solve the problems contained in these teaching materials. Results of interviews with students that is twenty-five students did not like the learning process and sixteen students liked the learning process in the classroom. The reason given by the students assume they do not like learning is more desire the learning process beyond the classroom related to the school environment. So that the school environment can be used by teachers during the learning process.

Researchers wanted to try a different approach in the learning process of mathematics in the classroom who use the school environment as a context for learning mathematics. The approach

will be used by researchers is realistic mathematics education (PMR) because of the presence of the PMR approach then students are encouraged to think creatively and directly involved to resolve the existing problem-solving daily life (reality). Realistic mathematics education can enable students during the learning process.

The background of the problems stated above, the problem to be studied is what learning outcomes achieved by students on the material after undergoing a rectangular flat field of learning with PMR approach? and what the difficulties experienced by students in the material field of flat rectangles with PMR approach?

Theory

A. Definition

1. Learning Outcomes

According to Sudjana (2010, 22), learning outcomes are the abilities students have after receiving a learning experience. According to Warsito (in Depdiknas, 2006, 125), learning outcomes are characterized by a relatively permanent positive behavioral change in the learners. According to Wahidmurni (2010, 18), a person can be said to have succeeded in learning if he is able to show a change in him. These changes include in terms of ability to think, skill or attitude towards an object.

According to Bloom's taxonomy, it is grouped into three domains (domains) namely the cognitive domain (thinking ability), affective sphere (attitude), and psychomotor realm (skill). In connection with that then by Gagne (in Sudjana, 2010, 23) suggested learning outcomes into five types among other things: (1) the results of intellectual learning is the most important learning outcomes of lingsikolastik system; (2) cognitive strategies that regulate the way of learning and thinking person in the

broadest sense, including the ability to solve problems; (3) attitudes and values, associated with the direction of one's own emotional intensity as inferred from the trend behavior toward people and events; (4) The verbal information, knowledge in the sense of the information and facts; and (5) motor skills are skills that serve for the environment and attain concepts and symbols.

To know one's learning outcomes is done with test and measurement. Tests and measurements require a tool as the data collection instrument learning outcomes assessment. According Wahidmurni (2010, 28), the instrument is divided into two major parts, namely test and non-test. According to Hamalik (2006, 155), the learning results obtained can be measured through the progress that students get after learning the real. Learning outcomes visible changes in behavior on students that can be observed and measured by a change in attitude and skills. The change can be interpreted as a better development and improvement than ever before.

According to Bloom's theory there are three areas in which learning outcomes: cognitive (thinking skills), affective (attitude), and domains psychomotor (skills).

2. Approach of Realistic Mathematical Learning (PMR)

a. Philosophy

Approach Realistic Mathematics Education (RME) or approach Realistic Mathematics (PMR) was first introduced in the Netherlands in 1970 by Hans Freudenthal. The underlying philosophy of PMR is mathematics and human activity. According to Shadiq and Mustajab (2010, 7), the PMR Approach is an approach that expresses experiences and events close to the student as a means of understanding math problems. This means math must be close to the students and

relevant to their daily lives. Thus abstract mathematical concepts, can be understood in real by the students because the abstract concept can be implemented in their lives.

This is confirmed by the concept of Freudenthal (in Suradi, 2001, 2) which states that mathematics is a human activity. Therefore, students should be given the opportunity to rediscover the ideas (reinvention) and construct mathematical concepts with adult guidance. This work is done through the exploration of a variety of situations and problems realistically. Realistic in this regard is intended not just related to the real world, but emphasizes the real problems that can be imagined by students. So the emphasis is to make something that becomes real in the minds of students.

3. Principle Approach Realistic Mathematics Education (PMR)

As according Treffers (1987) formulated the three principles of realistic mathematics education (in Wijaya, 2012, 24-26), namely:

- i. Guided Reinvention / progressive mathematizing, this principle gives students the opportunity to discover their own mathematical concepts by solving various contextual problems that students already know. Graphically progressive is meant to be math in vertical and horizontal. Math horizontally, the student should be able to identify the contextual matter so that it can be transferred into a math problem in the form of models, diagrams, tables to be understood. While the vertical math, students completed the form of formal or non-formal mathematics of the contextual problems using concepts, mathematical operations and procedures that apply.

- ii. Didactical phenomenology (learning phenomenon), this principle emphasizes the importance of contextual questions to introduce mathematical topics to students. What should be considered is the suitability of the context application in the learning and matching effects of the rediscovery of the mathematical form and model of the contextual question.
- iii. Self – developed models (model – model dibangun sendiri), prinsip ini dengan model – model yang dibangun berfungsi sebagai jembatan antara pengetahuan informal dan matematika formal.

4. Characteristics of Realistic Mathematics Learning Approach (PMR)

As according to Treffers (1987) formulated five characteristics of Realistic Mathematics Education (in Wijaya, 2012, 21-23), namely:

- i. Use of Context

Context is not just a real-world problem, but could be in the form of games, the use of props, or other situations as long as they are meaningful and can be imagined in the minds of students
- ii. The use of mathematical models for the progressive

The use of the model serves as a bridge from concrete knowledge and mathematics to formal-level mathematical knowledge
- iii. Utilization of student construction results

Students have the freedom to develop problem-solving strategies so that a variety of strategies are expected to be obtained.

iv. Interactivity

Utilization of interaction in mathematics learning useful in developing cognitive and affective abilities of students simultaneously.

v. Linkage

Through this connection, a mathematics learning is expected to introduce and build more than one mathematical concept simultaneously.

B. Process Problem Solving

By Polya (1985), problem solving as an attempt to find a way out of the difficulties in order to achieve a goal that is not so easy right away to be reached, while according Utari (in Hamsah 2003, 24), problem solving may be creating new ideas, find techniques or a new product. Even in the learning of mathematics, besides problem solving has a special meaning is different interpretation, for example solving the story problem that is not routine and apply math in everyday life. Polya (1985) proposed a four-step problem-solving phase to understand the problem, plan the problem, solve the problem and look back.

a. Problem Solving Process According to Polya (1985).

The problem-solving steps according to Polya (1985) are as follows

a. Understanding the Problem

To be able to understand a problem that must be done is to understand the language or terms used in the community, to formulate what is known, what is being asked

b. Plan Problems

To plan for problem solving we can look for the possibilities that could happen ever solved a problem that has a similar pattern to the problem to be solved.

c. Implement the Plan

This step is easier than solving plan, which must be done is run a strategy that has been made with diligence and thoroughness to get a settlement.

d. Looking Back

Activities in this step is to analyze and evaluate the strategies and the results obtained correctly, the strategy created can be used to solve similar problems.

Methodology

The type of this research is descriptive research in quantitative and qualitative. Research subjects at this research is all students of class VIID SMP Negeri 1 Ngaglik which amounted to twenty five students. This research was conducted at SMP Negeri 1 Ngaglik. This study was conducted in April for the second semester of the academic 2015/2016. Data Collection Technique are observation, giving questionnaire, written test, student activity sheets, and documentation. Data analysis technique are data analysis implementation of learning process plan (RPP), analysis of interest-learning questionnaires

Results and Discussion

A. Initial Observation Declaration of Research

Before the research activities carried out, the researchers conducted interviews with teachers on mathematics teaching methods in class. Teaching methods that teachers teach using lecture methods and student conditions during the learning process are very active. Based on the results of observation before the researchers do direct research is the ideal learning process because students are active during the learning process and students can dig information they do not understand by the process of signing answer. Once the researchers conducted observations, the researchers will use realistic

mathematics teaching methods in class VIID with the matter "Wake flat rectangular Rectangular and square". The number of students in class VIID twenty five students are still actively participates in education in SMP Negeri 1 Ngaglik.

Researchers conducted a study in class and took this VIID some random sample of ten students that they prefer the realistic mathematics teaching methods because they think mathematics is learned has to do with everyday life. During the learning process, the students are more understanding and able to solve the problems that the teacher gives. But we as students realize that we do not like theory too much

B. Constraints in Research

Investigators before research experience barriers within the limitations of a book entitled realistic mathematics education because of the limitations of books in the library is very little variance that researchers take resources from various journals that have been studied and used by other researchers. Both researchers experienced obstacles about permission to retrieve data in SMP Negeri 1 Ngaglik because they have to take care of a letter of permission through the Education Ministry Sleman. The three researchers experience obstacles when doing the preparation of the material because researchers must really understand the concept of learning materials rectangular field, especially rectangular and square. The four researchers must be patient while doing data retrieval because most of the students who have different character and must explain clearly the concept of rectangular subject matter.

C. Worksheets Two

Indicator one based on the results of student work then obtained learning results:

1. 20 students say length $AB = 3$ cm, because length $AB =$ length of CD

2. 3 students say length $AB = 3$ cm, because length $AB =$ length of CD is the same length
3. 2 students say length $AB = 3$ cm

Expected conclusion student is the length of $AB = CD = 3$ cm long, since $ABCD$ is a square. Consequently it has two pairs of same sides of length. So long $AB = CD$ length = 3 cm

So the conclusion about the number 1 is as many as 25 students have not been right to identify the properties - the nature of the square. One character is if there are two pairs of sides equal in length, the size of the two pairs of sides of the same length

Indicator 2 based on the results of student work then obtained learning results:

1. 20 students say the length of $BC = 3$ cm, because the length of $BC =$ length of AD
2. 3 students say the length of $BC = 3$ cm, because length $BC = AD$ length is the same length
3. 2 students say the length of $BC = 3$ cm

Expected conclusion student is the length of $BC = AD = 3$ cm long, since $ABCD$ is a square. As a result, two pairs of the same length. So long $BC = AD = 3$ cm long.

So the conclusion of the question number 2 is as many as 25 students have not been exact to identify the properties of the square. One character is if there are two pairs of sides of the same length, the size of the two pairs of sides of the same length

Indicator three based on the results of student work then obtained learning results:

1. 11 students say yes, at point E
2. 9 students say yes, because the AC line and the BD line intersect at point E
3. 3 students say yes, because it intersects at point E

The expected conclusion of the students is the ABCD rectangle with AC and BD are the two intersecting diagonals. As a result AC and BD are located at the E point of the second diagonal intersection. Thus the length of AC and the length of BD are the two diagonals that intersect at the midpoint call the point E

So the conclusion about the number 3 is as many as 23 students are not right to identify the properties - the nature of the square. One of its properties is if there are two diagonals intersecting at the midpoint of the second diagonal then the intersection of the two diagonals located at point E call the middle point

Conclusion

Based on the implementation of research on the application of realistic mathematical approach to the material field of rectangular field to the learning outcomes and interest in students in class VII D SMP Negeri 1 Ngaglik and the discussion obtained, it can be concluded as follows:

- Student learning result obtained from chapter four, the researcher can draw conclusion that twenty five students have been able to identify rectangular properties, but students have not been able to explain exactly one of the known rectangular properties. Twenty five students have been able to identify the properties of the square, but students have not been able to identify any of the known square properties.
- The difficulties students encounter on the rectangular flat matter with the PMR approach are the students confused to answer the exercise question about if the workings in which the sample examples are altered, the students find it difficult to cite the corresponding rectangular and square examples in daily life, students are still confused if to explain the results of his work with his friends.

Suggestions

1. Mathematics teacher at SMP Negeri 1 Ngaglik to be able to consider PMR approach as an alternative influence on students' learning outcomes and interests.
2. To other researchers who choose PMR approach model as an alternative influence to improve learning outcomes and student learning interest to always do research more optimally in learning mathematics either in different schools or different subject so that can see the influence of PMR approach to learning outcomes and interests student learning.

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THE ETHNOMATEMATICS ASPECTS OF BANJAR CULTURE IN BALANGAN DISTRICT OF SOUTH KALIMANTAN

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Abstract

Culture-based education has a vital role as an incentive for individuals and communities to achieve in all areas of life. The purpose of this research was to describe how mathematics exists in the culture of Banjar society. The subjects of this research was two resource persons who had deep knowledge about sociology and anthropology that exist in Balangan district. The object of this research is the ethnomatematics aspects found in the Banjar community. This research used qualitative research that was intended to explore the ethnomatematics found in Banjar culture. Data obtained from this research was in the form of interviews of Subject 1 and Subject 2. The results of the analysis showed that there are many material of mathematics that exist in Banjar culture, such as physical culture including some tools traditional agriculture and non-physical artefacts such as how to measure the land area and suggestions for further research that can be use to develop the etnomatematics that have discover into a mathematics learning package.

Keywords: ethnomatematics, Banjar society, culture.

Introduction

Curriculum 2013 aims to prepare Indonesian people to have the ability to be better live as individuals and citizens who are faithful, productive, creative, innovative, and affective and able to contribute to the life of society, nation, state, and world civilization. Education is rooted in the culture of the nation to build the life of the nation today and the future. This view makes the 2013 Curriculum developed based on the diverse Indonesian nation culture, directed to build a life of the present, and to build the foundation for a better nation life in the future

In its own learning Curriculum 2013 emphasizes the observation of concrete problems that are problems that can be imagined by students eg using examples of the environment in which they are located, of course every different place in Java and Kalimantan Island is of course different,

then should use culture which is in place so it becomes real for learners. Then to the semi-concrete here is a bridge between the real world and the world of mathematics, and finally the abstraction of the problem. Therefore mathematical concepts need to be taught by considering local aspects that develop in the community around the environment of learners.

Taking into account the surrounding environment or the local culture of the child resulting in assimilation between mathematics and their lives. The first step that needs to be done, and become the focus in this research is to explore - the investigation of elements of community culture that contains mathematical concepts. Exploration results will be used as a basis in the development of mathematics teaching materials.

Cultural values that are the basis of the character of the nation is an important thing to be instilled in every individual, for that the value of this culture should be instilled early on so that each individual can better understand, interpret, and appreciate and realize the importance of cultural values in carrying out every activity of life. Cultivation of cultural values can be done through the family environment, education, and within the community of course. Preservation of local culture and the development of national culture through education both formal and non-formal education, using all containers and educational activities. Education and culture is something that can not be separated in everyday life, because culture is a unified whole, prevails in a society and education are fundamental needed for every individual in society.

The inclusion of mathematics consciously or unconsciously into various aspects of life would be interesting to study, whether the study in economic, political, social, cultural, or other aspects. One of the interesting aspects studied is the cultural aspect. In human culture, mathematics generally penetrates into the culture but humans rarely realize that mathematics has penetrated their culture. Therefore, the study of mathematics in culture needs to be developed so as to give

an idea to the cultured society about the role of mathematics in its culture. Based on the description of the background of the problem then the problem posed in this research is what mathematics materials exist in the culture of Banjar community with the aim of Describe the mathematical material that exist in Banjar culture.

Theory

A. Banjar Society

The anthropologists, historians, and cultural of Banjars has disagree on the origin of the Banjar ethnic. According to Djantera Kawi (2011: 4), there are several opinions about the Banjar tribe. First, Banjar people come from mainland Southeast Asia. Secondly, Banjar people are native to the island of Borneo. However, there is a tendency to say that Banjar are ethnic Malayo-Polynesian, and the origin of Banjar people is from Champa (Thailand), Vietnam, Cambodia and Southeast Asia. They migrated to Kalimantan through several periods because the island is very sparsely populated and to seek fertile areas for agriculture, as well as to build a new government.

B. Culture

Soelaiman Soemardi & Selo Soemardjan (1964) explains that a culture is a fruit or a work of creation & sense of society. A culture does have a very close relationship with the existing developments in society. Lehman, Himstreet, and Batty (1996) define culture as a collection of some life experiences that exist in a particular group of people. Life experience in question can be a belief, behavior, and lifestyle of a community.

Parsudi Suparian (1999) says culture will base all behavior in society, because culture is a human knowledge that is entirely used to understand and understand the environment

& experience that happened to him. According Koentjaraningrat, (1985) also explains that the notion of culture is a system of ideas and feelings, an action and work produced by humans in the life of society, which made it his own by learning.

From some of these definitions, can be obtained understanding of culture is something that will affect the level of knowledge that includes ideas contained in the human mind, so as to create habits in everyday life, the culture is abstract. While the embodiment of culture is the objects created by humans as being cultured, in the form of behavior and objects that are real, such as patterns of behavior, language, equipment life, social organization, religion, art, etc. all of which are intended to help human beings in the life of society.

From the two definitions above it can be concluded that Banjar culture is a habit, behavior and way of thinking in everyday life and objects that are real in the community of Banjar and the work of the community itself such as cooking tools, agricultural equipment, buildings in particular that occupy the area of South Kalimantan.

C. Ethnomatics

The ethnomatmatic notion described by D'ambrosio in (Rosa & Orey, 2011: 35) says that "The term 'ethnomathematics' has been used by D'Ambrosio (1985) to mean" the mathematical practices of identifiable cultural groups and may be regarded as the study of mathematical ideas found in any culture ".

Ethnomathematics was introduced by D'Ambrosio, a Brazilian mathematician in 1977. Ethnomatmatic definitions by D'Ambrosio in ethnomatic terms are defined as: mathematics practiced among identified cultural groups such as national tribal societies,

labor groups, children of certain age groups and classes professional "(D'Ambrosio, 1985) .The definition of ethnomatematics has a broader sense of ethno (ethnic), then ethnomatematics is defined as a cultural anthropology of mathematics from mathematics and mathematics education. defined as maths practiced by cultural groups, such as urban and rural communities, labor groups, children of certain age groups, indigenous peoples, and others.

Methodology

The type of this research is qualitative descriptive research. The purpose of this study is to reveal facts, circumstances, phenomena, variables and circumstances that occur when the study goes and serve what it is. Qualitative descriptive research interprets and discloses data pertinent to the current situation, attitudes and views that occur in society, the contradictions of two or more circumstances, relationships between variables, differences between facts, the effect on a condition, and others. the problems studied and investigated by qualitative descriptive research refers to quantitative studies, comparative studies, and can also be a correlational study of one element along with other elements. Usually this research activities include data collection, data analysis, meginterpretasi data, and ends with a conclusion that refers to the analysis of the data. The purpose of qualitative research here is to construct a histotic complex picture, analyze words, report informant views in detail, and conduct studies in a natural setting.

The subject is two expert informants who know about the culture of Banjar community namely Yunita Fazarwati, S.Pd and Riska Damayanti, S.Pd. While the object in the research is the ethnomatematics that exist in the culture of banjar society. This research was conducted in Balangan Regency of South Kalimantan Province and development was done in Balangan Regency South Kalimantan Province in the Year 2016/2017.

The research instrument is a tool or facility used to collect data to make the work easier and the result is better in a more thorough, complete, and systematic meaning for easy processing, (Arikunto, 2006: 160). Instruments in this study include: The main instrument used in this study is the researcher itself so that researchers must be "validated". Validation of researchers, including; understanding of qualitative research methods, mastery of insight into the field under study, readiness of researchers to enter the object of research-both academically and logically (Sugiono, 2011); Observation, the purpose of observation is done, among others, by finding information about the aspects of ethnomatematics that have been found and then linking them to school learning; Questionnaires, questionnaires were given to the expert ie lecturers from mathematics education and math subject teachers (beta and product test). The data will illustrate in detail the quality of packets that are validated by the expert

Data collection methods used in this study about ethnomatematics in the culture of banjar society are: Observation, is one of the data collection techniques in any research including qualitative research, and used to obtain information or data as the purpose of research; Interviews conducted on two expert speakers from the banja community, here selected teacher of sociology and anthropology as an expert; Document Analysis, Document analysis method is also done to collect data in the form of ethnomatematic information that exist in banjar society culture. The meaning of the document here refers to books, articles, scientific papers, archives or other similar documents that may be used as supplementary informants as part of case studies where the main data source is participant observation or interview; Documentation, research results from observation will be more credible or reliable if supported photographs, writings, or works of the respondents who researched. However, the documents used must be documents that reflect the actual state of the document not made for a particular interest.

Data analysis techniques used in qualitative research focused on ethnography using inductive analysis. Inductive is the thought process that begins with one or several phenomena to make a conclusion (inference). Here all phenomena must be researched and evaluated before proceeding further into the inductive thinking process, the reasoning process also known as the scientific thinking process.

Results and Discussion

On 2003 of February, the Establishment of Balangan Regency in South Kalimantan Province. Broadly speaking Balangan Regency has two majority tribes, namely the tribe of Banjar and Dayak tribe. The Banjar tribe here is mostly Islamic, while the Dayak tribe has a diversity of trust evenly among them mostly embrace Christianity and Buddhism but among the elderly the election of religion is only as a formality in other words as a marker there is a belief in identity, can be called animism and the dynamism or religion of the ancestors or commonly called kaharingan religion. But now most of the young people have a lot of professed religions recognized in Indonesia in earnest, such as Buddhism and Hinduism.

A. Borongan: system on ground measurement

Square of area is a common unit used to declare land area in Banjar community especially “*Hulu Sungai*” area. The unit area is defined as 10 fathom $\times$ 10 fathom or 100 square depots. Based on the results of interviews with some people who know about the culture in Balangan District that the height $\approx$ length of human or with almost the same size. While one fathom is 170 cm or 1.7 meters in size based on the results of one fathom size interviews obtained from the size of people who are not too high and that is not too low in the area. This deal lasted for generations aims to equalize the size, because it is

feared that short-bodied people will lose money when buying land and people with high stakes benefit.

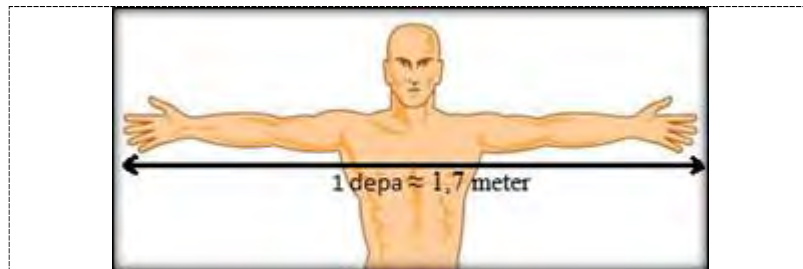


Figure 1. Simulation, comparison of one fathom with meter

So the conversion of one “borongan” into the international system is

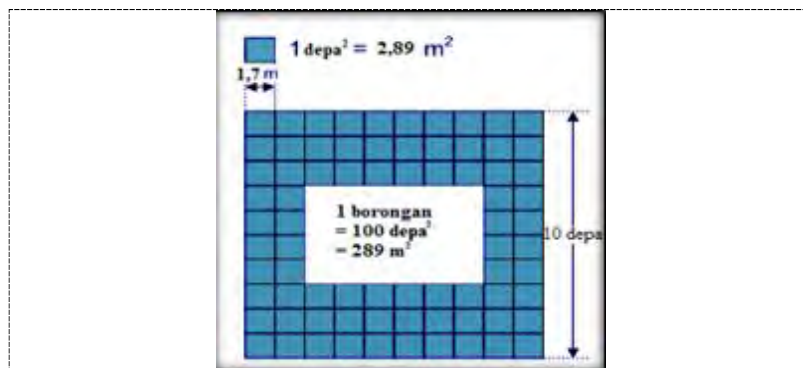


Figure 2. Conversion of one “borongan” into international system (meter)

Table 1.Wide comparison

Unit	International measurement system
1 fathom ²	2,89 m ²
1 borongan	289 m ²
35 borongan	1 ha dan 115 m ² atau 10.115 m ²

The hectare unit was more widely used in Indonesia than the square kilometers (km²) units to express the agrarian extent. Often one hectare of land in the Banjar community was agreed on 35 pieces of land. 1 ha ≈ 35 *borongan* .

B. Ethnomatics on “balogo” game

Balogo is one of the traditional game types of Banjar tribe in South Kalimantan. Balogo game name taken from the word logo, which is to play by using the logo tool. The game of Balogo was well known in 1980 to 2000, at that time almost every child knew it. This game is done by children up to teenagers and generally played by men with the number of players 2 to 6 people.

Logo made of coconut shell material with the size of the diameter of about 5-7 cm and thickness between 1-2 cm. The shape of this logo tool is diverse, there are shaped *bidawang* (river crabs), triangle, shape of kites, and leaves. In the game must be assisted by a tool called *panapak* or sometimes some areas have called it with *campa*, the sticks or hitters that are about 40 cm long with a width of 2 cm. The function of the *panapak* or *campa* for hit the logo to slide and knock down the logo of the opponent installed while playing.

This balogo game can be done one on one or team. If played in a team, then the number of players who "up" (who do the game) must be equal to the number of players who "pairs" (players whose logo is installed to be torn down) The number of team players at least 2 people and a maximum of 6 people. Thus the number of logos played as many as the number of players agreed in the game

How to install this logo is established lined back on transverse lines. Therefore the core of this balogo game is the skill of playing the logo in order to knock down the opponent's logo. The team that most can knock down the opponent's logo, they are the winners. As the end of the game, the losing party is required to hold the winning player.



Figure 3. Shape Logo



Figure 4. Shape of Logo Sticks (*Panapak*)

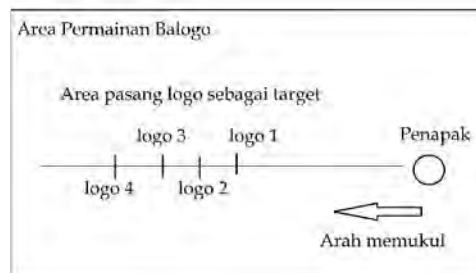


Figure 5. Balogo game area

The cultural values contained in the balogo game are skill, hard work, cooperation, and sportsmanship. Balogo games require special skills to knock down the logo of an opposing player. Then the cooperation is needed to knock down the opponent's logo, and the sportman gained from the losing player is required to hold the winning player because the rules are so.

C. Ethnomathematics on the hats (tanggui) Banjar society

In this section can be seen examples of typical hats Banjar community called Tanggui to protect from the sun light because in the southern part of Kalimantan the weather is quite hot and protect from rain. Can be seen on the hat has the concept of a circle. Tanggui is the traditional cap / head cap from Banjar Society.

Tanggui is usually used by farmers, farmers or peddlers selling on the river. The rigidity of the toll is no different from the hat is usually to protect the head from the scorching sun. The typical hat of this Banjar Society is a parabolic craft of woven *nipah* leaf. The nipah leaves are still young in the sun until wilted so strong, then formed into a parabola and given a booster on the edge. Nipah itself is a kind of palm (palma) that grows in the environment of mangrove forests or tridal areas.



Figure 6. tanggui



Figure 7. tanggui are used from the farmer

D. Nyiru

In this section can be seen the traditional handicrafts found in Malay culture including the culture of the Banjar community. "Nyiru" this tool is usually used as a winnowing rice to separate the good grain and less good. The winnowing tools also have the concept of a circle. There is little difference between nyiru in South Kalimantan and in Java, in Kalimantan which is used as a ring-shaped retainer is rattan wood, while many are found in Java using bamboo as well.

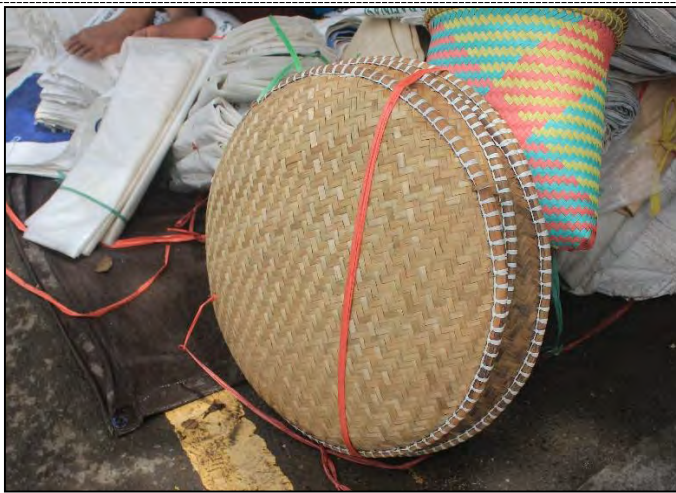


Figure 8. Nyiru

E. Bakul

Ethnomatics in Banjar culture are also found in traditional "bakul" tools, used by people in their daily lives. Bakul are usually used to harvest fruits are also used to harvest the results of rubber society. The process of making "bakul". Provide *purun* plant. And selected the leaves to be dried, selected a good plant to be used as a basket. weigh the plant as much as 1 kg. Flatten the plant by pounding. Giving color to taste. Weaving with lift method 2. Make a basket strap with lift method 2 and tidy it up. Sew the edges with rope rope to neatly.



Figure 9. Bakul

Tabel 3. Culture that suitable for learn material in the school

No	Culture	Mathematical Activity Culture	Matched Matter Material for scholl
1	"Borong" system on the sale and purchase of land	Memperkirakan ukuran tanah dengan menggunakan manusia Estimating the size of one fathom human depth	Comparison: Scale Rectangular: • Area and circumference

Comparison:			
2	Balogo game	-	Rectangular: • Kites
3	Tanggui	-	Circle
4	Nyiru	-	Circle
5	Bakul	-	Circle Tube

Conclusion

Based on the results of data analysis obtained from this study, it can be concluded that a lot of mathematical material that exist in the culture of banjar society, such as in the comparative material, rectangle, line and angle, wake up space, build side curved space, congruent, similarity, and circle. Ethnomatematics that is more expressed in this research is a physical ethnomatematics that is the traditional tools commonly used in the daily life of Banjar people, especially for farming and farming.

For school teachers especially in South Kalimantan area, it is suggested to use mathematic learning product that developed as one of mathematics learning which is expected to stimulate the process of solving mathematical problems especially the use of local culture. The implementation of mathematics learning in schools should always be tailored and based on the curriculum set by the Government, but taking into account the use of local culture as a learning context.

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THE IMPLEMENTATION OF PROGRAM BASED LEARNING (PBL) MODEL TO ENHANCE STUDENTS' MATHEMATICS LEARNING ACHIEVEMENT OF GRADE VII A SMP NEGERI 2 GODEAN

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Abstract

This research aims to describe the implementation of mathematics learning through Problem Based Learning (PBL) model dan to know which PBL model may enhance the students' achievement of mathematics learning for grade VII A of SMP Negeri 2 Godean. This is classroom action research through teacher collaboratively. The subject of the research was class VII A of SMP Negeri 2 Godean which consist of 32 students. The data collection were feasibility observation, interview, field note, documentation, pretest, and posttest. The analysis data was analyze descriptively.

The result of the research shows that the average percentage of cycle 1 of feasibility observation was 76.11% which categories good and the average percentage of cycle 2 was 95.56% which categories very good. In the pre observation the average percentage of students' achievement was 50% which categories low and in the cycle 1 was 71.87% which categories high. The problem shows that the average percentage have not fulfill the indicator of success yet which was 75%. By the problem, the research continued to the cycle 2 which the average percentage arise into 87.5% and consider as high criteria. Since the indicator of success of students' achievement fulfilled, so that the posttest is given to the students. The posttest result shows arise of percentage and become 90.62% consider as very high criteria. Based on the data, can be concluded that the implementation of mathematics learning using PBL model consider good and the students' achievement was increase.

Keywords: PBL, learning achievement.

Introduction

Education is the foundation which determine the strength and the progress of the country. Education obtained from formal way or non-formal way. One of formal education is school. School is educational institution which in charge to apply the learning process properly and optimally so that high quality education can be created. Huda (2013: 2) states that learning is the result of memory, cognition, and metacognition which influence to the comprehension, this

problem usually happens when someone is learning, and the condition usually happen in the daily life, because learning is the natural process of anyone. In the educational field, many sciences should be learned, which one of them is Mathematics subject. Shadiq (2013: 13) states that mathematics is a knowledge which discuss about pattern and regularity.

Based on the early observation in class VII A SMP Negeri 2 Godean, which obtained the condition view of students during the learning process of mathematics subject. During the learning process, when the exercise given to the students, there were some students who could not finish the given exercise since they could not understand the material well. It can be seen by the result score of daily exercise of some students which consider as lower from KKM, the score was below 70. From the 32 students of class VII A, there are 14 students which the percentage was 40% got score below KKM and 18 students which the percentage 60% got score above KKM. The lowest score in class VII A was 25 and the highest score was 100 with the average score was 68,75. It shows that the acievement of students in class VII A was low.

The low achievement of students' influenced by the less of student's activeness in learning mathematics, for example students tend to silence because of less confident to ask to the teacher because they did not understand the material. In the other hand, the condition of the learners still lacks of condusive because of the learning activity still dominated by teacher so that the learning activity in class is passive. The students tend to memories the formula than understand the concept of the given material. It can be seen from the learning process in class while teacher change the question form, students could not finish the given question.

The condition of the learners which less of condusive make the learning process become ineffective. It can be seen from the students which not focus when teacher explain and teacher do not involve the students in the learning process. Based on the problem, can be assumed that

students of class VII A of SMP Negeri 2 Godean is one of class which the learning achievement still under the KKM. Therefore, it is needed to implement the learning model which can increase the students' learning achievement of class VII A of SMP Negeri 2 Godean.

One of model which can increase the students' learning achievement is Problem Based Learning (PBL). Tan (Sulistyarini. M.M, & Santoso. F.G.I, 2015: 60) Problem Based Learning is the use of intelligence variety which need to confrontate to the chance of real world, the ability to facing the new variety and complex. The specific characteristics of PBL model is the learning process started from giving problem in a real life as a learning context to learn about critical thinking and the skill to solving problem, and to get knowledge and essential concept from learning material.

From the above description, the researchers to conduct research on " the implementation of program based learning (pbl) model to enhance students' mathematics learning achievement of grade VII A SMP Negeri 2 Godean" which aims to describe the implementation of learning mathematics through *Problem Based Learning* (PBL) model, to enhance students' learning mathematics achievement of class VII A SMP Negeri 2 Godean and to know whether the *Problem Based Learning* (PBL) model in learning mathematics can enhance students' learning mathematics achievement of class VII A SMP Negeri 2 Godean.

Literature

Barrow (Anwar, 2017: 357), PBL is learning which created from investigation, understanding *learning*, dan give solution from some problems. Thus, the principle of PBL is authentic solving problem. The main problem which bring to the class is starting with stimulus and main

framework of learning process. In PBL model, the students stimulated the skill to solve the problem effectively which in the future may useful in the real world.

Oon Seng Tan (Fathurrohman, 2015: 115) states that problem based learning have characteristics, namely:

1. Learning started by a problem.
2. Making sure which given problem related with real world of the students or integrated with the concept and the problem in the real world.
3. Organizing the subject in problem field, not in exact discipline field.
4. Giving big responsible to the learners in order to make and runs directly to the learning process of theirs.
5. Using small group.
6. Charging the learners to demonstrate which they have learnt in the form of product or work.

It may create the skill of the learner. Thus, the skill learned to the learners.

Problem Based Learning consist of five main phases which start from the learner introduction with some problem situation and finished with presentation and work result analysis of the learners. Briefly, the five phases of PBL model in the table as follows:

Table 1. Problem-Based Learning Syntax

Phase	Teacher Activity
Phase 1 Provides an orientation about the problem to the students	Teachers discuss learning objectives, describing important logistical needs, and motivating students to engage in problem-solving activities.
Phase 2 Organize students to do research	Teachers help students to define and organize learning tasks related to the problem.
Phase 3 Assisting independent and group investigations	Teachers encourage students to get the right information, carry out experiments and seek explanations and solutions.
Phase 4 Develop and present artefacts and exhibits	Assist students in planning and preparing appropriate artefacts (works) such as reports, models, and helping them to pass them on to others.

Phase 5 Analyze and evaluate the process solving problem	Helps students to reflect on or evaluate their investigations and the processes they use

Source: Richard I (Arends, 2008: 57)

Based on some notion has described, it can be concluded that *Problem Based Learning* is a learning model which based on the principle that the issue (*problem*) is used to enable students to acquire new knowledge and develop the knowledge that has been acquired so that students are more active in the learning process as well as encourage students to be more creative in solving problems faced.

Methodology

The type of the research is *Classroom Action Research* (CAR) and conducted collaboratively which use Tagart and Kemmis research model. This research was conducted in SMP Negeri 2 Godean in class VII A second semester II in January-February of 2014/2015. Subjects in the study were students of class VII SMP Negeri 2 Godean A, while the object of the research is to improve the students' learning mathematics achievement using *Problem Based Learning* (PBL) model. The research design as follows:

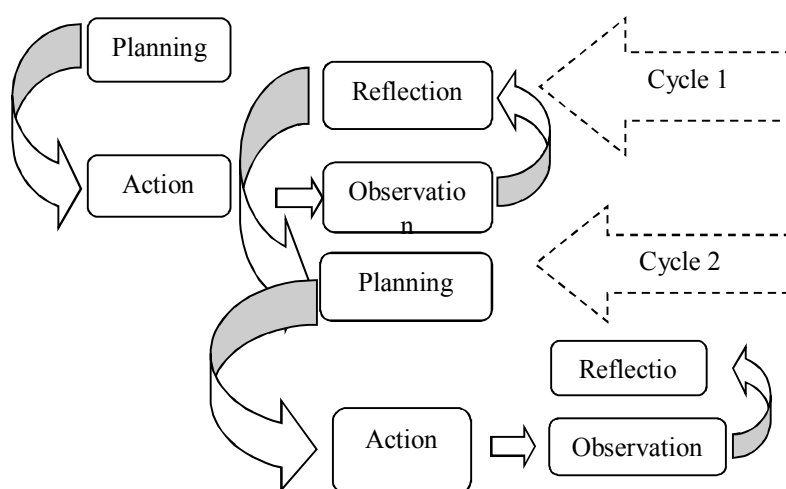


Figure 1. The Cycle of Study Design

The instrument of the study is the Student Worksheet (LKS), feasibility observation sheet, about the *pretest*, *posttest* questions, interviews, field notes and documentation. While the method of data collection were observation, written test (worksheet of *pretest*, *posttest* and LKS), unstructured interviews, documentation, and field notes.

The data analysis which used is descriptive qualitative data analysis. The data which obtained in this study are observational data about the learning process, interviews and daily reports. Additional data which obtained is unstructured interviews with students and photos documentation as consideration. The data analyzed is data of observation result of learning implementation and test result.

Findings And Discussion

The research was conducted in January 9, 2016 to January 27, 2016. The research consisted of two cycles. Each cycle held in 2 meetings which the time allocation for each meeting was 3 x 40 minutes. The implementation of the classroom action research in cycle 1 and cycle 2 consists of four phases: planning, implementation, observation and reflection as follows:

The researcher helped by observer observed the learning process in class using arranged observation sheet. The result of analysis observation through *Problem Based Learning* (PBL) on cycle I and cycle II..

Table 2. Analysis Observations Learning Mathematics Cycle 1 and Cycle II

Cycle	Meeting	Percentage	Qualification
I.	1	74.44%	Good
	2	77.78%	Good
	Average	76.11%	Good
II	1	95.56%	Very good
	2	96.56%	Very good
	Average	95.56%	Very good

At the second meeting held Cycle Test 1. Based on the result test on cycle 1, students who achieve a minimum completeness criteria (KKM) there are 23 students or 71.88% of the total students. The explanation is in a form of table as follow.

Table 3. The Percentage of Students' Learning Mathematics Achievement in the Cycle I

No	Description	Results
1	The highest score	100
2	The lowest value	55
3	Average value	79.69

The result of student achievement is arranged to know student's mathematics learning achievement in every cycle and the average development of student achievement. Here is presented a graph of Pre completeness of Value Test, Cycle I, Cycle II, and Post Test.

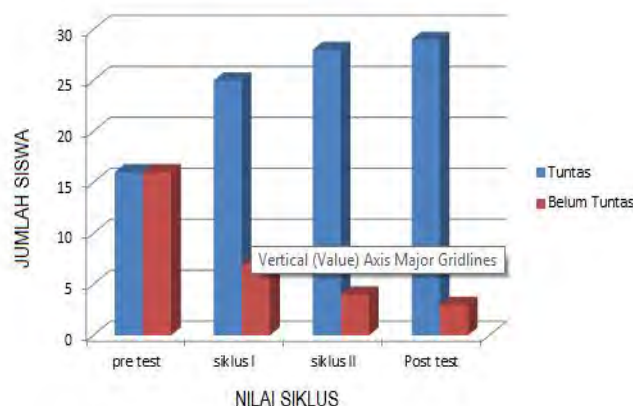


Figure 2. Graph completeness of Value *pretest*, Cycle 1, Cycle 2, and *the Posttest*

Overall, the research run well. In each cycle, every phase of action of learning mathematics through *Problem Based Learning* (PBL) model conducted by teacher in a proper way. Yet, the action of cycle 1 still have lack and need to be improved, namely:

1. Teacher have not give apercption, informed the learning model, and deliverd the main material on the next meeting.

2. Some group which discuss do not involve all of the member, because during the discussion there are some students chatted with other which the topic is out of the given material from LKS.
3. Teacher have not optimal in giving direction to the students especially in directing of using LKS, there are some group which do not fill all of the answer which part of instruction and or direction of LKS.
4. Teacher have not created a good interaction for students, it can be seen from some students which not confident while asked to ask about the material which do not understood, and when teacher asked to come to the front to give presentation of the result of the discussion

The implementation of cycle 1 still lack so that need to be improved on the cycle 2. In the cycle 2 it improved, as follow:

1. Teacher explained the model learning which implemented before on the cycle 1 which have been delivered. Teacher do emphasize the main topic which have been learnt to the next meeting. There is one-point observation which have been delivered which is teacher do not give exercise in the end of the meeting.
2. Overall, the group discussion has involved all of the member in learn and do the LKS and given exercise so that the students' interaction run well.
3. Teacher give direction to the student especially in direct using the LKS, every group able to finish the exercise easily on the LKS.
4. Teacher have make a good interaction, it can be seen from the confident of the students when asked to give question about the material which do not understood, and while asked to come to the front to give presentation of the discussion result.

CONCLUSION

Based on the result of the research and the discussion of classroom action research, it can be concluded that the mathematics learning process through *Problem Based Learning* (PBL) model may improve the students' mathematics achievement of class VII A of SMP Negeri 2 Godean. In order to pick the material which used *Problem Based Learning* (PBL) model it better to related it with familiar fact so that the implementation through problem may be found in the daily life and make it easy to be understood by the student. Through *Problem Based Learning* (PBL) model is expected have interaction and those interactions to discuss the learning material so that it is needed to have optimal supervise.

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TRANSFORMATION ON TEACHING AS A COMPETENCE DEVELOPMENT OPPORTUNITIES OF PROFESSIONAL TEACHERS

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Abstract

This article discusses the research results of the action transformation in teaching which are performed as one of the active processes of the teachers' competence development. The practice concept of action transformation become the main topic. The contents cover the results analysis of the exploratory research findings on previous experiments on the learning development in the device for the first levels school in the city of Semarang, on teaching texts that have been used in the document, the result teaching, result documentation close to the teaching and performance of teachers. The Introduction based on the fact and the existence of environmental students elements. That could be the great support for the action of teachers and professional knowledge to transforms the teaching way, product performance certification, as well as knowledge of learning. The purpose of the discussion is the concept of transformative teaching practices that are effective in the professional development of teachers from the perspective of competence. The study used methods are a mix, i.e. exploratory descriptive literature based descriptive qualitative approach. Results obtained are transformation on teaching in teacher action could be inserted in four competency standard is a new aspect in the development of an effective competence.

Keywords: *Transformative Teaching, professional development, teacher.*

Introduction

A fundamental understanding of the process of teaching in this discussion related to competence, achievement of goals, and utilization of the environmental aspects of the students to the maximum. The equitable utilization activity much done in education in Indonesia, especially in the city of Semarang, Central Java. The city is one of the cities with the number of junior high school (Middle School), and most certainly has many processes have been completed. The teaching process is said to be proper if the learning objectives are achieved and accompanied with good results. Creativity, innovation, strategy, methods, models, techniques, and materials applied to teachers during the learning process takes place serves as a door opener the key to

achieving completely. One implementation to realize it was the promulgation of regulations in the year 2007 number 18 Regulation Of The Minister Of National Education regarding teacher certification requires competence principal teacher professional size limits include the form of academic qualification, education and training, experience, planning and implementation, assessment, achievement, development, liveliness, and the existence of a form recognition awards. Teacher certification, however, is only one of the legal professional. Product performance is dynamic into the legality and are sustainable. It is still the homework the teachers, education provider (Kartowagiran, 2011).

The performance cannot be understood only as the results of product or accomplishment. Performance relates to adaptability and sustainable development actions. Dynamic benchmark not only academic qualifications based on sheets of legality. Education and training includes not only intense fields. The experience is also not measured only by time, as well as the planning and implementation of learning not only upon the completion of teaching hour's fulfillment. The results of teaching practice documentation obtained through observation shows all the benchmark is still limited. The teacher certification program aims at achieving a top limit on the performance of teachers, in fact still face many constraints (Murwati, 2013). It is based on the results of the research data suggesting that certification influence on motivation and performance only reach less than 70%. Professional size components are not balanced with textual practices.

One of the obstacles seem real, based on survey results on the changes of the statutes the use of curriculum in teaching is the emergence of a lot of empty space that also have an impact on locked performance development teacher. Focus teacher mapped on controlling the implementation of the task and the level of mastery, rather than on development. Obstacles arise from the events which resulted in take the performance of teachers for extra focus on time

management, strategy, and understanding the fulfillment of targets that impact on the application in practice (Retnawati, 2015). One of the obstacles seem real, based on the results of a survey on the changes of the statutes the use of curriculum in teaching is the emergence of a lot of empty space that also have an impact on locked performance development teacher. Focus teacher mapped on controlling the implementation of the task and the level of mastery, rather than on development. Obstacles arise from the events which resulted in take the performance of teachers for extra focus on time management, strategy, and understanding the fulfillment of targets that impact on the application in practice.

Theory

A. Transformative Teaching

Teaching activity not only in the form of the granting of information and knowledge on learner. The learning process must also be able to accommodate other elements in addition to the subject matter. As with any competence on the mastery of the lesson or other elements in addition to the information and knowledge presented, as well as the results of test mastery of the knowledge and information. In this regard, activities and teaching process is meeting the needs of students accompanied by a belief in spiritual and social viewpoint that leads to the end product in the form of the potential (Rosebrough & Leverett, 2011, p. 15). Understanding in a general form of teaching activities performed by the teacher to the students in the form of interaction that involves three basic components, namely teachers, the process of delivering the thing being taught, and learners. In addition, the teaching is also a sustainable activity, in the form of adaptive process, so the range and type of teaching followed the developments that continue running and always dynamic as a fulfillment of the demands. Teaching is also a process

of understanding with conceptual support structure, inferential bridge, comes the explanation, has the focus, all of which is a conscious process in certain situations or in different situations need to be equipped with special and general strategy for can always adapt (Newton, 2000, p. 67).

Dynamic activity in the class being one indicator as good teaching. It is supported by the four elements of elements (Bhatt, 2002, pp. 25-47), namely the attitudes that affect interpersonal phenomenon classes, psychology teacher education, psychology students, and predictive action to changes in class from time to time and on an ongoing basis. In this context it appears significantly, so it can be assumed the existence of a process of transformations are smooth. The fundamental things that can be understood in a transformative teaching is the existence of a relevance between study and other things outside of the learning that can cause a change as a way. Two things are fundamental in the transformative teaching is teaching with relevant concepts and relevant strategies (Rosebrough & Leverett, 2011). The first thing, the activity of which is done is inspire students or learners, incorporating the role of a teacher as a role of the entire teacher, teaching all students, and focus your learning on the students.

The second thing is how to teach with the relevant strategy. This includes understanding the concept that teaching is done for the occurrence of a learning process, find out how the student learns, and teaches students how to learn something. Thus, the teaching of transformative relates to how to teach which is when the learning process takes place that leads to action. The process is a set of ways of learning and teaching approach on student culture (nature) that is able to detect the level of student participation (Gutiérrez & Rogoff, 2003, p. 23).

Provide inspiration to the students can be done by implementing the transformational model of pedagogy, reflective of the goals to be achieved, is dynamic between teachers with students, are giving a way out, and synergize. He foregoing shows that concern for the students in the process of teaching is the main, and the value of the value of the development of the students become the thing that means due to take precedence. Students can be found through the range of alternative ways of approaching teaching with reality (Rodriguez, 2008, p. 351). Next is to clarify the role of the teacher to the students with the understanding that all teachers have the same role. Cooperation between teachers with another teacher who was his. In the process of teaching, teachers do not focus on just one of the students, but all students equally. Thus, the process of transformation into a teaching activity centered on the student, not the teacher, though moving on from parts of the world as a teacher knowledge.

The next step is to determine which strategies are relevant for students. To be able to determine strategy, focused thing is building the understanding that teaching should be a process undertaken by the students, knowing the methods and ways students can create a whole process, positioning the teacher as instructor, as well as developing knowledge of students through the stimulation of questions about things outside of the relevant subject matter. The entire process of building the transformative nature of the events that took place during the process.

B. The Competence of Teachers and Prospective Teachers

The position of teacher in a learning process is important. It does not relate to what is controlled by the teacher, but relates to how teachers master the methods in presenting it lands. Competence relates to the fundamental character of an individual. In the context of

this discussion are teachers and prospective teachers. Competencies related to effective performance an experts. Thus, for teachers or prospective teachers, to be able to run the task with good results and based on performance as an effective teacher. A teacher said to be successful if he managed to steer and guide their students acquire knowledge in their processes and achieve learning objectives. As with any law-related competencies of teachers who practiced in Indonesia. The teacher (Article 8 of law No. 14 of year 2005) is a professional workforce that has the standard feasibility and competencies is one of them. The task of the teacher (article 1 of law No. 14 of year 2005) is to be a professional education that is able to educate, teaching guide, direct, and train, assess, and evaluate the participants of his protégé. It is enhanced with teacher competence (article 10 paragraph 1 of the law No. 14 in 2005) which came into force, consisting of pedagogic competence, personality, social, and professional. All such statements are the basis of the administrative practice of the teacher.

The competence of teachers and prospective teachers from the viewpoint of practice is the success of the process. Things will be found the teacher was the situation and conditions of which are contextual. Teaching means ignore the changes happening. Competent in teaching means being able to realize a range of understanding and the understanding of the teaching activity by Peter Jarvis (2006) that teaching has an extensive sense. teaching activities are conducted to provide systematic information to someone, done in a professional, establishing the possibility for someone to do something through the training process, serves as a medium of communication, the agent, as well as examples of givers can also be understood as an activity to give consideration to someone with a choice of doing or not doing. Changes to become one of the indicator. One of the

facts it needs variety in teaching is the emergence of various kinds of teaching, increasing the function of teaching, and increase the magnitude of the teaching team in one part of the lesson. The other condition is the changing nature of naturally from things that are taught.

The presence of worries on the truth of knowledge within the span of time is the trigger for the existence of the teaching. Thus, a similar thing also can occur in the character of the students being taught. Back in elementary teaching, i.e. focusing on the students. All of these are associated with the level of readiness of the teacher who in the end came to the professionalization of teaching to teachers. Such conditions that the accompanying demands on competence that should be possessed by the teachers, both of which have been based as teachers or prospective teachers.

Methodology

This type of analysis conducted is exploratory descriptive literature. In this case the exploratory research is done to diagnose the situation of teaching by the teacher as the basis for doing detection against problems that appear related to the teaching. The results of the screening used to identify procedural not thing that happens in the process of teaching. As a statement of Marshal and Rossman (1999) that qualitative research in exploratory research offers the opportunity to be able to seek deep understanding towards the focus that is examined and the nature of the assumptions to be studied further (Best & Kahn, 2006, p. 247). The result was all triggers the discovery of new ideas that are positioned as a hypothesis. Descriptive research approach is carried out as a form of qualitative study cases. The object of exploration in the form of literature in the form of text documents and documentation of the results of the practice. The

entire literature has a limit on the process of teaching, teaching activity, both in terms of relevant education in junior high school levels.

Research conducted in the city of Semarang, Central Java, Indonesia. Instrument data acquisition using observation, observation, interviews, and documentation document. Data acquisition techniques in the form of observation, interview, observation passively on the activity and the process of teaching, analysis of documents and documentation literature and factual text. Overall the data obtained through that process is analyzed with a description of the analysis techniques. Research results and findings is an analogy to the fact is logically based on the basic concepts that are referenced.

Result and Discussion

Research results and discussion covers three things, namely 1) teaching in junior high school in the city of Semarang, Central Java, Indonesia; 2) competency and performance of teachers in fulfilling the needs of the students; as well as 3) transformative teaching practice concept as an effort of competence development of teachers and prospective teachers are professionals. It is the third acquisition for the results of the research are addressed on an ongoing basis and directs the hypothesis on the assumption, that the teaching of transformative action in developing the competence of teachers and prospective teachers of professional.

Teaching in junior high school in the city of Semarang using three types of curricula that apply in sequence they appear and eventually be used simultaneously in objects of different learners. Three types of curriculum is a curriculum unit level education (KTSP), curriculum-based scientific learning, 2013, and 2013 Edition of curriculum revisions, namely strengthening the integration-based learning, character education in learning (religious, nationalist, self-help, mutual, and integrity), integrating the creative attitude to build literacy, critical thinking,

collaborative and communicative, as well as the integration of higher order thinking skills. Accepting these conditions, many in some private schools and the curriculum apply to a group of students in class and different levels. On the first level of the class applied curriculum 2013 revised edition the year 2017, at the second level classes curriculum is applied to 2013, and at the third grade level curriculum unit of applied education.

The purpose of the teaching of each type of used curriculum leads to one product, namely the success of students and improving the competence of teachers and prospective teachers become more professional. The use of book electronic school curriculum unit as a supporter of education, and one packet of Guidebook for teachers and students on the curriculum of 2013 is the process of transition that time-consuming teacher in terms of mastery of the material, the understanding, and a search strategy in each process of teaching that he did. Strong factor of occurrence of such matters is the existence of a minimal basic benchmark which does not open the opportunity for teachers to do improvisational in the process. Emphasis on provisions improvisation presented as the preparation stage, not on the process. Change, flexibility, and deals with the pre pressure of teaching. Exploration on the device to be used in implementing the educational process on 2013 curriculum find space improvisations for teachers who are still vague. It is found after going through the process of analysis of the content and use of the practice of observation devices in the teaching process. Teachers are advised to seek additional learning resources in the context of the same theme, but the composition of the contents of the learning resources that are already available in the book did not leave time for teachers to take up space to convey the results of his acquisition. It is inferred based on the analysis of the composition of the contents by the time duration ranges are available. Similar findings were obtained from many sources of information practitioners, i.e. teacher educators.

The characteristics of children age 11-15 years tends to be imitative (Arthur, 2003), so the dominance element of practicality, intelligence, sensitivity, and choose for the benefit of himself only as acceptable reception by the logic of their thinking. Teaching with the previously mentioned processes indirectly impact close to the students. the real impact that appear, based on observations at some schools is, there was an atmosphere of monotonous, not excited in learning, as well as numerous actions in the classroom that add to the response of teachers outside the draft study. The nature of the device universal learning not to approach students on understanding their basic logic to know, learn, know, or are interested in digging further. These conditions also restrict the space motion of teachers when faced with limited teacher competency levels.

The performance of the teachers affected awareness on its own competence. As well as the legitimacy of competence (which is known by the term certification) is not only measured up to the limits of the document. Application practice of teachers in teaching basic amplifier should be made sustainable competence. The limitations of space and the development of competence teacher led outcomes and close student learning has become limited. Students need deeper knowledge to the emergence of initiatives to further his knowledge. Development opportunities for teachers need to be performed on a task, i.e. alleviation travel teaching. Thus, professional educators are able to educate students about how to develop your potential. Experience the success of teachers in developing the potential of him will be teaching, guidance, direction, and the process of exercises for students. The assessment does not appear only in one direction, but coming from both directions, i.e. teachers and students.

Pedagogic competence at demanding teachers some ability as an indicator. Teachers are capable of mastering the characteristics of the learners if mastered the knowledge of the

environment students. Teachers are able to be master learning theory and principles of learning which educate if teachers have gone through the process of deepening of knowledge about it. Teachers are able to develop the curriculum if the teachers have gone through the stage of analysis of the curriculum and finding it wanting to refine. Teachers are able to carry out the activity of learning to educate if teachers had to complete the selection process on learning that will be implemented. Teachers are able to develop the potential of students if the teachers have found the side of the potential students through analysis of the focus. Teachers are able to communicate with learners and do an assessment and evaluation if the teacher has done a proper indicator analysis. All of these are the basis of that achievement of competence for professional teachers need space for their processes and are sustainable. Performance measurement does not have limits for concentrations of the profession as a teacher. Performance measures based on there and whether the change is increasing which is dynamic

The process of developing competence for teachers and prospective teachers professional is always bound to be a teaching activity basic tasks. The giving of information and knowledge on learner includes actions to accommodate other elements relating to taught, or anything outside of teaching can and has relevance. Such action requires the analysis and consideration of the right of way to be able to bring together the two components (the major component in the form of basic things are taught and the supporting components in the form of other things that are able to develop the process of teaching). Learner needs analysis can be done by way of discovering the learners confidence in social and spiritual point of view on the students. As previously communicated by Rosebrough and Leverett (2011). Find these findings impact on the appropriate corresponding teaching strategies learners' character. In the teaching practice of knowing and mastering learning materials needed by students.

In that phase, the teacher can determine the right learning resources to be able to accommodate the appropriate lesson material with students. It is able to reach the motivation, effectiveness of implementation time, building the right analogy, as well as knowledge of applicative to learners. As well as being performed in teaching for students who live in the city of Semarang. Learning resources that have a closeness with students culturally motivated students to explore personal experience into learning spaces. The proximity of the object analogy helps students to more easily understand and have an impact on the duration of the alleviation process learning. As a simple example in learning to write short stories of heroism, the students more easily build character comes from its territory than from abroad. The application of the concept can be seen in the following image.

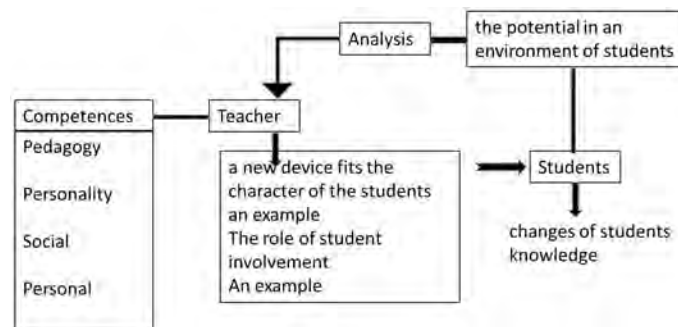


Figure 1. The application concept of transformative teaching

The process of teaching not only refers to the basic curriculum has been established universally. There is a process of analysis of the context between the regular teaching concept with the ability, the character of the environment, the context of the needs of the students, as well as the Mission of the locality. Thus, a device that has become a staple reference available with the process of balancing the composition and essence that is able to accommodate such things. Orientation as a preliminary activity in the learning process acts as an exploration of the teacher against a potential excavation there in the environment students or learners. Capping the transformation refers to the understanding of the activities and processes of teaching to meet the

needs of students who have been adapted with coverage of the existence of social and spiritual perspective that leads to the end product in the form of the potential (Rosebrough & Leverett, 2011, p. 15). Activity based teaching and culminate in students.

Pedagogic competence teachers consisting of the ability in mastering the character of learners, learning theory and principle, removing deprecated against curriculum used, performing educational learning, giving odds on learners, communicate actively, as well as conducting assessment and evaluation have been through the process of the transformation of specialized teaching and learning. For high school students first in Semarang city, studying with the essence of material relevant to the culture, the culture, the diversity of the community in the city of Semarang provides greater imitation attitude was instrumental in the development of knowledge. Scientific learning activities and enquiries can take place not only in classrooms. Post process of learning students are still able to continue deepening their knowledge of the environment after the class. Thus, teachers have been able to provide a way for students to develop its potential. Teacher communication with students can be continued on the next stages of teaching. Thus a form of interpolation in the pedagogic competence of teachers form orientation and activity development based on environment and initial conditions of students.

Teaching as a process of understanding with conceptual support structure, bridge inferential, comes the explanation, has the focus, all of which is a conscious process in certain situations or in different situations need to be equipped with special and general strategy for can always adapt (Newton, 2000, p. 67). The action of the transformation of teaching by the teacher in pedagogic competence can build the ability of pedagogic in students through a dynamic process. Dynamic activity in the class being one indicator as good teaching. The four elements of elements (Bhatt, 2002, pp. 25-47) the form of the existence of attitudes that affect interpersonal teacher new

activity on students inside and outside the classroom, learning appropriate conditions of psychology students as a form of practice teachers who educated, appropriate learning practices psychology students, and predictive action to changes in class awakened simultaneously with the process of developing professional teacher competence.

Teaching that contain elements of high relevance, conceptually, as well as strategies that focus (Rosebrough & Leverett, 2011) build an ideal transformation process. Environment students provide inspiration for students to be able to adapt to potential opportunities in their environment through the packaging concept of teachers. Practice of application of knowledge gained as a result of students learning nothing can return proved in practice and the impact on the currency of the logic. Teacher instrumental rendition brought back knowledge to students as knowledge has evolved. School environment as well as the system put in place to determine whether or not there is and the potential for teachers to develop their competency to become professional teachers. Thus, the action of the transformation performed by the teacher on an individual basis in accordance with the conditions of the students special educated. However the concept built in system can build a conducive school activity patterns. So if a teacher incorporate the role of a teacher as a role of the entire teacher, teaching all students, and a focus on student learning, action teaching transformation become routine staple.

One example of teaching with a relevant strategy is to provide a space for students to be able to present the potential of the surrounding environment. Understanding the concept of building a learning lesson, find out how the student learns, teaches students how to learn something, and teaching by asking questions. Thus, the teaching of transformative relates to how to teach which is when the learning process takes place that leads to action. Provide inspiration to the students can be done by presenting the relevant external element in support of the implementation of the

transformational model of pedagogy, reflective of the goals to be achieved, is dynamic between teachers with. The foregoing shows that concern for the students in the process of teaching is the main, and the value of the value of the development of the students become the thing that means due to take precedence. To be able to determine strategy, focused thing is building the understanding that teaching should be a process undertaken by the students, knowing the methods and ways students can create a whole process, positioning the teacher as instructor, as well as developing knowledge of students through the stimulation of questions about things outside the subject matter relevant to the middle of the learned in the classroom. The entire process of building the transformative nature of events during the process of the teaching takes place. As in the illustration in the picture below:

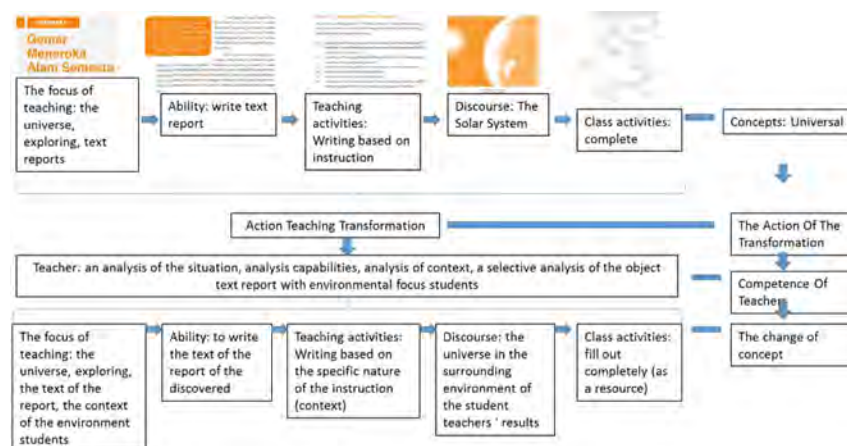


Figure 2. Transformative teaching in class

Change the concept of teaching universal contextual actions require action to become teachers in transforming the material components of the knowledge that was originally in the form of inquiry and scientific activity on the object data activity becomes unbounded actively sourced from students with teacher modelling and new stimulus then proceed with the activity of scientific and inquiry by the students. Significant differences in the object of the intended, broader, diverse, and easily affordable student competency development process when done.

This data as supporting transformative application description on the learning process here is the comparison of the changes in the ability of the two different study groups.

Comparison of the ability of the results of the study without the transformative process					
Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	post tes	62.07	30	4.215	.769
	pre tes	59.80	30	3.917	.715

Comparison of the ability of the results of the study with the transformative process					
Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	post tes	72.10	30	3.234	.590
	pre tes	66.22	30	3.062	.559

Figure 3. A comparative statistical analysis of data changes on the ability of the learners

The thing that made the basic considerations about the positive opportunities against the implementation of transformative action in teaching support teacher professional development opportunities in terms of the achievement of the learning results of aspects on improving the ability of the learners. Action teaching transformation of open space development competence of teachers that can be inserted in the circuit implementation of universal teaching.

Conclusion

The results of the exploratory analysis produced some conclusions that relate to changes to the concepts in action, the development of teaching competence of teachers, and performance improvement opportunities room teachers and prospective teachers of professional. The summary is 1) development professional teachers and prospective teachers can be placed as inserts in between the competence of the teacher who is already determined before, and not only on the results of the target product shoreless, 2) action of the teaching of transformation can be used as a system of practices in all subjects and all teachers, teacher competency development 3)

can take place simultaneously with the process of alleviation task systematically, 4) competency development done on teachers can apply to coverage of the student and is dynamic.

Action in the process of transformation of the teaching activity in the school environment of learning on the subject and direct object is right on target. Thus, development is happening on the teacher may continue to the students and then going back again on teachers as recurring in the rotation rate of the increase. Change is not always interpreted as a new form, but interpreted as a development of the old form into a more dynamic form.

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VALIDITY AND RELIABILITY OF LEARNING STYLE SCALE OF THE ELEMENTARY SCHOOL STUDENTS

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Abstract

This study aims to examine the validity and reliability of learning style scale of the elementary school students. This study used content and construct validity. Quantitative method and Professional expert judgement used in this study. The subjects were 45 elementary students, while the sample was took by cluster random sampling technique. The scale of the students' learning style consists of three aspects; they are visual, auditory, and kinesthetic styles. Point biserial formula is to measure the item's validity and the Alpha Cronbach coefficient is to measure the reliability. The results showed that 6 out of 54 items tested fell, so that the remaining 48 items are valid, with the range of validity index is ranging from 0.373 to 0.843. By Alpha Cronbach coefficient, it is found the reliability of students learning style is 0.890. So it can be concluded that the scale is valid and highly reliable to measure students' learning style.

Keywords: validity, reliability, students' learning style.

Introduction

Effective learning is a learning that engages students actively throughout the process. Active in the learning process, active in answering teacher's questions, and active in interacting with his classmates. Learning is said to be effective and successful if every student understands the learning concept. Students' ability to understand a learning concept is different in level. There are students with fast understanding level by reading textbooks, there are students who have a level of medium understanding which is for example students understand after hearing the teachers' explanation, and some are slow understanding level that usually prefers to form groups of learning with friends.

Students as people who are learning have different abilities in receiving learning materials and have their own uniqueness and characters. The students' uniqueness make students have

different response in understanding a lesson in terms of attitude or learning style that supports each student's concept understanding (Rijal & Suhaedir, 2015). There are many positive assumptions between learning styles and students' understanding, and vice versa students who have negative attitudes toward the learning are usually not eager to learn so that students' understanding concepts of the learning are less.

The key to each student's learning success lies in their learning style. The more they know and apply the learning style it will be more successful in learning process. This is supported by the research results of (Bire & Bire, 2014) that the learning style is the easiest way that students have in absorbing, organizing, and processing the information received in learning. An appropriate learning style is the key to students' success in learning. Students knowing the key to success in learning, students are able to absorb and process information and make learning easier with their own learning styles. The teachers' role is to direct the learning style of each student so that they are maximal in understanding the lesson concept.

Sutikno (2013) said that there are 3 styles of students' learning, they are: visual learning style, auditory learning style, and kinesthetic learning style. First, the visual learning style is a learning style that vision has an important role. Second, the auditory learning style is a learning style that relies on the learning through the ear. Students who have an auditory learning style can learn faster by verbal discussions and listening to what the teacher says. Third, the kinesthetic learning style is the learning style through moving, touching, and doing. Students who have a kinesthetic learning style are encouraged to learn through experience using a variety of learning models/equipments.

Learning styles that children use in accordance to the characteristics of lower class or higher class for example children who sit in lower classes prefer to use auditory learning style such as

listening to teacher's explanation and visual learning style by seeing pictures provided by teacher because the characteristics of lower-grade children are still in concrete thinking. Higher-grade children prefer to use kinesthetic learning style or direct practice in learning because the characteristics of higher-class children can already think abstractly. Furthermore, in this research of learning styles and concepts understanding will be seen based on Social Sciences learning in the classroom, whether the students have applied their learning styles and to know the extent of students' understanding on Social Sciences learning materials whether fast, medium, or slow.

Students that have high level or easy to accept learning and understanding the learning concept are already successful in applying the learning styles. The more students understand their own learning styles and the learning concept teach by teacher then the students learning outcomes will be maximized. The result obtained by teachers is successful in delivering the lessons to the students. There is a reciprocal between teachers and students ie teachers successfully convey lessons and students are understand the learning material concept. The more students knowing their character, knowing their ability in learning, knowing the way or style they learned then the higher the students' understanding in learning concepts. The positive impact of knowing and choosing the correct learning style for themselves is the students easily understand the learning concept. Conversely, the negative impact when students do not choose their own learning style correctly is the learning concept understanding in the lesson will be lacking.

In the process of teaching and learning activities in the classroom students need to be assisted and directed by the teacher to recognize their learning styles appropriate to themselves so that the learning objectives can be achieved effectively and students could understand the learning concept. Teachers must understand the character and personality of each student, because each

student is unique that have their own ability and character. This is supported by the results of Sutikno (2013) that the teachers' role is guiding and directing students to be able to apply their learning styles.

Each student is a unique and very special person. Unfortunately, teachers have not grouped students according to their ability or talents. This is supported by research of Bire & Bire (2014) teachers should understanding and developing the uniqueness of each student so that they can start learning in their own way. Every student is fond of fun, active, and not boring learning in the classroom. So the teachers should try to make the learning atmosphere easier and fun, learning requires learning styles or ways of learning for each student in order to understand the learning concept of a lesson.

Elementary school students have different learning styles in their learning. Each student applies the learning style or how to learn that easiest for themselves in absorbing information or subject matter. In fact there are still many elementary school students who do not know and apply the learning style because they do not know how to identify their own learning style. They do not understand the characteristics of auditory, visual, and kinesthetic learning style. Yet the key to students' success lies in their own learning style. Students who already know their learning style will be more easily understand the concept. The role of teachers is to direct the learning style of each student so that each student knows their learning style and make it easy to students understanding learning concept.

During the learning process, most teachers have not yet identified the students' learning styles. Teachers should understand about the students' learning styles, so that they can design learning in accordance to the students needs. This is because teachers do not have a standard instrument that can be used to measure students' learning styles. This adds to the urgency of

developing learning style measuring instrument in the form of a closed scale that has high validity. Based on this problem it is necessary to test the validity and reliability of the scale of student learning styles that can later be used to identify the learning styles.

Theory

Learning styles are a way of students learning that become a habit, and the habit is considered most appropriate for them. Learning styles that considered appropriate for students then repeated in every study so that every student in the learning process achieve success. Sobur (2013) said that learning styles are habits shown by individuals in processing information, knowledge, and learning a skill. Information processed in the form of learning material provide by the teacher, self-study, and study with their friends.

Karwati & Priansa (2014) said that learners' learning styles are a combination of how they absorb, and then organize and process information. Information that students learn by understanding learning styles means learning to create an environment in which everyone can learn from them, not just those using our preferred style. The result, students will be easier to receive new information and understand quickly, accurately, and effectively.

According to Utomo & Windarto (2012) learning styles are often defined as characteristics and preferences or individual choices on how to gather information, interpret, organize, respond, and think about that information. Learning styles are the key to develop performance in work, at school, and in interpersonal situations. When students are able and can recognize the learning style means students are able to absorb and process information, then students will be able to make learning and communicate more easily in accordance to their own learning style.

Amin & Suardiman (2016) said that learning styles are the easiest way that individuals have in absorbing, organizing and processing information received. The appropriate learning style is

the key to one's success in learning. Students in learning activities need to be assisted and directed to recognize learning styles that appropriate to themselves so that the learning objectives can be achieved effectively.

Summarizing from some opinions above, learning style is the easiest way that the learners have in absorbing, organizing, and processing the information received in learning. An appropriate learning style is the key to students' success in learning. Every student is aware of this, so students are able to absorb and process information and make learning easier with their own learning styles. Students in their learning activities need to be assisted and directed to recognize learning styles that suit themselves so that the learning objectives can be achieved effectively.

a. The Types of Learning Style

1) Visual Learning Style

The visual learning style is must first see the evidence and then be able to believe it. There are some characteristics that are typical for people who have this visual learning style. First, the need to see something (information / lessons) visually to know it or to understand it; second, having a strong sensitivity to colors; third, having a sufficient understanding on artistic matter; fourth, having difficulty in direct dialogue; fifth, too reactive to sound: sixth, difficult to follow verbal suggestions: seventh, often misinterpret words or utterances (Uno, 2010).

Visual learning style according to Sutikno (2013) is a learning style that vision has an important role. Teaching methods used by teachers should focus more on the media display, invite students to visit objects related to the lesson, or by showing the instrument directly to the students or describing it on the board. The appropriate form of assignment for students who have a visual learning style is observation. Students who have a visual learning style prefer to use

photos, create images, play colors, and maps to convey information and communicate with others.

2) Auditory Learning Style

According to Uno (2010) auditory learning style is a learning style that controls the hearing to be able to understand and remember information. Characteristics of this learning style actually put hearing as the primary tool of absorbing information or knowledge. So that, people with this learning style must listen, then can remember and understand the information.

According to Sutikno (2013) auditory learning style is the style of learning that relies on the success of learning through the ear. Students who have an auditory learning style can learn faster by using verbal discussions and listen to what the teacher says. Students with an auditory learning style can easily digest the meaning conveyed by voice, read the text aloud and listen to the tapes. Students who have an auditory learning style have sensitivity in tone and rhythm, usually able to sing, play a musical instrument, or recognize the sounds of various instruments.

According to Utomo & Windarto (2012) auditory learning style use the ear as a tool to absorb incoming information. Students with auditory learning styles are more likely to hear the information he or she is listening to from others such as by listening to a lecture or listening to a friend memorizing a material.

3) Kinesthetic Learning Style

According to Uno (2010) kinesthetic learning style has to touch something that provides certain information to remember it. An approach that could be used is to experience learning by using models, working in a laboratory or playing while learning. Students who tend to have kinesthetic learning style will absorb and understand information easier by tracing images or words to learn pronouncing or understanding the facts. Learning to be effective and meaningful,

people with the above characters are advised to test the memory by direct view of facts in the field.

According Sutikno (2013) kinesthetic learning style is the learning style through moving, touching, and doing. Students with this learning style are difficult to sit still for hours because their desire for activity and exploration is very strong. Students with kinesthetic learning style are encouraged to learn through experience using a variety of visual models, and learning methods that teachers can use in the learning process are role playing, simulations and so on.

According to Utomo & Windarto (2012) the kinesthetic learning style is a learning style that emphasizes the direct practice of what is being studied. Students with kinesthetic learning styles are more comfortable to be left do their activities alone or in direct practice.

Summarizes some of the above opinions, there are three learning styles: visual learning style (vision), auditory learning style (hearing), and kinesthetic learning style (moving, touching, and doing). Each student has all three learning styles, only one style usually dominates how he or she should learn. An appropriate learning style is the key to students success in learning. Students who already understand their own learning styles will find it easier to absorb the learning material using visual, auditory, or kinesthetic learning styles.

b. Identifying Learning Styles

According to DePorter & Mike (2016) identifying people with visual, auditory, kinesthetic learning styles are as follows:

1) People with visual learning style

- a) neat and orderly
- b) speak quickly
- c) meticulous to detail

- d) have problems remembering verbal instructions unless they are written, and often ask people for help to repeat them.
 - e) remembering what is seen, rather than heard
 - f) usually not distracted by commotion
 - g) often answer questions with short answers yes or no
 - h) fast and diligent reader
 - i) forgot to convey verbal messages to others.
 - j) prefers art rather than music
- 2) People with auditory learning style
- a) talk to themselves while working
 - b) distracted by the commotion easily
 - c) learn by listening and remembering what is being discussed rather than viewed
 - d) love to read aloud and listen
 - e) find it difficult to write, but great at telling stories
 - f) usually an eloquent speaker
 - g) prefer music to art
 - h) can repeat and mimic tones, bars and sound colors
 - i) like to talk, like to discuss, and explain things at length
 - j) better at spelling out loud rather than writing it down
- 3) People with kinesthetic learning style
- a) speak slowly
 - b) standing close when talking to people
 - c) touch people to get their attention

- d) always physical oriented and move a lot
- e) learn to start manipulating and practice
- f) memorize by walking and seeing
- g) using the finger as a pointer when reading
- h) use a lot of body cues
- i) can not sit still for long time
- j) love a busy game

Methodology

This study was conducted by measuring the learning style of elementary school students using closed questionnaire with two choices of answers. Research subjects are 45 students of 4th grade Muhammadiyah Bausasran Elementary School, Yogyakarta, Indonesia. The sampling technique is cluster random sampling technique by taking 1 class as a sample.

This research used content and construct validity. Quantitative method and Professional expert judgement used in this study. The scale of the students' learning styles consists of three aspects; they are visual, auditory, and kinesthetic. Point biserial formula used to measure the items validity and the Alpha Cronbach coefficient used to measure the reliability. Both validity and reliability were tested by statistic analysis using SPSS 20 for Windows.

This paper present the scale of the students' learning styles consists of favorable and unfavorable items. There are 27 favorable questions and 27 unfavourable question written in Bahasa Indonesia with 2 choices of answers (Yes or No). The items distribution shown in Table 1 as follows:

Table 1. The Questionnaire outline of individual characteristics with learning styles characteristics based on sensory preferences.

Sensory Preference Dimension	Indicator	Item Number	
		Favorable (+)	Unfavorable (-)
A. Visual learners			
1	neat and orderly	1	6
2	speak quickly	13	12
3	meticulous to detail	3	10
4	remember something based on visual association	17	4
5	usually not easily distracted by commotion	7	14
6	have problems remembering verbal instructions unless they are written, and often ask people for help to repeat them.	15	16
7	forgot to convey verbal messages to others.	9	2
8	often answer questions with short answers “yes” or “no”	11	18
9	prefers art (painting, sculpturing, drawing) rather than music	5	8
B. Auditory Learners			
1	talk to themself while working	1	4
2	moving their lips and pronouncing when reading	9	12
3	love to read aloud and listen	15	18
4	can repeat and mimic tones, bars and sound colors	3	6
5	find it difficult to write, but great at telling stories	17	10
6	Speaks eloquently	5	14
7	like to talk, discuss, and explain things at length	13	8
8	having problems with jobs that involve visualization, such as cutting parts to fit each other.	11	16
9	preferring oral jokes rather than reading comedy comics.	7	2
C. Tactual (kinesthetic) Learners			
1	responding to physical attention	7	12
2	touch people to get their attention	11	4
3	standing close when talking to people	1	14
4	always physical oriented and move a lot	15	6
5	learning through direct practice or manipulation	9	8
6	memorize things by walking or looking directly	17	18
7	using a finger to point to a word read while reading	3	10
8	generally bad in handwriting	13	2
9	likes activities or games that busy (physically) want to do everything	5	16
Total Questions		27	27

Source: (DePotrter & Hernacki, 2016)

Scoring Guideline

Question Nature	“YES” Answer	“NO” Answer
Favorable (+)	1	0
Unfavorable (-)	0	1

The above questionnaire outline is translated into a more operational question as seen in table 2 below:

Table 2. Questionnaire of Students’ Learning Style

Sensory Preference Dimension	Indicator	Answer	
		Yes	No
A. Visual learners			
1	I took notes in my notebook neatly and regularly.		
2	I rarely take notes of the messages the teacher verbally tells me.		
3	After I finished the test, I checked the answer carefully.		
4	I prefer to hear the teacher explain the lesson in front of the class instead of reading the textbook.		
5	I'm more interested in seeing sculptures, paintings, pictures than listening to music.		
6	When there is an important explanation from my teacher, I chat with a friend so I do not have time to take notes.		
7	I can still concentrate on reading books despite my noisy friends in class.		
8	I do not interested in seeing sculptures, paintings, drawings; I am more interested in music.		
9	I forget what the teacher said if I did not take note on it.		
10	I immediately submit a test answer sheet to the teacher once I finish the test.		
11	I answer other people's questions with short and necessary answers.		
12	I am less active in answering questions given by the teacher.		
13	I answered the teacher's question quickly.		
14	I find it hard to concentrate on reading a book when the class atmosphere is noisy.		
15	I find it difficult to remember verbal questions from teachers.		
16	I find it easier to understand the question in writing.		
17	I prefer to see pictures in books rather than listening to teacher explanations.		
18	I give answers to other people's questions in complete.		
B. Auditory Learners			
1	I find it easier to remember lessons if I speak for myself while studying.		
2	I often spent the break time reading rather than joking with		

	friends.
3	I easily repeat the subject matter when listening to music and songs.
4	I find it hard to remember lessons while talking.
5	When expressing an opinion or answering a question, I used to speak quickly and clearly.
6	I am not fluent to sing back the song/music that has been taught by the teacher.
7	In the interlude between lessons, I prefer to joke with friends.
8	I prefer taking notes than talking during group discussions.
9	I murmured as I read the book.
10	I prefer to convey my story ideas in writing, rather than spoken.
11	I find it difficult to understand the subject matter when displayed in drawings, concept maps, or graphs.
12	I read the book quietly.
13	While working on group assignments, I actively shared my opinions.
14	I speak in front of the class with fluency.
15	When searching for information about something, I prefer it to be read out by other people rather than read it myself.
16	I easily understand material in the form of images, graphics, or concept maps.
17	I like to tell stories, but it's hard to get my story idea in writing.
18	When looking for information about something, I prefer to read it myself rather than it to be read out by other people.

C. Tactual Learners

1	When talking to friends or teachers, I have to be near them.
2	My handwriting is neat and easy to read.
3	To make it easier for me to read, I used my finger to point to the word I read.
4	When I want to ask or talk to other people, I do not need to touch the person first
5	I am excited when I come to make or fix something with my hands.
6	As I listening to the teacher's explanation, I am calm.
7	I learn well when I can touch the object being studied.
8	I find it hard to remember the subject matter being practiced.
9	I find it easier to understand the subject matter when practiced directly.
10	While reading, I do not use my index finger to point to the word I read.
11	When I want to ask or talk to others, I need to touch the person first.

12	To be able to learn well, I do not need to touch objects being studied.
13	My handwriting is not neat.
14	I do not have to stand near a teacher or friend while talking to them.
15	When the teacher explained the material in front of the class, my hands could not calm down, often playing pencils or objects near me.
16	I'm not much help in making or fixing things.
17	I memorized the subject matter while walking or moving my arms and legs.
18	When I memorize, I usually sit quietly.

Results and Discussion

This study provides an overview for the preparation of a closed questionnaire instrument to measure the learning styles of elementary school students. The completed instrument consists of 18 questions items for the auditory learning style, 18 questions items for visual learning style, and 18 questions items for kinesthetic learning style. Students are asked to fill out a learning styles questionnaire with 'Yes' or 'No' answers according to their habits. The answer key is tailored to the question characteristics (favorable question or unfavorable question). Based on the test results of construct validity as much as two tests, obtained 48 items of valid statement distributed into 16 questions items for auditory learning style, 16 questions items for visual learning style, and 16 questions items for kinesthetic learning style. Unvalid items are number 2,3,10,11,35,37. Furthermore, the third test with 48 questions items still shows high validity so that the researchers decided to stop testing after the third test result and obtained 48 valid questions. The next step is to test the reliability with alpha cronbach coefficients for 48 questions items. From the test obtained high reliability value that is 0,869. The distribution of test result data is shown in the following table:

a. Testing reliability and validity for visual learning style

Table 3. Reliability of visual learning style

Cronbach's Alpha	N of Items
0,869	16

Table 4. Validity of visual learning style

		Validitas
VAR00001	Pearson Correlation	,461*
	Sig. (2-tailed)	,001
	N	45
VAR00002	Pearson Correlation	,746
	Sig. (2-tailed)	,000
	N	45
VAR00003	Pearson Correlation	,625**
	Sig. (2-tailed)	,000
	N	45
VAR00004	Pearson Correlation	,648**
	Sig. (2-tailed)	,000
	N	45
VAR00005	Pearson Correlation	,665**
	Sig. (2-tailed)	,000
	N	45
VAR00006	Pearson Correlation	,601
	Sig. (2-tailed)	,000
	N	45
VAR00007	Pearson Correlation	,596*
	Sig. (2-tailed)	,000
	N	45
VAR00008	Pearson Correlation	,643**
	Sig. (2-tailed)	,000
	N	45
VAR00009	Pearson Correlation	,677*
	Sig. (2-tailed)	,000
	N	45
VAR00010	Pearson Correlation	,501*
	Sig. (2-tailed)	,000
	N	45
VAR00011	Pearson Correlation	,460*
	Sig. (2-tailed)	,001
	N	45
VAR00012	Pearson Correlation	,601
	Sig. (2-tailed)	,000

	N	45
VAR00013	Pearson Correlation	,483*
	Sig. (2-tailed)	,001
	N	45
VAR00014	Pearson Correlation	,706
	Sig. (2-tailed)	,000
	N	45
VAR00015	Pearson Correlation	,487**
	Sig. (2-tailed)	,001
	N	45
VAR00016	Pearson Correlation	,506**
	Sig. (2-tailed)	,000
	N	45

b. Testing reliability and validity for the auditory learning style

Table 5. Reliability of Auditory learning style

Cronbach's Alpha	N of Items
,887	16

Table 6. Validity of Auditory learning style

		Validitas
VAR00001	Pearson Correlation	,373
	Sig. (2-tailed)	,012
	N	45
VAR00002	Pearson Correlation	,465
	Sig. (2-tailed)	,001
	N	45
VAR00003	Pearson Correlation	,587*
	Sig. (2-tailed)	,000
	N	45
VAR00004	Pearson Correlation	,792
	Sig. (2-tailed)	,000
	N	45
VAR00005	Pearson Correlation	,524
	Sig. (2-tailed)	,000
	N	45
VAR00006	Pearson Correlation	,439
	Sig. (2-tailed)	,003
	N	45
VAR00007	Pearson Correlation	,677*
	Sig. (2-tailed)	,000

	N	45
	Pearson Correlation	,821**
VAR00008	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,603**
VAR00009	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,500*
VAR00010	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,843*
VAR00011	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,431
VAR00012	Sig. (2-tailed)	,003
	N	45
	Pearson Correlation	,798
VAR00013	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,569
VAR00014	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,608*
VAR00015	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,642
VAR00016	Sig. (2-tailed)	,000
	N	45

c. Testing reliability and validity for kinesthetic learning style

Tabel 7. Reliability of kinesthetic learning style

Cronbach's Alpha	N of Items
,913	16

Table 8. Validity of Kinesthetic learning style

	Validitas
VAR00001	Pearson Correlation ,563
	Sig. (2-tailed) ,000

	N	45
	Pearson Correlation	,630
VAR00002	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,726
VAR00003	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,647
VAR00004	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,558 ^{**}
VAR00005	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,630 ^{**}
VAR00006	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,630 ^{**}
VAR00007	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,412
VAR00008	Sig. (2-tailed)	,005
	N	45
	Pearson Correlation	,674
VAR00009	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,529 ^{**}
VAR00010	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,839
VAR00011	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,718
VAR00012	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,747
VAR00013	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,597
VAR00014	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,839
VAR00015	Sig. (2-tailed)	,000
	N	45
	Pearson Correlation	,791
VAR00016	Sig. (2-tailed)	,000
	N	45

Conclusion

Research has completely examined on instrument of students learning styles questionnaire through content validity and construct validity test. A total of 54 questions items tested by respondents then analyzed by pearson correlation and alpha cronbach produced as many as 48 items of valid questions with high reliability. Furthermore the items of invalid questions are dropped so as not to interfere with data quality.

Acknowledge

Thank to Ministry of Research, Technology and Higher Education that funded the implementation of this research through the grant " Penelitian Kerjasama Antar Perguruan Tinggi".

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STUDENTS' MATHEMATICAL REASONING IN EXPLORING FUNCTIONS AND ITS DERIVATIVE

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Abstract

Mathematical reasoning has been identified as an important vehicle in investigating students' understanding about mathematical concepts and procedures. The students' mathematical reasoning can be examined by using mathematical tasks in which the students justify and generalize mathematical ideas. Therefore, the aims of this study are to analyze (1) the features of mathematical tasks that have been worked by the students, and (2) students' reasoning in solving the tasks. The mathematical tasks used in this study are in the topic of functions and its derivative. The findings suggest that the provided tasks have features that demand the students' reasoning. The tasks are also consistent to its initial set up during its implementation. However, we found that the students still lack graphical understanding. The recommendation about how calculus learning should be in promoting graphical understanding will be explained as well.

Keywords: Mathematical Reasoning, Mathematical Task, Conceptual Knowledge, Derivative, Function.

Introduction

Mathematical reasoning is important for students in learning and doing mathematics. Students use reasoning in many forms of learning. They use reasoning to justify their arguments to other students or teacher. They also employ their reasoning to generalize mathematical ideas.

Students' mathematical reasoning can be promoted using mathematical tasks. Stein and colleagues (1996) defined mathematical task as problem(s) that focuses students' attention on a particular mathematical idea. It can be a set of problems or a single complex problem. Francisco and Maher (2005) claim that giving students opportunity to work on the complex task can provoke their mathematical reasoning. When students deal with complex task, they need to decompose complex system into simpler subsystems to which they understand. When students understand the task deeply, they can justify and generalize mathematical ideas.

Since not all mathematical tasks can stimulate students' mathematical reasoning, the present study has following questions to be answered:

- Q1: What features do mathematical tasks that have been worked by students have?*
- Q2: How does students' mathematical reasoning?*

We argue that identifying task's features is necessary in order to give readers understanding the context of the present study.

A. The Framework of Mathematical Task

In present study, we use mathematical task framework proposed by Stein and Smith (2011). The framework divide tasks to be three phases through which students pass: first, the emergence of the tasks in curricular or instructional material; second, configuration or announcement the tasks by teacher; and at last, its implementation to students in classroom. The framework of mathematical tasks is shown in Figure 1.

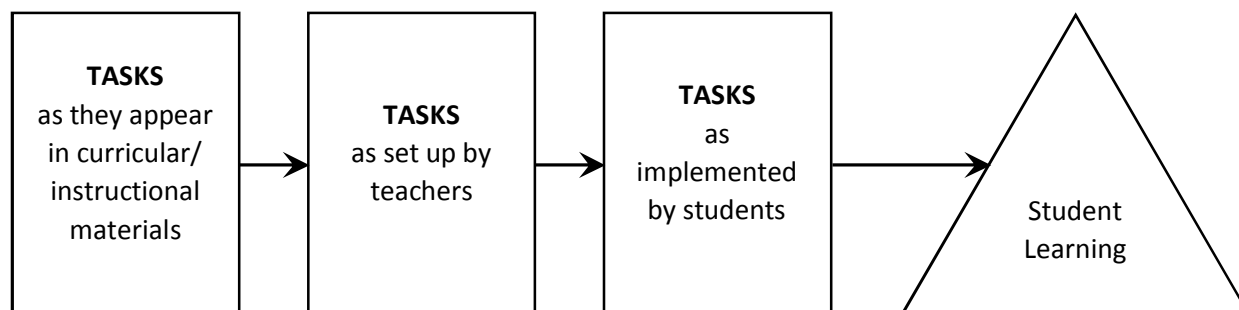


Figure 1 The Mathematics Tasks Framework

There is possibility that tasks in curricular/instructional materials different with the tasks that developed and announced by teacher. The experiences of teacher in solving and using the tasks can predict how the tasks will be accessed by students (Liljedahl, Chernoff, & Zazkis, 2007). As such, those teacher experiences and students' context can affect the design of the tasks. Teacher sorts and selects parts of curricular/instructional material's tasks that ensemble to students learning. The change of the tasks from curricula material to teacher set up is corroborated by the finding of Stein, Grover and Henningsen (1996). They contend that students tend to engage in working from ground-breaking materials and/or from teacher-developed materials than from a textbook series. Furthermore, students' engagement also come from their activity in doing mathematical tasks that demand them to use multiple-solution strategies, multiple representations, and explanation or justification of their answers.

Change can also happen from teacher set up tasks to implementation phase. Stain and her colleagues (1996) found that high-level cognitive demanding tasks are less likely consistent between teacher set up and implementation by students. Besides, those kinds of tasks are essential to promote the students' thinking and reasoning. In or order to keep the tasks in consistent manner during the implementation, it is important for teacher to have pedagogical affordances within the classroom context (Liljedahl, Chernoff & Zazkis, 2007).

B. Mathematical Reasoning

Literature give difference perspective on mathematical reasoning. Thompson (1996) described reasoning as "purposeful inference, deduction, induction, and association in the areas of quantity and structure." National Council of Teachers of Mathematics (2009) defined it as "the process of drawing conclusions on the basis of evidence or stated assumptions." When students work with

data or premises, they will use their reasoning with certain assumption to make a conclusion. Students also use reasoning in explaining their conjecture in order to reassure interlocutors.

Moshman (2004) defined reasoning as “epistemically self-constrained thinking.” He explained that making inferences is a natural process in which everyone engages, but when people are aware of and “constrain their inferences with the intent of conforming to what they deem to be appropriate inferential norms,” they engage in reasoning. Conner and colleagues (2014) agreed with this definition and described mathematical reasoning as purposeful inference about mathematical entities or relationships.

Mathematical reasoning can emerge in social setting, for example students’ group discussion. Therefore, we introduce collective argumentation. Collective argumentation is characterized as “multiple people working together to establish a claim” (Conner et. al., 2014). A helpful diagrammatic method to examine the kinds of reasoning encountered in collective argumentation can be understood by using Toulmin’s (1958/2003) model, see Figure 2.

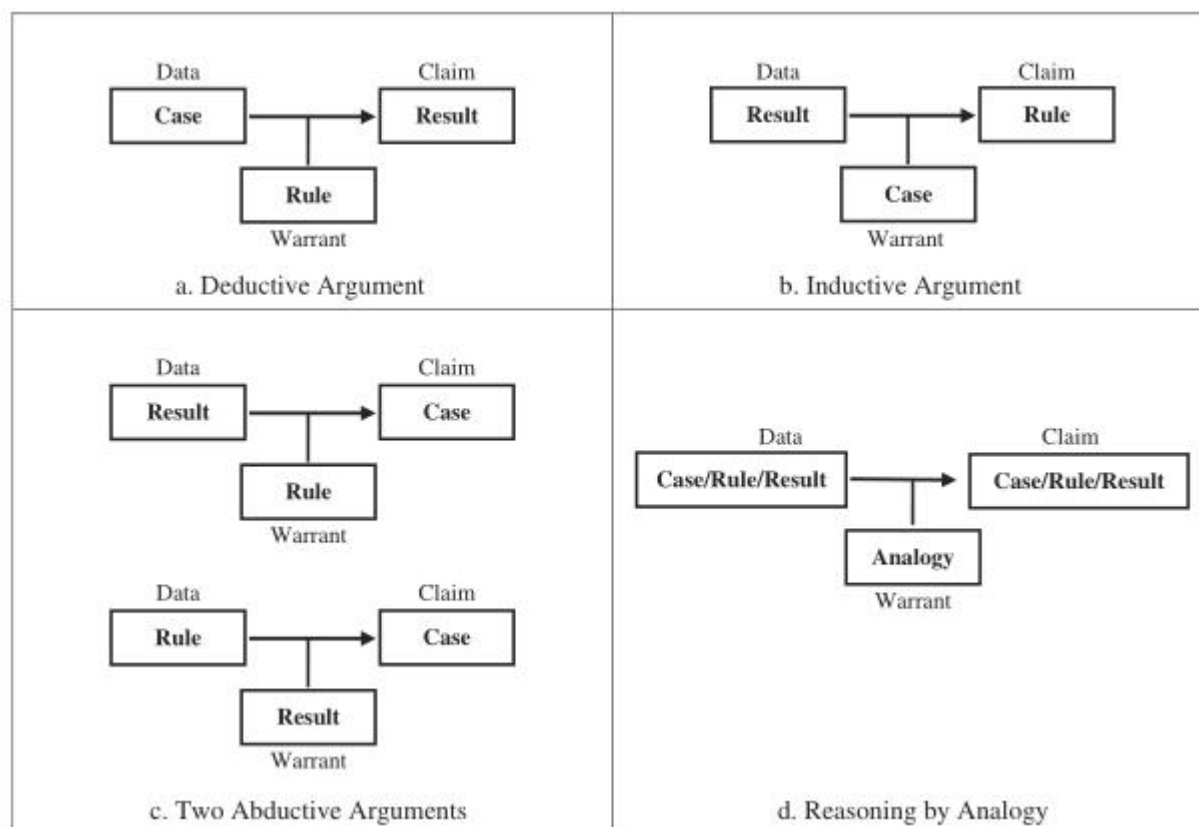


Figure 2 Toulmin-style diagrams of arguments reflecting different kinds of reasoning.

When engaging in deductive reasoning, one constructs conclusions as the logical consequence of aforementioned assumptions or conditions. As illustration, a student may claim that One exterior and one interior angle make a half circle. Since a half circle has 180 degrees, he concludes that the interior angle is 180 degrees minus the exterior angle.

When students engage in inductive reasoning, they draw abstractions or generalizations from individual observations. Abductive reasoning as making “an inference which allows the construction of a claim starting from an observed fact.” Similarly, Reid (2010) characterized the structure of abductive reasoning as the reverse of deductive reasoning. Reasoning by analogy requires developing a claim based on noticing similarities between corresponding cases (Reid, 2010).

Method

The present study is a case study that use qualitative data. Subjects of the study were first year undergraduate students in a private university that come from difference places in Indonesia. They were the students of first author in Differential Calculus class that held twice a week where each meeting employed two hours class.

First author developed tasks in the topic of Derivative. This process began with searching problem in calculus textbooks. The problems to be considered were the problems that afforded students opportunities to explore mathematical ideas and concepts in meaningful ways. After the problems searching process, the chosen problem was one from calculus textbook by Briggs (2013: 159). The problem was as follows.

Suppose the line tangent to the graph of f at $x = 2$ is $y = 4x + 1$ and suppose $y = 3x - 2$ is the line tangent to the graph of g at $x = 2$. Find an equation of the line tangent to the following curves at $x = 2$.

(a) $y = f(x)g(x)$

(b) $y = f(x)/g(x)$

After the problems were chosen, the next step was modifying that problems so that it would suit for the students. This process yielded the following problems.

Suppose the tangent line to the graph of f at $x = 2$ is $y = 3x - 2$ and suppose $y = x + 1$ is the tangent line to the graph of g at $x = 2$. Sketch possible graphs of f and g on the coordinate plane. Why do you sketch the graphs of f and g like that? Give your reason.

The problem we present above was the same for all students. That problem was followed by another problem that not same among students. However, the latter also had the similarity: it demanded students to use Rule of Differentiation, e. g. Power Rule, Constant Multiple Rule, Sum Rule, Product and Quotient Rule.

The problems were announced in the classroom and students in the class were divided into thirteen small groups. Each group consisted 3 – 4 students. The group formation was determined by first author that considered the students’ achievement on the previous quizzes, so that each group consisted high- and low-achievers. It was intended that students can discuss one another in their groups actively.

Finally, two groups were chosen to be interviewed by first author right after the class finished and each group was represented by two students to be reviewed at once. We selected two students in each interview so that students were not nervous when interviewed by their lecturer. Besides, it was important to study how their collective argument. The interview technique to be

used in this present study was semi-structured interview. In general, the interview was used to know the students' mathematical reasoning for the given tasks.

Results and Discussion

The present study aims are to analyze the features of mathematical tasks that have been worked by the students, and students' reasoning in solving the tasks. In answering first question, we describe the mathematical tasks and its implementation by students. Then, we use the data from students' worksheet to analyze students' mathematical reasoning.

C. Description of Mathematical Tasks

The tasks consist of two problems, e.g. sketching possible function graphs and using The Derivative Rule. The number of possible solution strategies for the first problems is more than one. The first problem is a problem which does not define clearly what the question asks for, therefore allowing many possible solutions, so it is open-ended problem (Kwon, Park & Park, 2006). In fact, the first problem has infinite number of solutions provided they satisfies to conditions, e.g. they must be the graph of function, if they meet The Vertical Line Test, and they must have tangent line that mentioned in the problem. Examples of alternative solutions of the problem is shown in Figure 3.

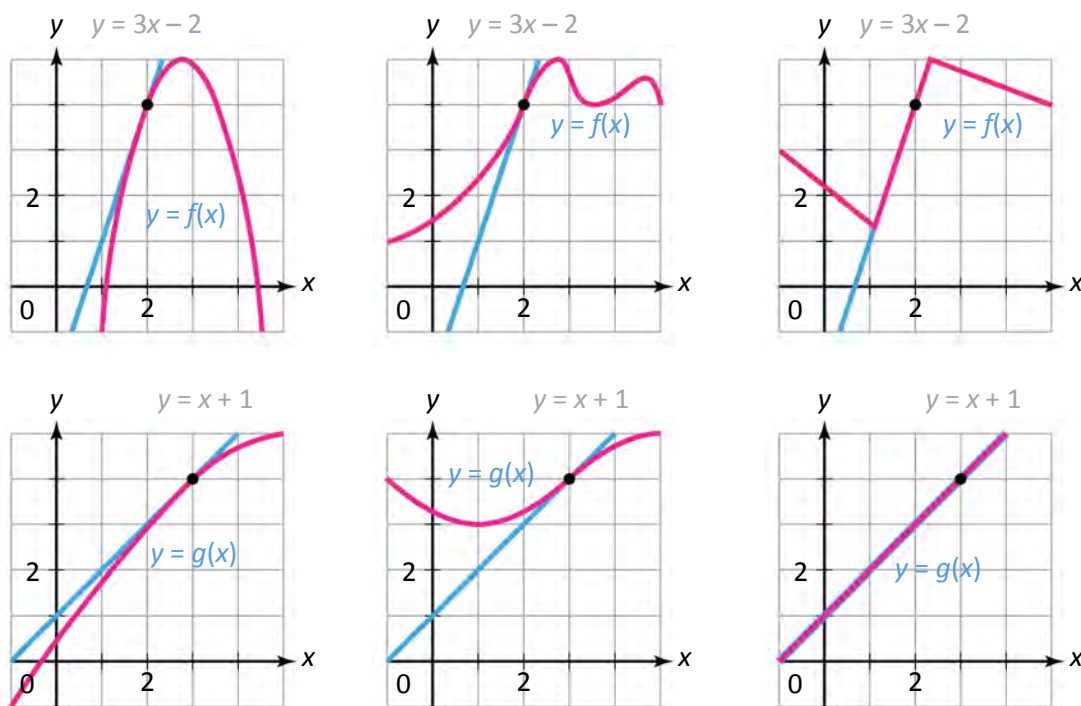


Figure 3 Alternative solutions of first problem

Many alternative solutions of the first problem show that it can be represented in different ways in the students' thinking. Since the given tangent line have gradient not equal to zero, the tangent line can intersect graph of f or g in two ways. It intersects at an inflection point or at a point that not inflection point. When tangent line intersect graph not at an inflection point, it can coincide with the graph. Biza & Zachariades (2010) found that tangent line that intersect the graph at an

inflection point and tangent line that coincides with the graph are among the most challenging cases for students.

The first problem demands students' reasoning since it asks students to give argument why they sketch the graph like they did. This question can stimulate discourse among students in a group. In this situation, dialogic and dialectic conversations can emerge. Therefore, the problem requires communication between student to one another. There can be communication between students and instructor as well.

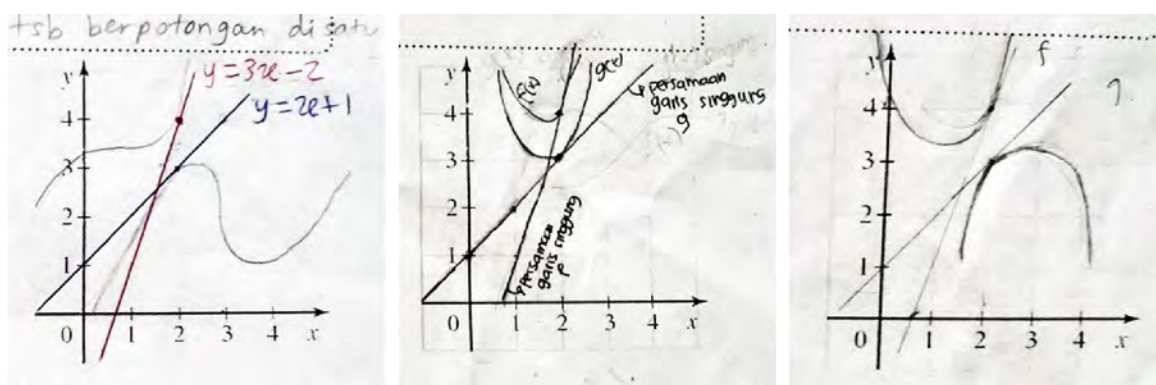
Second problem, the one that requires student to apply Derivative Rules, has exactly one solution but can be carried out by different strategies. In the first strategy, students can apply the Derivative Rules and then substitute the given value of variable to obtain an answer. Second, students begin by substituting the value of variable and then followed by applying the Derivative Rules.

This problem emphasizes the visualization of function. It requires students to interpret what the tangent line is and determine the derivative of functions based the information from the tangent line. Habre & Abboud (2006) observed that the algebraic representation of a function still dominated students' thinking for most students. Therefore, this problem can be challenge for students to think in unpopular way, so it stimulates communication among students, or between students and instructor.

D. Task Implementation

Tasks implementation by students is discussed in this section. The discussion is based on the students' work.

Solution strategies and Representation. After the tasks implementation, there are four correct answers that can be categorized into three types. The types of students' answers are shown in Figure 4. The first one, students sketch cubic-function-like graph for f and g . The other two are the parabola, but having different characteristic. Therefore, there is consistency between tasks set up and implementation.



Gambar 4 Types of students' answers for first problem

All of the graphs that have been sketched by students, however, just represent on case. All of them intersect with its tangent line at a point other than inflection point. There is no graph by

students that coincide with the tangent line as well. It shows that those two cases are challenge for students in present study. This is consistent with Habre & Abboud's (2006) findings.

For the second problem, there are eight correct answers in which different strategies are encountered. It is conforming to the tasks set up. The different strategies that appear in the students' answer for the second problem are shown in Figure 5. Upper image shows that students find the derivative of the combined function respect to variable first, and then they determine the derivative at certain point. On the other hand, the students also can solve the problem by applying the Derivative Rules and substituting a value into variable at once, as shown in lower image. Furthermore, Figure 5 show different symbolic representation of derivative, e.g. Leibniz (upper image) and Lagrange's notation (lower image) of differentiation.

Misalkan $h(x) = f(x)g(x) - x^2 + 5$. Tentukan $h'(2)$.

$$\begin{aligned} h(x) &= f(x)g(x) - x^2 + 5 \\ h'(x) &= (f(x)g'(x) + f'(x)g(x)) - 2x \\ h'(2) &= (f(2)g'(2) + f'(2)g(2)) - 2(2) \end{aligned} \quad \left| \begin{aligned} h'(2) &= (4 \cdot 1 + 3 \cdot 3) - 4 \\ h'(2) &= (4 + 9) - 4 \\ h'(2) &= 13 - 4 = 9 \end{aligned} \right.$$

Misalkan $h(x) = f(x)g(x)$. Tentukan $h'(2)$.

$$\begin{aligned} h'(2) &= f(2) \frac{d}{dx} g(2) + g(2) \frac{d}{dx} f(2) \\ &= 4 \cdot 1 + 3 \cdot 3 \\ &= 13 \end{aligned}$$

Figure 5 Different strategies and symbolic representation of second problem

Communication. Both problems in the task have demanded communication among students in the group. The problems also encourage students to communicate to the instructor. For example, students ask to instructor about how to apply the Derivative Rule if the graph of functions and their tangent line are given.

E. Students' Mathematical Reasoning

Students' mathematical reasoning in the present study is identified by students' worksheets and interview. Their reasoning that emergence in first problem are similar. They argue that the graph they drew have tangent line that same with the given line since the graph and the line are intersect each other. The represented students' reasoning that written on their worksheet is as follows.

The reason we draw the curve as shown in the figure is because it is one of possibilities that the curve intersects the given tangent line.

The argument that students use in the reasoning above is deductive. They use the definition of tangent line to show that a given line on figure is a tangent line of the graph they drew. In this case, the data is students' graph, the warranty is the definition of tangent line, and the claim is their conclusion. The deductive argument of students for first problem is shown in Figure 6 below.

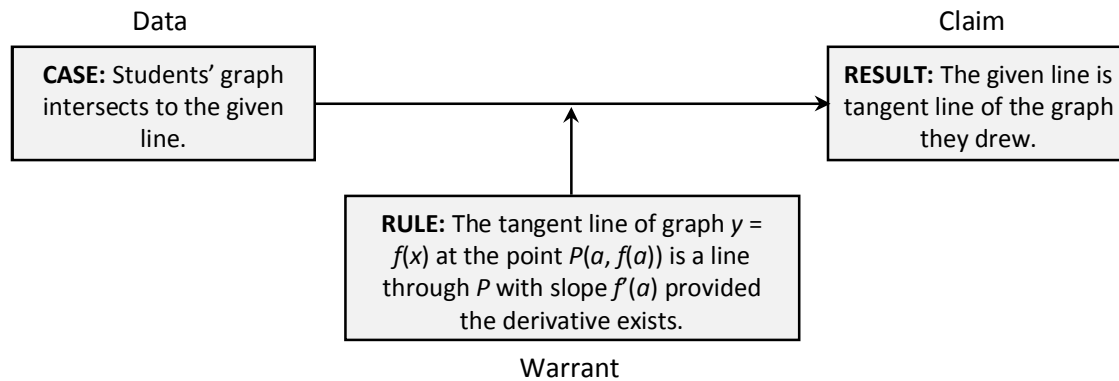


Figure 6 Example of deductive argument by students

However, not all students aware of tangent line definition in supporting their argument. They prefer to use informal terms, i.e. “touch” and “stick,” in describing the graph and its tangent line relation. As such, they thought that tangent line always intersects the corresponding graph exactly at one point. Yet it is not the case. They ignored the case that tangent line can cut the graph at more than one point. For example, $x = 9$ is tangent line of $f(x) = x^3 - 6x^2 + 9$, but this tangent line intersects the graph at $(0, 9)$ and $(6, 9)$. This misunderstanding about tangent line can be shown in the following interview.

- S1 : We draw the graph of f like that (pointed the graph) so that the graph can touch the given line at $x = 2$.
 I : What do you mean about touching?
 S2 : I mean it's intersect at one point.

For second problem, almost all of students cannot directly solve the problem. They asked the instructor for further explanation. However, instructor not give them explanation. Rather, he give students scaffolding on how solving the problem. After the discussion process, the students' reasoning can be shown in the following interview.

- I : At first, what is your procedure to solve the problem?
 S2 : Applying the Derivative Rule for multiplication, Pak.
 I : What do the rule say?
 S2 : The derivative of fg is equal to the sum of f multiplied by the derivative of g and the multiplication of the derivative of f and g .
 I : Okay, and then explain your answer.
 S2 : We look at the graph. If x that equal to 2 is substituted into the equation (pointed the tangent line equation of f), we get $y = 4$ and the derivative of g is equal to the gradient of its tangent line, and then add the result to that $g(x)$, when $x = 2$ we get $y = 3$ then multiply by the derivative of $f(x)$ that is equal to the gradient of its tangent line, i.e. 3.

Based on the students' reasoning for second problem, we conclude that students use the deductive reasoning. The data of their argument are described as follows:

Data	Warrant	Claim
• The derivative of	Derivative Rule:	$h'(2) = 13$

function at certain point equal to the gradient of its tangent line that passing through the point. The value of function at certain point equal to the value of its tangent line at the point.	$\frac{d}{dx}[f(x)g(x)]$ $= f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$	

Conclusion

The present study found that the mathematical tasks' set up is consistent to its implementation. The characteristics of the tasks are open ended and multi representation both in set up and implementation. However, students' answers to first problem are not representative for all cases. Students not presented the case that tangent line intersect the graph of function at an inflection point. Also, they not exposed the case when tangent line coincides the corresponding graph. It is consistent to Biza & Zachariades (2010) finding that those two cases are most challenging problems in the topic of tangent line.

We found that students can use the deductive arguments in their reasoning. They use the data that they found from the given problem together with the rule in making conclusion. However, there are students that simplify their argument too much. This simplification caused their argument not correct. The students have difficulties in finding the information from the graph as well. In other words, they still lack of graphical understanding.

Based on our findings, we suggest that instructors should conduct calculus learning that focus on theoretical analysis. It is consistent with Asiala, Cottrill, Dubinsky & Schwingendorf (1997) findings. They found that the students whose course was based on the theoretical analysis of learning may have had more success in developing a graphical understanding of a function and its derivative, than students from traditional courses.

Acknowledgment

The first author thanks to the PPIP, Center for Learning Development and Innovation in Universitas Sanata Dharma for the grant. We also would like to thank the participating students for allowing us to study their reasoning.

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Documentation



Figure 1: The International Conference on Research in Education 2017



Figure 2: Opening of The Conference by Traditional Dance



Figure 3: Welcome Speech from Vice Rector 1 Sanata Dharma University



Figure 4: First Day Conference



Figure 5: Conference's Speakers and Committee



Figure 6: The Participants of The Conference



Figure 7: Activities in The Parallel Classes



Figure 8: Activities in The Parallel Classes



Figure 9: Preparation of The Second Day Conference



Figure 10 : ICRE's Keynote Speakers



IFigure 11: Second Day Conference



Figure 12: Second Day Conference



Figure 13: Second Day Conference



Figure 14: Second Day Conference