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"Improving Professionalism and Reflective Thinking through Design Research"

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"Improving Professionalism
and Reflective Thinking through Design Research"

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Preface

It is an honor and privilege to welcome you to the 7th South East Asia Design Research International Conference. The conference's theme, "Improving Professionalism and Reflective Thinking through Design Research," invites us to reflect on the current educational challenges, e.g. globalization and industrial revolution 4.0, and transform them into opportunities through design research. It acknowledges the need to develop our professionalism so that we can proactively contribute to the advancement of educational science and praxis. It challenges us to re-thinking the design research as a method to make learning and teaching innovation possible, but also as a paradigm in building our capacity for innovation.

Yogyakarta is an artsy and historical city which serves as a fitting cultural, social, political, and economic milieu for the conference. The tagline, "Jogja Istimewa," itself shows how the city has special values to be explored and experienced, and we encourage you to absorb the city's abundance: The Kraton, the cultural and political heart of the city; Fort Vredeburg museum; Malioboro road; Dipowisata urban tourism, to name a few.

The perfect ambience of Yogyakarta will provide us with a convenient space to interact and exchange ideas with colleagues as a means of professional learning. Our goal is for you to get new ideas, tools, and materials from the conference which will contribute to your professional development. The variety of sessions, workshops, and social events will give you opportunities to connect with friends and colleagues to expand your networks. We are excited about the keynote and invited speakers. We believe they will share challenging and innovative ideas about education.

This conference is the result of the hard work, support, and dedication of a number of parties. We wish to thank all the committee members who together make the conference possible. The committee has been working throughout the year to propose sessions, review a record number of submissions, answer queries, arrange the schedule, and response to last-minute requests. We also want to thank Sanata Dharma University; Ministry of Research, Technology, and Higher Education of Indonesia; Sogang University and SEAMEO QITEP in Mathematics for their contribution to funding the conference. Thank you for being here with us. We value your presence at the 7th South East Asia Design Research International Conference. Enjoy the conference!

Yosep Dwi Kristanto, Conference Chair
Albertus Hariwangsa Panuluh, Conference Vice Chair

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Professional Development of Teachers and Development of Teaching Material in Higher Order Thinking Skill (HOTS) with Mathematical Realistic Approach

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Abstract: In this globalization era, everyone is required to have the skills to think critically, creatively, communicatively, and collaboratively, and to have the ability in communication and information technology. This ability is called high-level thinking skills or Higher Order Thinking Skills (HOTS), so must be emphasized in every learning process at every level of education, especially mathematics education. However, HOTS of Indonesian students is still low (PISA, 2015). The reasons are because of the teacher's limited ability to think at HOTS and teaching materials that do not apply HOTS (Collin, 2014). Therefore, this scientific study aims to develop teacher professionalism in HOTS and develop teaching materials that do apply HOTS. Of the several alternatives in the professional teacher enforcement of the Directorate General of Primary and Secondary Education of the Ministry of National Education (2005), researchers in develop teacher professionalism in the MGMP empowerment program in the East OKU district area. While the development of teaching materials used is Realistic Mathematics Education (RME), which has been shown to increase students' understanding of mathematics learning so as to enhance students' understanding of higher-order thinking skills. So that collaboration between the development of teacher professionalism and the development of teaching materials is expected to improve HOTS of Indonesian students.

Keywords: HOTS, RME

Introduction

In this globalization era, every person is required to have the ability or skill to be able to compete, commonly referred to as 21st century skills. These skills include matters of critical thinking, creative, communication, and collaboration, as well as abilities in communication technology and information both actively and passively. To get there, the Higher Order Thinking Skills (HOTS) must be emphasized in every learning process at every level of education. Higher Order Thinking Skills need to be developed in school as a basic ability to jump in real life. This is confirmed by Marshall & Horton: "High Order Thinking Skills [HOTS], such as logical thinking, critical thinking and reasoning skills are the basic skills for daily life, apart from academic achievements in the schools" (2011). Mathematics is one of the strategic "homes" to teach this thinking ability. Therefore, knowledge and Higher Order Thinking Skills along with aspects of learning, should be mastered by teacher, especially mathematics teachers. "The nature and development of these skills, specifically in the context of teaching and learning must be understood by teachers in all sectors of education" (Armella & Santos-Trigo, 2013).

However, if the teacher does not have an understanding of HOTS, it is hoped that high-level learning will be difficult. This, as Collin reminded, "The ability to integrate HOTS into mathematics can be limited by a number of factors including HOTS's limited knowledge" (Collins, 2014). Mathematical learning which is oriented towards developing higher-order thinking skills requires adaptation of assessment activities. As in learning, assessment oriented to higher-order thinking skills is expected to facilitate students in increasing their capacity for higher-level thinking. Questions that require higher-order thinking skills have already begun to be applied in the National Examination in the 2104/2015 school year and are increasingly being extended to the National Examination in 2018. This is expected to encourage the development of higher-order thinking. Student skills in Indonesia so that it becomes a competitive nation.

Various national and international studies show that high order thinking skills of students in Indonesia are still low. This was indicated by decline result of national examination the in 2018

compared to the results of the previous year. The decrease in the results of this National Examination was allegedly caused in 2018 student and teacher feel the question were more difficult than the previous years. The low order thinking skills of Indonesian students is also evident from the results of several international assessments. The results of the 2015 PISA (International Student Assessment Program) study in 2015 showed that Indonesian students were ranked 63rd out of 69 countries.

By adapting Realistic Mathematics Education (RME) with a concept to improve mathematics education in Indonesia which discusses how to improve students' understanding of mathematics and develop reasoning power. Learning with RME models is suitable or supportive high order thinking skill especially with subject and contextual learning (Suktinah, 2007: 20). Several studies on RME have been conducted at the primary or secondary school level showed increase high order thinking skill (Hadi, 2002; Fuadiah, 2009; Zulkardi, 2002; Haryono, 2011).

Therefore, this scientific study aims to develop teacher professionalism in HOTS and develop teaching materials that do apply HOTS. Of the several alternatives in the professional teacher enforcement of the Directorate General of Primary and Secondary Education of the Ministry of National Education (2005), researchers in develop teacher professionalism in the MGMP empowerment program in the East OKU district area. While the development of teaching materials used is Realistic Mathematics Education (RME), which has been shown to increase students' understanding of mathematics learning so as to enhance students' understanding of higher-order thinking skills. So that collaboration between the development of teacher professionalism and the development of teaching materials is expected to improve HOTS of Indonesian student.

Research Method

The Directorate General of Primary and Secondary Education of the Ministry of National Education (2005) follows several alternatives for the Teacher Professional Development Program, as follows:

1. Teacher Education Qualification Improvement Program
2. Equalization and Certification Program
3. Competency Based Integrated Training Program
4. Educational Supervision Program
5. MGMP Empowerment Program (Subject Teachers' Meeting).
6. Teacher symposium
7. Other traditional training programs
8. Read and write journals or scientific works
9. Participate in Scientific Meetings
10. Conduct research (specifically classroom action research)
11. Internship
12. Following the Actual News and Media News
13. Participating and Active in Professional Organizations
14. Promoting Collaboration with Peers

Of the several alternatives in the professional teacher enforcement of the Directorate General of Primary and Secondary Education of the Ministry of National Education (2005), researchers in develop teacher professionalism in the MGMP empowerment program in the East OKU district area for 20 hours. Because MGMP Empowerment Program (Subject Teachers' Meeting) covers five development models for teachers that is: Individual Guided Staff Development, Observation/Assessment, Involvement in a development/Improvement Process, Training, and Inquiry.

a) Implementation methods and techniques used in the implementation of professional development of mathematics teachers in East OKU district by applying the principles of Andragogy include adding:
   - Brainstorming
   - Discussion
   - Work in group
   - Presentation

- Plenary

b) Structure and Program

The professional development activities of mathematics teachers in OKU Regency are carried out with the following structures and programs:

- 2013 curriculum policy (resource persons) 2 hours
- 21st century concept of learning and renewal (resource person) 4 hours
- Development of HOTS questions (Resource person) 3 Hours
- HOTS Model (Resource Person) 2 Hours
- Group work (Participants) 4 hours
- Discussion / Percentage (Peseta) 4 Hours

The results obtained were tested by the participants in their respective education units and asked for help to validate the questions that have been generated and revised based on the expert/expert and retested.

Discussion

To achieve the objectives of this scientific study, researchers examine several important things that have proven to be able to develop teacher professionalism in HOTS and develop teaching materials in HOTS that are easily understood by students. But because this research is still ongoing researcher only can gather some research about the collaboration between the development of teacher professionalism and the development of teaching materials to improve HOTS of Indonesian students. Higher order thinking skill (HOTS) is one of the students' abilities that should be developed through teaching and learning. Teachers' knowledge about HOTS and its teaching and learning tactics is a key to successful education higher order thinking skill (HOTS) is one of the students' abilities that should be developed through teaching and learning. Teachers' knowledge about HOTS and its teaching and learning tactics is a key to successful education higher order thinking skill (HOTS) is one of the students' abilities that should be developed through teaching and learning. Teachers' knowledge about HOTS and its teaching and learning tactics is a key to successful education

According to Retnawati et al., 2018 higher order thinking skill (HOTS) is one of the students' abilities that should be developed through teaching and learning. Teachers' knowledge about HOTS and its teaching and learning tactics is a key to successful education. However, in implementing HOTS, the overall findings indicate that two-thirds of the teachers (66.6%) were still low-level users of HOTS. This is based on the teachers' response in the open-ended question that gave little evidence that they implement HOTS. This research has indicated that educational change depends on what teacher 'do' and 'think'. It is what the teachers believe and what teachers do in the classroom that ultimately shapes the kind of learning that students get (Hashim AT, et al 2015). So, from statement above develop, teacher professionalism in HOTS is very important.

Researcher choose MGMP empowerment program as teaching development professionalism method because MGMP Empowerment Program (Subject Teachers' Meeting) covers five development models for teachers that is: Individual Guided Staff Development, Observation/Assessment, Involvement in a development/Improvement Process, Training, and Inquiry (Table 1). So that, hopefully can increase teacher professionalism in HOTS.

Table 1. Teacher Development

Teacher Development Model	Information
Individual Guided Staff Development	Teachers can assess their learning needs and be able to learn well to direct themselves. Teachers must be motivated when aligning basic learning goals
Observation/Assessment	Observing and evaluating from teaching provides teachers with data that can be used for the purpose of improving student

	learning. Reflection by the teacher in practice can be enhanced by other observations
Involvement in a development/Improvement Process	Adult learning is more effective about solving problems to solve problems. Teachers need to gain knowledge or skills gained through the process of improving the school or curriculum.
Training	There are techniques and behaviors that are suitable for the teacher to emulate in the class. Teachers can change their behavior and learn to apply behavior in their classrooms.
Inquiry	Professional development is a collaborative studio by the teachers and problems that arise from efforts to make them disciplined with the values of the field of education.

Higher order thinking skill (HOTS) is one of the students' abilities that should be developed through teaching and learning. Teachers' knowledge about HOTS and its teaching and learning tactics is a key to successful education. However, in implementing HOTS, the overall findings indicate that two-thirds of the teachers (66.6%) were still low-level users of HOTS. This is based on the teachers' response in the open-ended question that gave little evidence that they implement HOTS. This research has indicated that educational change depends on what teacher 'do' and 'think'. It is what the teachers believe and what teachers do in the classroom that ultimately shapes the kind of learning that students get. High order thinking skills, history teaching, curriculum change, curriculum innovation

According to Zulkardi and Putri (2010), RME is a learning theory that starts from things that are real or experienced by students, supports the process of learning mathematics, discussing and collaborating, and finally using mathematics is to solve problems both individually and in groups. In this role, the teacher or moderator or evaluator while the role of students is more and actively thinking, communicating their arguments, justifying their answers, and also practicing their mind strategies. From the opinion of the experts above, it can be concluded that the RME in making the lesson more real, because the problem given is a contextual problem. In solving contextual problems students are guided by the teacher until they understand the mathematical concepts they are learning. For students, they are required to be more active in thinking, communicate their arguments, justify their answers, and prepare strategies to support their answers. So, from statement above we can conclude that RME can increase students 'understanding of mathematics learning so as to enhance students' understanding of higher-order thinking skills.

Conclusion

The results of this scientific study hopefully that the development of teacher professionalism can be done by increasing the professionalism of educators in developing and utilizing educational technology in the world of education. Professional educators can interpret the commitment to increase their professionalism and continuously develop strategies that they use in doing work in accordance with their profession. Educator can be achieved by deepening scientific field (cognitive) through postgraduate education, education and short-term training; improve psychomotor and affective abilities through training, workshops, seminars, discussions, academic and academic activities while developing teaching materials that are important for students, with high order thinking skills can be done using the RME approach it has been proven.

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Students' Reflection on Maori's Initial Life and Its Relationship with White People in New Zealand through the DESCA Approach

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Abstract: Reflection is one of the learning activities in several learning models. This study wants to answer the student's reflections about the Maori Life and Their Relationship with White People in New Zealand through the DESCA approach (Dignity, Energy, Self-Management, Community, Awareness). This research uses qualitative research with grounded theory and systematic design. Some students represent their groups in class about the History of Australia and Oceania. The results of the questionnaire also answered reflections based on material. The questionnaire adopted the DESCA approach. Reflection is given after the learning process. This reflection can be a reference for researchers and students to follow up on the learning process and classroom action research.

Keywords: Reflection, Maori Life, White People, DESCA Approach

Introduction

This research was appointed to explore concepts through reflection. Reflection is the way each individual reviews the learning process that has been done. Harisman (2018) in his journal states that reflection can help individuals to correct the mistakes they have made and avoid the same mistakes.

The application of reflection to students is a common thing to do with USD students. Reflection is one part of the approach called the Reflective Pedagogy Paradigm (PPR). PPR implementation in learning through a cycle consisting of 5 main elements. The main elements are: context, experience, reflection, action, and evaluation (P3MP, 2008: 8).

Learning PPR patterns is learning that integrates learning in the field of study with the development of human values. Learning in the field of study is tailored to the context of students, while the development of human values is developed through the dynamics of experience, reflection and action. This learning is escorted by evaluation (Subagya, 2010: 51).

PPR learning objectives are realized in 3 elements that exist in the learning objectives. These three elements are Competence, Conscience, and Compassion. Competence is cognitive or intellectual ability, Conscience is an affective ability to make choices that can be morally accountable, while Compassion is a psychomotor ability in the form of concrete and inner actions accompanied by compassion for others (Subagya, 2010: 23-24).

The process of reflection is related to the professionalism of students as prospective teachers in teaching activities according to Donald (1987) and Danielson (2009) that a professional teacher must reflect on his actions. Lin (2013) also conducts research in professional development where teachers reflect themselves with peers. Zeichner (2008) has used his experience for years to reflect. According to Calderhead (1989), teachers must realize that the role of reflection is very important in learning world teacher learning process.

Students will discuss the material and its depth through reflection. There are many studies of Maori life in New Zealand. This article focuses on learning design, where students are invited to reflect on the beginning of Maori life in New Zealand and its relationship with white tribes in Australia. The term white tribe refers to the British immigrant community who built a colony and federation in Australia. The great exploration of Europeans into the Pacific region is in line with the slogan of the English nation, namely *"Swing to the East"*.

After the occupation and the tribal war, the pride of Maori culture began to live again in the 20th century. In 1936, the Maori per thousand birth rates was 44; increased to 46 in 1961 but fell again to 39

in 1967 (Osborne, 1970). In 1961, the Maori tribe constituted 7.4% of the population of New Zealand. In 2000, the Maoris could amount to 700,000, or 14% of the population of New Zealand (McLintock, 1966). At present Maoris estimates that they represent 10% to 12% of the population. The high percentage of Maoris is in the younger age group, and relatively few in the older age group (Brown, 1991).

The approach used as a guide to process reflection is DESCA. The DESCA approach was developed by Merill Harmin and Melanoe Toth (2012) who respond to fundamental questions about teaching. Every strategy explains that everyone must respect each other, not regulate like a boss; collaboration not isolation; commitment on learning, not fear of failure and dignity, not flattery or appreciation only for a handful of students. A Practical approach that drives the extraordinary positive abilities students have. This approach is based on approaches that suggest a focus on students' natural focus. Bring out the best abilities students have, which are often accompanied by positive abilities that students themselves have not yet known.

This approach is more concrete to achieve goals through 5 potentials that exist in students.

Table 1. Dignity

1	**2**	**3**	**4**	**5**
Students feel inferior: Students appear lethargic and lazy, as if they feel insignificant, weak, and helpless. Or they act as if they will be worthless without success or recognition from others. They show a level of self-confidence, self-respect, and low self-esteem.			Students learn respectfully; Talented or not, students sit and walk with upright and confident. Students feel confident that they can succeed and solve problems. Students feel very confident about their pride.	

Table 2. Energy

1	**2**	**3**	**4**	**5**
Students seem unhappy or anxious: The rhythm of learning in the classroom seems slow, often without creativity, a lot of waiting, not passionate, wasting time. Or the class atmosphere is too chaotic, causing stress, tiring, and chaos.			Student energy flows well: Students are busy, involved and active. The atmosphere in the classroom is very lively, no one pays attention to time. Time seems to pass quickly.	

Table 3. Self-Management

1	**2**	**3**	**4**	**5**
Students only follow orders: Students do not show personal responsibility or personal choice. Students learn passively, without commitment from themselves.			Students organize themselves: Students make the right choices and guidelines, and carry out self-discipline, have the willingness to learn and be diligent. Students do not need to be governed.	

Table 4. Community

1	2	3	4	5
Students only care about themselves: Students act for their own sake, regardless of the circumstances of others. They do not show sharing behavior, do not cooperate, do not respect each other, or are kind to friends or teachers			Compactness appears: Students often show mutual sharing, work together, be kind, and feel dependent on each other. There is no antagonistic, mocking, or rejection behavior.	

Table 5. Awareness

1	2	3	4	5
Students look bored and busy themselves: Class feels unpleasant. Students seem unconcerned, do not respond, or think narrowly and superficially. Little or no thinking, finding out, or learning concentration; many students don't pay attention to the lesson. Student's talk looks like she is or is not smart.			Students who are insightful and ready: Students demonstrate the concentration of learning, observing, listening, thinking, paying attention, evaluating, and creating. Students look smart, can understand what is happening. They have a high level of attention. Student talk looks smart.	

The study was conducted in the History of Australia and Oceania class. At the 11th meeting the students conducted the lecture on the topic “New Zealand conditions after the British occupation”. Before lectures are conducted, researchers have designed the implementation of learning. There is one group consisting of 4 students who explain the material and materials given by the lecturer. After that, students conduct discussion activities. After carrying out the discussion students fill out a questionnaire such as confirmation of the material or reflection of the learning activities that have been carried out.

From some of the above explanations, this article wants to answer student reflections through the beginning of Maori tribal life and its relationship with the white tribe (of British descent) in New Zealand through the DESCA approach.

Research Method

The method used in this research is a qualitative approach with grounded theory research design. Student reflection in the form of a review of the process of learning and reflection helps each individual realize the importance of analyzing a historical event. A pattern of historical events in various parts of the world will occur or repeat with different times and masses. Researchers use Creswell's (2015) view of research design. The research design is a systematic qualitative procedure that is used to bring up a general explanation of the researcher based on the participants' views, describe the process or interaction between participants.

Discussion

At the planning stage the researcher prepares teaching materials for courses in History of Australia and Oceania. The brief material on the topic of the Beginning of Maori Tribe Life and Its Relationship with the White Tribe in New Zealand. The initial concept that was intended to show students was openness that made progress. This was also felt by the Maori tribe who was labeled as a native of New Zealand. The second concept that wants to be instilled in students is the attitude of humanism in every human person. The Maori are considered to have a civilization better than the Aboriginal people. This can be seen from parliament that the indigenous people of New Zealand have a good position in parliament compared to the indigenous tribes in Australia.

With swiftness and learning from experience, the British government responded to the good opportunities of various heterogeneous tribes in New Zealand by offering the Waitangi Agreement for the tribe who would accept the benefits of the British. Various interventions were given one of them by offering weapons to cooperative tribes. In addition, these tribes are offered for trade cooperation.

In addition to preparing teaching materials with students, researchers also prepared questionnaires filled through the google form application as a medium for student reflection. The research carried out on the Learning Implementation began on May 13, 2019 in the course of History of Australia and Oceania which was attended by fourth semester students of FKIP USD History Education.

The results of the reflection on DESCA are described in 2 categories, namely the statement and question categories. Here is a diagram of the results of the first category:

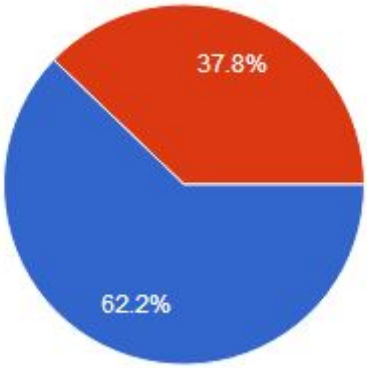

Figure 1. Reflection diagram of dignity

From the reflection about dignity, students who answered yes were 62.2% while those who answered were 37.8%. Most students feel more inferior to show their abilities. This finding is reinforced by the heterogeneous classroom situation that is derived from students with a variety of backgrounds, so it tends to group to reach something even closed.

The concept of dignity is elaborated through several ideas outlined by students including. Everyone has the same opportunity to act, has an open attitude, is open to change. This is in line with the struggle

of the Maori people who felt threatened by the beginning of the arrival of colonialism, in such circumstances they were able to take the positive things offered by the colonial side.

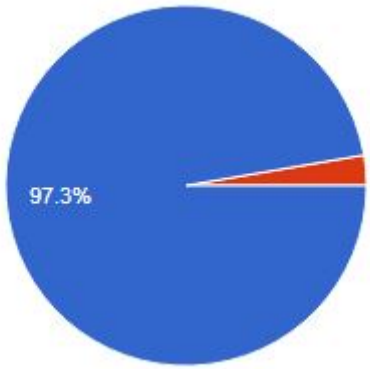

Figure 2. Reflection diagram of energy

The second diagram illustrates energy reflection. 97.3% of students answered that they have the spirit of life if their family and friends support their actions. This finding was proven during lectures that there are many personal problems that can be solved by reinforcement of friends from one area or one principle. Every individual's enthusiasm for life is in accordance with the principles taught by Driyakara, each individual is concerned with shared interests rather than personal interests. But there is still conflict about what I have done. More than that I will stick to the philosophy of Sunan Kalijaga, *Urip iku urup* so that despite many conflicts, I keep the spirit because while not harming others I will continue to work

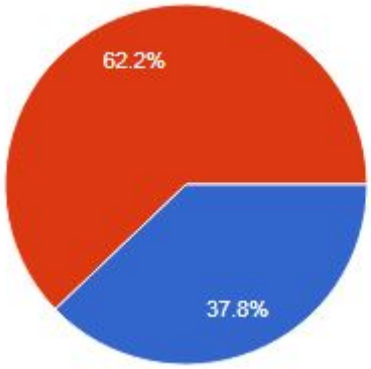

Figure 3. Self-management reflection diagram

Furthermore, the student self-management reflection diagram is explained that 62.2% of students are always ready with challenges and assignments despite new things. The remaining 37.8% of students are not ready. One thing that is important to study each historical event, especially analyzing the dynamics of historical events makes students feel they gain more experience to look to the future in the direction of progress.

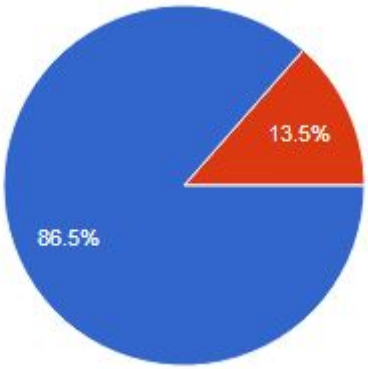

Figure 4. Diagram of community reflection

From Figure 4 it can be explained that there are 86.5% of students who prefer to work proactively and creatively than waiting for instructions from parents and lecturers. These results indicate that the current of globalization has a significant impact on the development of student life and even the dynamics of culture and background are a strong reason that many generations in Indonesia are able to pass through challenges. For that, it needs great support from the leaders of change to change the mindset of today's generation.

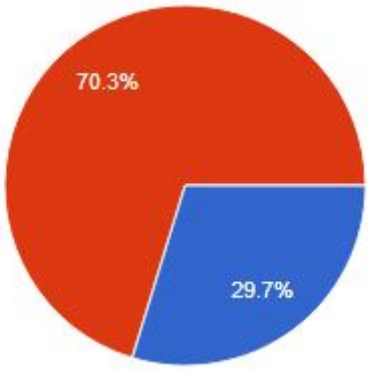

Figure 5. Reflection diagram of caring

The last diagram illustrates that 70.3% of students have no effect if an action is detrimental or beneficial to themselves and others. So, it is said that these students care more about each other than their own interests.

Conclusion

This article wants to answer Students' Reflection on Maori's Initial Life and Its Relationship with White People in New Zealand through The DESCA Approach.

This research shows new concepts about life by analyzing and reflecting about national life in Indonesia as a country of pluralism with Maori Tribe Life and its Relationship with the White Tribe in New Zealand.

New concepts instilled from the results of reflection include: (1) upholding dignity by working sincerely, not being afraid of the comfort zone, and looking for supportive opportunities; (2) maintaining positive energy by living in harmony and, being enthusiastic in working as long as it does not harm others; (3) being able to share time and willing to sacrifice for priority; (4) always maintaining common

interests by maintaining tolerance and unity; (5) being self-committed by showing concern as perpetrators of change.

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The Comparison of Effectiveness between Think Pair Share (TPS) and Team Assisted Individualization (TAI) Types of Cooperative Learning in Mathematics at Junior High School Students

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Abstract: The current study aims to describe and compare the effectiveness of TPS type and TAI type of cooperative learning. The effectiveness of learning is seen from a significant increase in learning outcomes, the students' activities are averagely in the active category at minimum, and the students' responses tends to be minimally in the positive category. The research design used was a quasi-experimental study with Pretest and Posttest group design. This study involved two experimental classes. The population in this study was the seventh-grade students of SMP Negeri 3 Walenrang with which the two classes being the samples of the study were class VII.B taught by the use of TPS and class VII.C with TAI type of cooperative learning. The two research instruments used in this study were a test of mathematics learning outcomes and a non-test instrument which is an observation sheet of student activity and questionnaire of student responses. To find out the effectiveness of metaphorical learning through cooperative learning in TPS and TAI type, the data were analyzed with one sample t-test statistics at a significance level of 5%. Then to compare the effectiveness of the two experimental groups, the data were analyzed with an independent sample t-test. The results showed that (1) cooperative learning of TPS and TAI type were significantly effective in incereasing students' mathematics learning outcomes, the average of students' activity was categorized as 'active', and student responses tends to be positive in category, (2) there was no significant differences between TPS type and TAI type of cooperative learning in the seventh grade students of SMP Negeri 3 Walenrang.

Keywords: Cooperative Learning, Think Pair Share, Team Assisted Individualization

Introduction

By the globalization era and the advancement of science and technology, education has certainly emerged to have a very important role. Education is a vehicle to improve and develop the quality of human resources. The success of education is measured by the improvement in the quality of human resources. All education providers in every unit have a great responsibility in educating students to master the competence they should achieve. Teachers in this case play an important role in the education processes. One of which is in mathematics learning.

Generally, the purpose of education for students is interpreted as the development of cultural values and national character of students so that they may gain positive values and characters to be applied in their lives as members of a religious, nationalist, productive, and creative society. To achieve this, educators who play an important role during the learning process need to apply a learning model that can stimulate students to be able to think critically, to analyze, to improve problem solving skills as well as mastery of concepts.

Mathematics is a field of science which is very fundamental. The students' low achievement particularly in junior high school mathematics is still a major problem to teachers in this field in particular and to the world of education in general. The low learning achievement of mathematics is influenced by many factors including the learning process at school. At schools, some teachers tend to choose unsuitable models and approaches to be used to overcome students' difficulties in learning mathematics. Although the 2013 curriculum requires teachers to be creative in choosing the learning models, most of which applied by teachers in Junior High Schools at Walenrang are still monotonous, so the students still have some difficulty in understanding the material being taught to them. There are many learning models and approaches that are designed to help students to improve their mathematics

learning achievement. With that being the case, cooperative learning could be one of the learning models that can increase students' participation in class and place them as the center of learning. Among many cooperative learning models, the researchers chose to apply Think Pair Share and Team Assisted Individualization type of cooperative learning. These two types of cooperative learning models are chosen because group learning and collaboration are thought to be more effective and useful.

According to Slavin (2008: 257), TPS learning is a very simple learning yet very useful by grouping students in pairs which can increase students' interaction, independence, responsibility and participation in learning. By collaborating and discussing with friends their peer students will be able to solve any problems encountered during the class. This is in line with previous research by Utama, et al. (Zuhanisani, 2016) suggesting that TPS type of cooperative learning has a significant effect on student achievement. Whereas research by Siur Asih Siburian emphasizes that TPS is one method that can be used to solve learning problems in junior high schools.

The Team Assisted Individualization (TAI) is another type of learning model from cooperative learning that is able to create an effective learning. This learning model is designed to individually overcome student's learning difficulties, therefore learning activities mostly makes uses of problem solving. A distinctive feature of the Team Assisted Individualization (TAI) learning model is that each student individually learns the lesson which has been prepared by the teacher. This is supported by the previous research conducted by Tarim and Akdenis (Zuhanisani, 2016) which revealed that the TAI type cooperative learning model had a more significant effect than the STAD type cooperative model.

The nature of effective mathematics learning can be fulfilled only if the students' skills to work individually and cooperatively can be raised, and if they have a sense of responsibility. As it is known that the two types of cooperative learning model; Think Pair Share (TPS) and the type of Team Assisted Individualization (TAI) are learning models that can improve the effectiveness of students' learning achievement. Siti Amirah Budiastuti, et al. (2013) in her research stated that mathematics learning achievement of students who were taught with TPS type of cooperative model was as good as TAI and both were better than using conventional learning models. Therefore, the researchers want to compare the two learning models. On the other hand, they also want to see how students' responses and enthusiasm take part in mathematics learning before and after using both Think Pair Share (TPS) and Team Assisted Individualization (TAI) types of cooperative learning models.

Research Method

This research is a quasi-experimental study with Pretest and Posttest groups' research design. The population is all seventh-grade students at SMP Negeri 3 Walenrang and the sample is taken using the simple random sampling technique to obtain class VIIB as an experimental class I which was taught by using Think Pair Share (TPS) type and class VIIC as an experimental class II by using Team Assisted Individualization (TAI) of cooperative learning. The data collection instruments used in this study are a test, a questionnaire, and observation sheets. The test is used to collect data on student mathematics learning outcomes before and after treatment of the sample, meanwhile questionnaires are used to collect students' responses after the application of the learning model, and lastly observation sheets of students' activities are used to collect the data on students' participation during the classes.

The type data of this current study is quantitative. This data was obtained from a student learning achievement test. Quantitative data analysis was performed using statistical tests on the pretest, posttest, and test improvement scores in the learning outcomes of both classes. The data were analyzed to test the research hypotheses stated as follows:

H0: There is no significant increase in mathematics learning outcomes of students who received treatment in the form of TPS and TAI type of cooperative learning

H1: There is a significant increase in mathematics learning outcomes of students who received treatment in the form of TPS and TAI type of cooperative learning

Differences in student learning outcomes in the two classes; experimental class I taught using the Cooperative Learning Model Think Pair Share (TPS) type and experimental class II taught using the Team Assisted Individualization (TAI) type of cooperative model were determined by using the

Independent Sample T-test analysis test. Before conducting the analysis, the researcher previously conducted the Data Normality Test and the Variant Homogeneity Test. In addition to those, the researcher conducted the Paired Sample T-Test to see whether there was an increase in learning outcomes after implementing the TPS type cooperative learning model or the TAI cooperative type.

Discussion

Before applying the treatment to the experimental class, the sample must be in a balanced state, the data used must be normally distributed. Based on the normality test, the sig. value in the experimental class I who were taught using a TPS type of cooperative model is 0.44 greater than 0.05. It was then concluded that H_0 was accepted (normally distributed data) and sig values. In the experimental class II taught using the TAI type cooperative model is 0.124 greater than 0.05, so it was concluded that H_0 was accepted (normally distributed data). While from the homogeneity test results, it was obtained that the probability or sig. value is 0.097 and it was greater than 0.05, so it is concluded that both groups and samples come from populations that have the same variance (homogeneous).

Based on paired sample t-test, the average score of students' learning outcomes after being taught with TPS type of cooperative learning is better than the average score of student learning outcomes before TPS being implemented. Based on the average value of students in experimental class I, it was obtained that the average score of students after and before being taught with being taught with TPS type of cooperative learning are respectively 89.4 and 35. Because the average value of posttest is higher than the posttest, it can be concluded that there is an increase in student learning outcomes after being taught by using TPS type of cooperative learning. As for the experimental class II, the average score of student learning outcomes after being taught with TAI type of cooperative learning is better than the average score of students' learning outcomes before being taught with TAI type of cooperative learning.

Based on the students' average scores, the average score of students after and before being taught with TAI type of cooperative learning are respectively 82.95 and 30.33. Because the posttest average score of students is higher than the pretest, it can be concluded that there is an increase in the learning outcomes of students taught with cooperative learning type of TAI. While the results of the independent sample t-test obtained a significance value of 0.091, which means H1 was rejected. So, it can be concluded that there is no difference in the improvement of students' mathematics learning outcomes taught by the TPS type and the TAI type of cooperative models. Based on the achievement of learning effectiveness, both TPS and TAI types of cooperative learning are effective to be applied in the lesson topic of Integers in seventh grade students of SMP Negeri 3 Walenrang. The details are presented in the Table 1.

Table 1. The effectiveness of learning outcomes

Cooperative learning types	Results of Learning outcomes	Average students' participation during the class	Average students' responses during the class	Difference between pretest and posttest
TPS	100% (accomplished)	3,36 (effective)	3,17 (Good)	54,15
TAI	100% (accomplished)	3,1 (effective)	3,48 (Good)	52,35

Based on the results of the analysis by comparing the average difference between pretest and posttest, it was found out that the average learning outcomes of students who are taught with TPS and TAI types of cooperative learning are in category of complete. It can be seen in the average activity of students who are taught with TPS model which is greater than the average activities of students taught with TAI type, both are in the effective category. But the response of students taught with TAI type was greater than the response of students taught with the TPS type and both were in the good category. Moreover, the difference between the pretest and posttest scores in the class taught with TPS model is

greater than the difference in the pretest and posttest in the class taught by the TAI type. It can be concluded that students' participation, student responses and average outcomes of student learning in TPS type are better than those in TAI type. But the results of data analysis show that the probability value obtained is greater than 0.05, meaning that the average difference between student learning outcomes before and after being taught with TPS and with TAI type has no difference (similar) with mathematics learning outcomes after being taught with TAI type cooperative learning. There are several findings during the study such as (1) the increase of learning outcomes in the TPS taught class is greater than of which in TAI taught class, although there is no significant difference. (2) The rejection of the hypothesis that says there is a difference in the increase of mathematics learning outcomes of students who were taught using TPS and TAI types. It may happen in the TAI class due to discussion group members' assignment which was based on different abilities. The students may think it was less pleasing because they did not want to part away from group members which they usually discuss with during the class. Students felt that the success or failure of group discussions depended on whether the group members are smart or not. In fact, one element of cooperative learning is the existence of mutual cooperation and positive interdependence. TPA and TAI types are learning process that uses the skills of being on duty, taking turns, listening actively, and willingness to ask questions about the unknown, Van Wyk (Budiastuti, 2013).

Conclusion

Based on the results of data analysis and discussions, it can be concluded the results of the study are as follows: (1) students respond positively to the application of TPS and TAI types, (2) student activities during the application of TPS and TAI types are relatively effective, (3) Student mathematics learning outcomes have increased after the application of TPS and TAI types, (4) There is no significant difference in the improvement of learning outcomes after the application of TPS type and TAI type of cooperative model.

Based on the conclusion of the above research results, the author can provide some suggestions summarized as follows: (1) Referring to the results of this study, TPS and TAI types of cooperative type can improve student mathematics learning outcomes. With that being the case, the teacher can use the learning models in mathematics learning. (2) In implementing TPS and TAI types, it is expected that the teacher prepares the best and maximizes the role of group discussion so that the learning process can take place effectively. (3) Other researchers can conduct research on the effectiveness of the TPS and TAI types of cooperative models on students of different subject matter.

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Analysis of Problem-Solving Skills of Seventh Grade Students of Indonesia Institute of Yogyakarta Junior High School in Triangle Materials after the Implementation of Problem-Based Learning Model

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Abstract: The objectives of this study were (1) to describe the learning steps of triangular material using a problem-based learning model (2) to describe the problem-solving skills of class VII students of the Yogyakarta Institute of Indonesia Junior High School in triangular material, after learning using problem-based learning. This type of research is design research. The research instruments used were field notes and learning outcomes test sheets. Field notes are used to describe the steps of problem-based learning while the learning outcomes test sheet is used to see students' problem-solving skills according to NCTM. Method of collecting data is in the form of documentation and test results. Data analysis techniques carried out are data reduction, data presentation, and conclusion. This research was conducted in March 2019. The research subjects were 20 seventh grade students of the Yogyakarta Indonesian Institute Junior High School. The results of this study are in the form of a description of the implementation of a problem-based learning model in triangular material and the analysis of problem-solving skills of seventh grade students of the Yogyakarta Indonesian Institute Junior High School after the learning outcomes test. Based on the results of the learning process description, the steps of the problem-based learning model in the triangular material at Indonesia Institute of Yogyakarta Junior High School at the first and second meetings were carried out according to the design made by the researcher. For analysis of problem-solving skills, in the number one problem, students have reached 4 indicators of problem-solving skills according to NCTM. Whereas in question number two, students have reached 3 indicators of problem-solving skills according to NCTM.

Keywords: Problem based learning, learning design, problem solving skills.

Introduction

Based on the results of observations that have been carried out in class VII of the Yogyakarta Indonesian Institute Junior High School on February 5 and 8, 2019, researchers found problems that occurred during mathematics learning activities. Most students are very active to play and do not focus on learning activities. Only a few students in the class listened to the teacher who gives learning material. This certainly influences the activities of solving the problem exercises given by the teacher. In the process of solving the practice questions, students did not complete the practice independently, but the problem-solving strategies were dictated by the teacher and there were several practice questions completed by the teacher himself without any contribution from the students. Several studies that can overcome the problems above are research from Samosir and Surya (2017) and Yusri (2018). Both of these studies obtained results that the implementation of a problem-based learning model can help students in generating problem solving skills in the learning process. So, the researchers designed the Hypothetical Learning Trajectory using a problem-based learning model on triangular material in class VII of the Yogyakarta Indonesian Institute of Middle School. Furthermore, at the end of the meeting, the researcher will analyze the problem-solving skills through the test of learning outcomes that are done by students.

Students' problem solving skills are analyzed based on indicators of problem solving skills according to NCTM, namely; identify the elements that are known, asked, and the adequacy of the elements needed, formulate mathematical problems or develop mathematical models, apply strategies to solve various problems (similar and new problems) in or outside the mathematics, explain or interpret the results according to the origin problem, and use mathematics meaningfully. In this study there are two formulation of the problem, namely:

1. How is the description of problem-based learning model implementation in triangular material in class VII of the Yogyakarta Indonesian Institute Junior High School?

2. How are the problem-solving skills of the seventh-grade students of Yogyakarta Institute of Indonesia Junior High School on triangular material after implementing a problem-based learning model?

Research Method

This type of research is design research. The research subjects were 20 seventh grade students of the Yogyakarta Indonesian Institute Junior High School. The method of data collection is the documentation and implementation of learning outcomes tests after the learning process takes place. The research instruments were field notes and learning outcomes test sheets. Field notes are used to describe the steps of problem-based learning while the learning outcomes test sheet is used to see students' problem-solving abilities according to NCTM. The data analysis technique used is the process of qualitative data analysis which begins with reducing data, presenting data, drawing conclusions.

Result and Discussion

3.1 Description of the Learning Process

3.1.1 The first meeting

In this study there are five phases of the problem-based learning model namely; student orientation to problems, organizing students to study, guiding individual/group experiences, developing and presenting work, analyzing and evaluating problem solving processes. The following is the result of the description of the learning process at the first meeting:

3.1.1.1 Stage of Student Orientation on Problems

In this phase, the teacher explains the purpose of learning, namely students can identify and explain the types of triangles with achievement indicators understanding triangles based on conditions to form a triangle, and through question and answer activities, the teacher also reviews the prerequisite material: students understand triangular material for levels elementary school and students master line and angle material.

In this phase, the teacher also explains the problem that will be solved by students.

Table 1. Student and teacher conversation

Teacher:	To better understand the material to be learned today. I will provide LKS consisting of 3 questions that you must complete. (The teacher reads out the indicators of achievement of competence, instructions for work, and the questions / problems listed below)
Students:	(listen to the teacher's explanation)

Problem in student worksheet:
Indicators of competence achievement
Get to know a triangle based on the terms of a triangle
Clue: do the questions below correctly
Question:

1. draw three random triangle shapes
2. measure the length of the sides of the triangle
3. which of the lengths of the sides below can form a triangle:

Table 2. Student Worksheet

	Side 1 (cm)	Side 2 (cm)	Side 3 (cm)
a)	1	4	6
b)	6	8	10
c)	5	15	6

3.1.1.2 Organizing students to learn

In this phase, the teacher divides students into several groups, each group consisting of 4-5 students. Next, the teacher distributes logistics such as: rulers and answer sheets in the form of millimetric paper to each group.

Table 3. Student and teacher conversation

Teacher:	You will solve these questions in groups so that you can discuss and share what you know to friends then you can solve the LKS questions. One group consists of 4 people and there is 1 group of 5 people. The group is based on the seat. Please those who sit on rows 1 and 3 turn around and form groups.
Students:	(begins to turn around and sit in groups)

3.1.1.3 Guiding individual / group experiences

In this phase, the teacher actively goes around from one group to another to help students if they experience difficulties. What happened during the discussion process, most groups raised their hands to ask questions when experiencing difficulties. There is one group asking as follows:

Table 4. Student and teacher conversation

Student:	Sis, this question number 1 means drawing a random triangle of 3, right?	Student:	Isosceles triangle, equilateral triangle.
Teacher:	not a random triangle, but a scalene triangle. Scalene triangle is any triangle you know, it doesn't have to be as random.	Teacher:	Yes, good. That means you can draw those three triangles right.
Student:	So can I draw right triangle?	Student:	(bobbing while starting to draw)
Teacher:	Yes, you can. Then what else?		

3.1.1.4 Develop and present the work

In this phase, the teacher asks all groups to take turns presenting the results of their work in front of the class. When another group presents the results of their work, the teacher asks the other group to listen. After presenting the results of the group work, the teacher asks the students if there is a response from other groups. But when the four groups presented the results, none of the groups gave a response, so at the end of the presentation from each group, the teacher thanked them and together with the other groups appreciated each group that work with applause.

Presentation from one group:

Table 5. Student and teacher conversation

Student:	Assalammualaikumwarrohmatulohiwabarakatu	Teacher:	Any responses?
Teacher+ students:	Walaikumsalam	Students:	No.
Student:	After we discussed, now we will present the results of our work. Number one, first triangle all sides 3 cm. The second triangle, the sides: 4 cm, 3 cm and 5 cm. The third triangle, its sides: 4 cm, 4 cm and 2 cm. Number three a is not a triangle, b is a triangle, and c is not a triangle.	Teacher:	Ok if there is no response, thank you and please give applause.

3.1.1.5 Analyze and evaluate the problem solving process

In this phase, the teacher confirms and concludes what has been learned in today's learning.

Table 6. Student and teacher conversation

Teacher:	For numbers 1 and 2, the average response of the group is quite correct and for number 3 a, if the sides are 1cm, 6cm, and 4cm it is not a triangle. So, if you draw, there is a line that exceeds that triangle. Now for the b side with sides of 6 cm, 8 cm, and 10 cm is a triangle because when it is drawn exactly it forms a triangle. And for the third one is c with sides 5 cm, 6 cm, and 15 cm, where the side that is 15 cm long the line will be longer than the existing triangle. Like that, brothers and sisters. Then, from questions number 1 and 2, what conclusions can you take? What is the triangle like?	Teacher:	7> 5. That means right. Then the others. Now 3 and 5. 3 + 5, is it greater than 4? What is 3 + 5?
Students:	There are 3 sides.	Students:	8.
Teacher:	How about the size?	Teacher:	8. Means 8> 5. Then the last one, 4 and 5. Is 4+5 greater than 3? 4 + 5?
Siswa:	(speaking unclearly)	Siswa:	9.

Guru:	Some can be the same, some cannot. The figure is measured based on the size of the ruler. Then for number 3?	Guru:	9. 9> 3. So, the condition for making a triangle is the sum of the two sides of the side greater than the length of the other side. Like this one (while pointing at the blackboard). So all three must be true. Suppose one of them is wrong, for example, 2, then this 1 (while pointing at the board) is less than 4, meaning that it is not a triangle. Ok, do you understand the conditions, right? The number of the two sides of the triangle must be greater than the length of the other side. Ok?
Students:	(didi not answer)	Students:	Ok.
Teacher:	From number 3 it can be concluded that the number of lengths of two sides must be greater than the length of the other side. Suppose the first side length is 3 cm, second is 4 cm, and the third is 5 cm (while drawing on the board). So, we must know whether the two triangle sides lengths are larger than the other sides of the triangle. Brothers and sisters, please pay attention to this explanation, because this material or this requirement will be used for the next meeting on Friday. Is 3 + 4> 5? Is it bigger or not? What is 3 + 4?	Teacher:	Understand, right? So, this condition will be used for further material, Friday. Later you will meet with Sis Mensi, with us too.
Students:	7.		

3.1.2 Second Meeting

3.1.2.1 The student orientation stage on the problem

At this stage the teacher explains the learning objectives, which will discuss the material about the types of triangles based on the length of the sides and based on the angle. Next the teacher reviews the material at the previous meeting, namely the requirement to make a triangle. After that the teacher explains the problem that will be solved by students.

Problems in student worksheet:

1. The number of the three sides of a triangle is 9 cm. Determine the length of the sides (in positive integers) and the type of triangle.
2. Given an ABC triangle with a large angle of 50°, then determine the three most likely two other angles, and what type of triangle is that? Explain the reason.

3.1.2.2 Organizing students to learn

At this stage the teacher divides students into groups of 4 to 5 students in one group. Then the teacher distributes the LKS while expressing that the students must discuss with their group friends to do the problems given in the LKS.

3.1.2.3 Guiding individual / group experiences

At this stage the teacher monitors the course of group discussions by going around to help students who are experiencing difficulties. The teacher also said that students may ask if someone does not understand.

The teacher goes around, and a group asks:

Student: Sis, what if we have more than one triangle?
Teacher: what number do you mean?
Student: Number one, Sis.
Teacher: It's okay, what matters is that it must be in accordance with the conditions.
The teacher continues to hear other groups asking:

Student: Sis for number one, it means the overall length of the side is nine centimeters, right?	Teacher: The statement "summarizing the three sides of a triangle is nine centimeters" means that if you add all the sides to the triangle the number is nine meters
Teacher: Try to look again at the statement on question number one. Student: I'm confused Sis.	Student: Oh, that's so, hahaha ok, thanks sis.

Teacher goes around and a group asks for question number 2:

Student: Sis, how do you determine the other angles?	Teacher: The summing of the three angles in a triangle is one hundred eighty degrees. Now, in question number two, you already know one angle, how do you determine the other two angles?
Teacher: do you still remember the total sum of angles in a triangle?	Student: Oh, Sis, using reduction, right?
Student: Forgotten, how much is it, Sis?	Teacher: Yes, like that, try to do it based on the ideas that you find
Teacher: You have learned it in elementary school Student: Forget Sis. How much is it sis?	

3.1.1.4 Develop and present the work

In this phase the teacher asks 2 groups who are willing to write the results of their work on the board. The first group writes and explains the problem no.1 and the second group writes and explains the problem no. 2.

Teacher: Explain to your friends the steps you are completing.

Student: For number one, we get a triangle with a length of sides three centimeters, three centimeters, three centimeters.
Teacher: Ok so what kind of triangle is that?
Student: Equilateral triangle and isosceles triangle, sis.
Student: We get the angles of fifty degrees, fifty degrees and eighty-five degrees. We subtract 180 degrees with 50 degrees and minus 50 degrees again.
Teacher: Why do you reduce it again by 50 degrees? What is the reason?
Student: Because it's an isosceles triangle, the two angles must be the same size.
Teacher: Good, for this problem there are still unclear or anyone want to ask?
Student: No, sis.

3.1.2.5 Analyze and evaluate the problem solving process

At this stage the teacher gives test questions and asks students to work individually for 40 minutes. After completing the test, the teacher invites students to evaluate what they have learned.

Table 7. Student and teacher conversation

Teacher: What have we learned today?	Teacher: ok I confirm again, there are two types of triangles, namely triangles based on the length of the sides and triangles based on the size of the angle. Well, triangles based on the length of the side are like isosceles triangles, equilateral triangles and scalene triangles. I'm sure you can tell the difference. Triangles which are based on the size of the angles are also three, namely the right triangle, one of the angles is 90 degrees. Then there is a blunt triangle with one angle more than 90 degrees, then there is an acute triangle, all angles smaller than 90 degrees.
Student: Triangle and angle size, sis.	

Based on the description of the learning process, it is seen that the steps of problem-based learning that are designed have emerged in practice in the field.

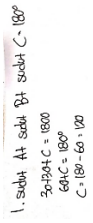
3.2 Problem Solving Skills Analysis

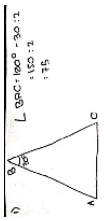
Problem 1:

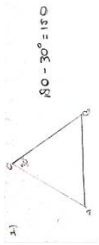
The value of one angle in an isosceles triangle ABC is 30°. Determine the other angles!
There are 3 possibilities that appear in the execution of the question.

Table 8. Student's Answer

Student Answer Group		
First group	**Second Group**	**Third Group**







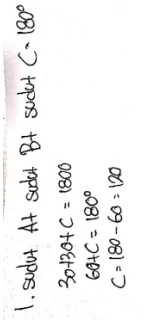
Description:

First group: it can be seen that students know that one of the angles beside the angle of ABC is 120 ° (This answer is correct according to the first strategy that the researcher has written on the THB clues). In this case, students already understand how to find the other side. But students only focus on finding angular values that are not angles forming an isosceles triangle. But from the students' answers, students actually know that the other angles (forming an isosceles triangle) are the same as in the question, which is 30 °. But students seem to forget that the other two angles are also asked, not just one, even though they understood that the other angle was the same as in the question.

Second group: it appears that students get the value of one angle beside the angle ABC is 75°. The results obtained are in accordance with the results stated in the second strategy the researchers wrote on the THB clues. Unfortunately, the way to get these results is still wrong. This is because students make a counting operation as follows, 180° – 30°: 2. Obviously, in the counting operation students are still mistaken. The division counting operation must be completed first, then the addition operation. If the counting operation is done incorrectly, the results obtained are also wrong. So, the researchers can conclude that students are able to understand, know, and solve problems that are being faced but the way it solved is still wrong and have not answered the whole question (students only answer 1 angle, they should answer the value of 2 angles, too).

Third group: it can be seen that students do not understand yet that the triangle should have three values of angle. The following is a justification based on indicators of problem-solving skills according to NCTM on student work:

Table 9. The Analyze of Problem Solving Skills According to the NCTM Indicators

Student's answer	Problem Solving Skills Indicator that reached	Explanation
	Identifying the elements that are known, asked, and the adequacy of the elements needed.	Students are able to identify the elements that are known, asked, and the adequacy of the elements needed in the problem even though implicitly. This is because the teacher gives less detailed instructions on the questions given.
	Formulating mathematical problems or compiling mathematical models.	Students are able to develop mathematical models to solve the problem. This can be seen from the student's answer: "angle A + angle B + angle C = 180°"
	Implement strategies to solve various problems (similar and new problems) within or outside mathematics.	Students use the addition and subtraction operations to obtain the angle they want to find.

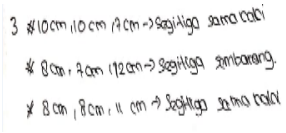
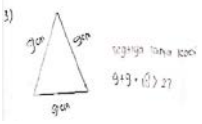
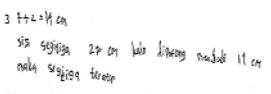
Explain or interpret the results according to the origin problem.	Students are able to interpret the results according to the original problem. Where the results are obtained from the problem given by the teacher and students' reasoning that if it is an isosceles triangle, it means that the other angles are also 30 °, so they can just look for another angle with a mathematical model and get another angle of 120°.
Use mathematics significantly.	Students have not been able to use mathematics significantly. This is because the teacher is less detailed in giving instructions to the questions given.

Conclusion

Students in the first possible answer have reached the four indicators of problem-solving skills, but the fifth problem solving skills, namely: using mathematics significantly has not been achieved. This is because the teacher is less detailed in giving referrals to the questions given. In the first indicator of problem-solving skills the teacher can only see the students' answers implicitly. Just like the fifth indicator of problem-solving skills, this is because the teacher is less detailed in giving instructions on the questions given. This is a mistake from the teacher. So that it is expected, the researcher / teacher can be more detailed and thorough in making the instructions and questions that will be given to students.

Problem 2:

Table 10. Student's Answer

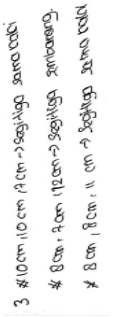
First Group	Second Group	Third Group
		

Description

First group: it can be seen that students have been able to determine three possible sides of the triangle with the length of the sides of the triangle is 27 cm. The students implicitly understand the terms in forming a triangle, it can be seen from the determination of the length of the three sides of a triangle that meets the requirements to form a triangle, namely the sum of the lengths of the two sides of the triangle must be greater than the third side. Then students can determine the type of triangle according to the length of the side.

Second group: show that students have determined one possibility about a triangle with a length of sides 27cm. Implicitly students have understood the terms in forming a triangle. This can be seen from the determination of the length of the three sides of the triangle that meets the requirements to form a triangle, namely the number of lengths of the two sides of the triangle must be longer than the third side. But students are still mistaken in writing the meaning of the terms for the triangle "9 + 9 = 18 > 27" should be written like this: 9 + 9 > 9. Students have been able to represent triangles in the form of images, but the size of the sides does not match the 9cm scale. In the third student's answer, it can be seen that students do not understand the question well, students do not understand the terms of forming a triangle and determining the type of triangle based on the length of the sides. The following is a justification based on indicators of problem-solving skills according to NCTM on student work:

Table 11. The Analyze of Problem Solving Skills According to the NCTM Indicators

Student's answer	Problem Solving Skills Indicator that reached	Explanation
	Identifying the elements that are known, asked, and the adequacy of the elements needed.	Students have not been able to identify the elements that are known, asked, and the adequacy of the elements needed in the problem even though implicitly. This is because the teacher is less detailed in giving instructions to the questions given.
	Formulate mathematical problems or compile mathematical models.	Implicitly students have been able to compile a mathematical model, this can be seen from the determination of the type of triangle whose total sides are 27 cm. Students have determined the sides correctly. In this case, before students determine the intended sides, students must perform a calculation operation that involves the process of making mathematical models.
	Implement strategies to solve various problems (similar and new problems) within or outside mathematics.	Implicitly students have been able to apply strategies in determining the lengths of the sides of a triangle based on the requirements to form a triangle. The sum of the two sides must be longer than the third side.
	Explain or interpret the results according to the origin problem.	Students are able to interpret the results according to the original problem. Where students have been able to determine the three sides of the triangle which if added together the result is 27cm, and students have been able to determine the type of triangle based on the length of the sides.
	Using mathematics significantly.	Students have not been able to use mathematics significantly. This is because the teacher is less detailed in giving instructions to the questions given.

Conclusion:

Students in the first possible answer have achieved three indicators of problem-solving skills but have not achieved the first and fifth problem solving abilities. This is because the teacher is less careful in giving referrals to the questions given. This is a mistake from the teacher. So that it is expected, researchers / teachers can be more thorough in making instructions and questions that will be given to students.

Conclusion

Based on the results of the learning process description, the steps of the problem-based learning model in the triangular material at Indonesia Institute of Yogyakarta Junior High School at the first and second

meetings were carried out according to the design made by the researcher. From the results of the analysis of problem solving abilities, in question number one, students have reached 4 indicators of problem solving skills according to NCTM, namely identifying elements that are known, asked and adequacy of necessary elements, formulating mathematical problems or developing mathematical models, applying strategies to solve various problems (similar and new problems) in or outside mathematics, explain or interpret the results according to the original problem. Whereas in question number two, students have reached 3 indicators of problem solving skills according to NCTM, namely formulating mathematical problems or developing mathematical models, applying strategies to solve various problems (similar and new problems) in or outside mathematics, explaining or interpreting results according to original problem.

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Learning Design about Proving Trigonometry Identity Using Problem-Based Learning (PBL)

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Abstract: This study aims to develop the design of learning proof of identity trigonometry in grade 10 Math and Science using PBL. Learning design is compiled using design research according to Gravemeijer & Cobb (in Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006), focusing on the first stage, namely: preparing for the experiment. The results of the study were in the form of a trigonometric identity proof learning design using PBL which had been tested on 33 Math and Science students of grade 10 in one of the private high schools in Yogyakarta. The learning process is adjusted to the syntax of PBL according to Ibrahim and Nur (Rusman, 2016). Phase 1: Orientation of students to the problem. Educators convey material topics, apperception, and explain in general the processes that will be experienced by students. Phase 2: Organize students to learn. Educators divide students into groups to work on Student Worksheet 1. Phase 3: Guiding individual or group experiences. Educators go around to each group to provide support in solving problems. Phase 4: Develop and present the work. Educators ask students to collect Student Worksheet 1 answers and then ask two students to present their group answers in front of the class. Phase 5: Analyze and evaluate the problem-solving process. Educators guide the analysis and evaluation process in accordance with the learning objectives to be achieved.

Keywords: learning design, trigonometric identity, problem based-learning syntax

Introduction

Based on the experience of the researcher teaching proof of trigonometric identity, this topic is not an easy topic to learn by students. In the 2016-2017 school year, researchers taught proof of trigonometric identity using the lecture method. By using this method, the learning outcomes that students get are not satisfactory. From 35 Math and Science students of grade 10-6 and 34 Math and Science students of grade 10-7 in the academic year, data obtained 54% of students in grade 10-6 were not completed and 82% of students of grade 10-7 were not completed. The average grade 10-6 bill is 71 and grade 10-7 is 64. The data makes researchers interested in composing learning designs about proving trigonometric identity by using problem-based mathematical learning models.

Based on the background described above, the researcher proposed the following problems: How is the design of learning to prove the identity of trigonometry in grade 10 Math and Science using PBL? The purpose of this study was to develop a learning design proof of identity trigonometry in grade 10 Math and Science using PBL.

Design Research and Problem Based Learning

Graveimejer & Van Erder (Prahmana, 2017: 13) states that design research is a research method that aims to develop a local instruction theory (LIT) with cooperation between researchers and educators to improve the quality of learning. According to Prahmana (2017: 15) there are two important aspects related to design research, namely hypothetical learning trajectory (HLT) and local instruction theory (LIT). HLT is a hypothesis or prediction of how students' thinking and understanding develop in a learning activity (Prahmana, 2017: 11). Broadly speaking, LIT is the final product of HLT that has been designed, implemented, and analyzed the learning outcomes (Prahmana, 2017: 21). According to Gravemeijer & Cobb (in Van den Akker, Gravemeijer, McKenney, and Nieveen, 2006), design research consists of three stages, namely: preparing for the experiment, experiment design, and retrospective analysis.

Problem Based Learning (PBL) is one of the learning models that was first introduced in the 1970s at the Faculty of Medicine, McMaster University, Canada as an effort to find solutions in diagnosis by

making questions according to the situation (Rusman, 2016). Linda Torp and Sara Sage (2002) state their understanding of PBL as follows:

> *Problem-based learning is focused, experiential learning (minds-on, hands-on) organized around the investigation and resolution of messy, real-world problem. PBL—which incorporates two complementary processes, curriculum organization and instructional strategy—includes three main characteristic, namely (1) engages students as stakeholders in a problem situation, (2) organizes curriculum around a given holistic problem, enabling students learning in relevant and connected ways, and (3) creates a learning environment in which teachers coach student thinking and guide student inquiry, facilitating deeper levels of understanding.*

Ibrahim and Nur (in Rusman, 2016) suggest that PBL is one of the learning approaches used to stimulate high-level thinking of students in situations that are oriented to real-world problems, including learning how to learn.

From the opinions of some experts, researchers define PBL as a learning approach that presents contextual problems so as to stimulate the interest of students to learn. Students work in teams to solve the contextual problems given by educators. PBL is a learning method that challenges students to "learn how to learn", working in groups to find solutions to real-world problems given by educators. Contextual issues given by education are deliberately chosen to foster curiosity and high interest in finding solutions.

The principles or characteristics of PBL (Rusman, 2016) are (1) problems become the starting point in learning; (2) the problems chosen are problems that exist in the real world and are not structured; (3) problems require multiple perspectives (multiple perspective) in solving them; (4) problems can challenge the knowledge, attitudes, and competencies of students and then students can identify learning needs and new fields of learning; (5) learning self-direction becomes the main thing; (6) the use of diverse sources of knowledge, their use, and evaluation of information sources is an essential process in PBL; (7) learning is collaborative, communicative, and cooperative, (8) developing inquiry and problem solving skills as important as mastering the content of knowledge to find solutions to a problem; (9) openness of processes in PBL includes the synthesis and integration of a learning process; and (10) involves the process of evaluating and reviewing the experiences and learning processes of students. Ibrahim and Nur (Rusman, 2016) propose PBL steps as follows.

Table 1. PBL Syntax According to Ibrahim and Nur (Rusman, 2016)

Phase	Indicator	Educator's Behavior
1	Student orientation on the problem	Explain the purpose of learning, explain the logistics needed, and motivate students to be involved in problem solving activities.
2	Organizing students to learn	Helping students define and organize learning tasks related to the problem.
3	Guiding individual or group experiences	Encourage students to gather useful and appropriate information, carry out experiments to get explanations and problem solving.
4	Develop and present the work	Helping students in planning and preparing suitable works such as reports, and helping students to share assignments with other friends.
5	Analyze and evaluate the problem solving process	Helping students to reflect and evaluate the investigations and processes that students use.

Research Methods

The type of research used is design research according to Gravemeijer & Cobb (in Van den Akker, Gravemeijer, McKenney, and Nieveen, 2006) focusing on the first stage, namely: preparing for the experiment. This research was conducted in March-April 2018.

The primary data source of this study is the HLT Trigonometric Identity topic for class X Math and Science in which there is a draft Student Worksheet (SW).

Results and Discussion

Learning objectives such as those listed in HLT are: (1) students can prove trigonometric identity and (2) students can find strategies to prove trigonometric identity. This section will show the design of learning in accordance with the syntax of problem-based learning according to Ibrahim and Nur and adapted to the learning objectives above.

Phase 1:

Educators deliver material topics to be studied, after which educators explain in general the process to be undertaken, namely educators will provide problems and students will be divided into groups to solve these problems.

After explaining the process to be undertaken, educators provide apperception by asking: What are the basic identities that have been learned in previous learning?

If students can mention the basic identity that has been learned in the previous learning process, educators give appreciation and then continue in the next phase. If students are unable to mention the basic identity that has been learned in the previous learning process, educators guide students to recall the basic identity that has been learned.

Phase 2:

Educators divide students into groups while dividing the SW. Group members have been written on the SW. Educators divide students into groups based on mathematical achievements on previous topics.

Problem:

Prove the following trigonometric identity:

$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha} = \tan\alpha - \cot\alpha$$

Next educator asks students to work in groups. Educators convey rules that must be done in groups, namely the process of discussion is only carried out in groups and may not discuss between groups. If there are questions, the group is asked to ask the educator directly. Educators provide opportunities for students in groups to ask about the rules of the game that have been set by educators. If there are questions, the educator answers the questions given, if there are no questions, the educator invites students in the group to start group discussions. The educator asks students to look at the problems listed in the SW, then ask the students to recall the basic identity mentioned earlier. Learning because it is important to be able to solve the problems given.

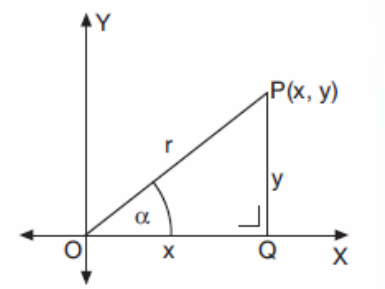
Phase 3:

Educators go around to each group to provide support in solving problems.

*Alternative Answers 1***.** If while traveling around the group have not found a way to solve the problem, then the educator encourages and gives support by inviting students to re-read the basic identity contained in the notes. After students understand the basic identity again, educators ask, which tribe can be replaced by using the basic identity formula. Can tan α be replaced with another? Can sin α be

replaced with another? Can cos α be replaced with another? Can cot α be replaced with another? If it's been replaced, what else can a mathematical process do? Educators provide opportunities for students to discuss the process to resolve the problem again.

Alternative Answers 2. The group answers but uses a right triangle assistance strategy. For example, the answer to the group is as follows:



$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha} = \tan\alpha - \cot\alpha$$

$$\frac{1-2\left(\frac{x}{r}\right)^2}{\frac{y}{r}\cdot\frac{x}{r}} = \frac{y}{x} - \frac{x}{y}$$

$$\frac{1-\frac{2x^2}{r^2}}{\frac{yx}{r^2}} = \frac{y^2-x^2}{xy}$$

$$\frac{\frac{r^2-2x^2}{r^2}}{\frac{yx}{r^2}} = \frac{y^2-x^2}{xy}$$

$$\frac{r^2-2x^2}{yx} = \frac{y^2-x^2}{xy}$$

$$\frac{x^2+y^2-2x^2}{yx} = \frac{y^2-x^2}{xy}$$

$$\frac{y^2-x^2}{yx} = \frac{y^2-x^2}{xy}$$

proven

The educator appreciates the effort that has been made by the group and asks the group to think of other ways by giving a support in the form of questions what if not using a help triangle? Which tribe in the left or right side can be replaced by using the basic identity that has been learned? Educators give groups opportunities to discuss again.

Alternative Answers 3. Groups prove by using one special angle, for example:

$$\frac{1-2\cos^2 60^o}{\sin 60^o \cos 60^o} = \tan 60^o - \cot 60^o$$

$$\frac{1-2.\left(\frac{1}{2}\right)^2}{\frac{1}{2}\sqrt{3}.\frac{1}{2}} = \sqrt{3} - \frac{1}{3}\sqrt{3}$$

$$\frac{1-\frac{1}{2}}{\frac{1}{4}\sqrt{3}} = \frac{2}{3}\sqrt{3}$$

$$\frac{\frac{1}{2}}{\frac{1}{4}\sqrt{3}} = \frac{2}{3}\sqrt{3}$$

$$\frac{2}{\sqrt{3}} = \frac{2}{3}\sqrt{3}$$

$$\frac{2}{3}\sqrt{3} = \frac{2}{3}\sqrt{3}$$

proven

Educators give appreciation then educators ask: If α on the question is replaced with 60° the proven identity formula. How about 30°? Does it still meet? What about 45°? Does it still meet? What about 569°? How much can we prove identity using numbers? Can we prove trigonometric identity with numbers? Educators invite students in groups to make conclusions about proving using numbers.

Alternative Answers 4. The group answers by describing one side but the other side is written continuously. For example, the answer from the group deciphers the left side and writes continuously the right side:

$$\frac{1-2\cos^2 \alpha}{\sin \alpha \cos \alpha} = \tan \alpha - \cot \alpha$$

$$\frac{\sin^2 \alpha + \cos^2 \alpha - 2\cos^2 \alpha}{\sin \alpha \cos \alpha} = \tan \alpha - \cot \alpha$$

$$\frac{\sin^2 \alpha - \cos^2 \alpha}{\sin \alpha \cos \alpha} = \tan \alpha - \cot \alpha$$

$$\frac{\sin^2 \alpha}{\sin \alpha \cos \alpha} - \frac{\cos^2 \alpha}{\sin \alpha \cos \alpha} = \tan \alpha - \cot \alpha$$

$$\frac{\sin \alpha}{\cos \alpha} - \frac{\cos \alpha}{\sin \alpha} = \tan \alpha - \cot \alpha$$

$$\frac{\sin\alpha}{\cos\alpha}-\frac{\cos\alpha}{\sin\alpha}=\tan\alpha-\cot\alpha$$
$$\tan\alpha-\cot an\alpha=\tan\alpha-\cot\alpha$$
proven

Or, the group deciphers the right side and writes down the left side continuously:

$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}=\tan\alpha-\cot\alpha$$
$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}=\frac{\sin\alpha}{\cos\alpha}-\frac{\cos\alpha}{\sin\alpha}$$
$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}=\frac{\sin^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha}$$
$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}=\frac{1-\cos^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha}$$
$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}=\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}$$
proven

Educators appreciate the efforts that have been made by the group and ask the group to discuss it again is there another way or alternative?

Alternative Answers 5. The group deciphers the two sides so that they get the same shape. Suppose the group answers are as follows*:*

$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}=\tan\alpha-\cot\alpha$$
$$1-2\cos^2\alpha=(\tan\alpha-\cot\alpha)(\sin\alpha\cos\alpha)$$
$$1-2\cos^2\alpha=\left(\frac{\sin\alpha}{\cos\alpha}-\frac{\cos\alpha}{\sin\alpha}\right)(\sin\alpha\cos\alpha)$$
$$1-2\cos^2\alpha=\left(\frac{\sin^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha}\right)(\sin\alpha\cos\alpha)$$
$$1-2\cos^2\alpha=\sin^2\alpha-\cos^2\alpha$$
$$1-2\cos^2\alpha=1-\cos^2\alpha-\cos^2\alpha$$
$$1-2\cos^2\alpha=1-2\cos^2\alpha$$

After the left and right sides are deciphered together, identical values are obtained.
Proven.

Or

$$\frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha} = \tan\alpha - ctg\alpha$$

$$\frac{\sin^2\alpha+\cos^2\alpha-2\cos^2\alpha}{\sin\alpha\cos\alpha} = \frac{\sin\alpha}{\cos\alpha} - \frac{\cos\alpha}{\sin\alpha}$$

$$\frac{\sin^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha} = \frac{\sin^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha}$$

After the left and right sides are deciphered together, identical values are obtained. Proven.

Educators appreciate the efforts that have been made by the group and ask the group to discuss it again is there another way or alternative?

Alternative Answers 6. The group answers the question by describing the left side until the right side is obtained.

$$\begin{aligned} \textit{Left side} &= \frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha} \\ &= \frac{\sin^2\alpha+\cos^2\alpha-2\cos^2\alpha}{\sin\alpha\cos\alpha} \\ &= \frac{\sin^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha} \\ &= \frac{\sin^2\alpha}{\sin\alpha\cos\alpha} - \frac{\cos^2\alpha}{\sin\alpha\cos\alpha} \\ &= \frac{\sin\alpha}{\cos\alpha} - \frac{\cos\alpha}{\sin\alpha} \\ &= \tan\alpha - \cot\alpha \\ &= \textit{right side} \end{aligned}$$

The left side is the same as the right side, proven.

Or conversely, the group answers the question by describing the right side until the left side is obtained:

$$\begin{aligned} \textit{Right side} &= \tan\alpha - \cot\alpha \\ &= \frac{\sin\alpha}{\cos\alpha} - \frac{\cos\alpha}{\sin\alpha} \\ &= \frac{\sin^2\alpha}{\sin\alpha\cos\alpha} - \frac{\cos^2\alpha}{\sin\alpha\cos\alpha} \\ &= \frac{\sin^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha} \end{aligned}$$

$$= \frac{1-\cos^2\alpha-\cos^2\alpha}{\sin\alpha\cos\alpha}$$
$$= \frac{1-2\cos^2\alpha}{\sin\alpha\cos\alpha}$$
$$= left\ side$$

The right side is the same as the left side, proven.

Educators appreciate the results of discussions that have been conducted by the group.

Educators continue to go around to assist groups in solving problems given by educators. If the time to solve the problem is less than 10 minutes, the educator informs that the time for discussion is only 10 minutes and asks the students to immediately report the results of the discussion.

After the discussion time is over, the educator informs that the time for the discussion has expired, then the educator appoints four groups to advance to write and present the results of the discussion to other friends. Advanced group appointments based on workmanship strategies carried out by groups in proving trigonometric identities.

Phase 4: Develop and present the work

After the discussion time has expired, the educator appoints four groups of students to advance writing and presenting the results of the discussion to other friends. Four groups were selected based on the work strategy carried out by the group in proving trigonometric identity.

The four groups selected are the groups that work by using the right triangle, outlining the two sides so that they get the same shape, describing the left side so that the right side is obtained, and the right side so that the left side is obtained.

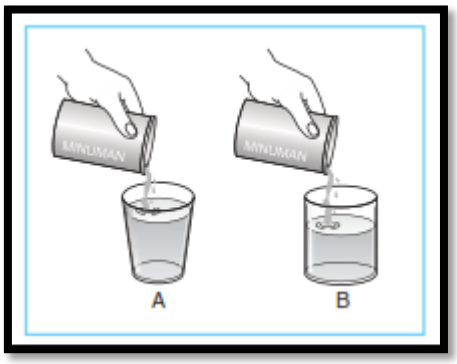
Educators along with other students monitor the four groups who write the results of their discussion on the board then the educator gives the opportunity for selected students to present their answers. After all selected students present their answers, educators give other students the opportunity to ask questions.

Phase 5: Analyze and evaluate the problem solving process

After the four students present the group answers, the educator guides the analysis and evaluation process in accordance with the learning objectives to be achieved. Educators open the process of analysis and evaluation by asking students to review the answers and presentations of the four students. Then educators ask questions to students such as the following: What are the differences and similarities in the four answers that have been written and presented? What conclusions can be taken from the answers to the presentation results that have been displayed? How many strategies can be done to prove trigonometric identity?

Educators guide class discussion until students can find differences and proof of equality as indicated by four answers written and presented and educators guide students to conclude that there are four strategies to prove trigonometric identity, namely (1) using the aid of a right triangle, (2) decipher the left side so that the right side is obtained, (3) decipher the right side so that the left side is obtained, and (4) decipher the two sides at once so that the same shape is obtained.

Educators confirm the conclusions found by students by making illustrations or practicing directly how to prove the volume of the two glasses is different in shape but has the same volume of water. Educators provide illustrations like in the picture below:



To prove that the volume in glasses A and B is the same, it can be done by:

1. Give the water level mark to the glass B then empty the glass B and then fill the glass A into glass B, it is observed that the height of the water poured from glass A has the same height as the B cup water that is discarded. It was concluded that the contents of glass A and glass B were the same. This is like proof by describing the left side until the shape is identical to the right side.
2. In the opposite way, measuring the water level in the glass A empties the glass A and then feeds the water B into the glass A, it is observed that the height of the water poured from glass B has the same height as the discarded A water. Concluded the contents of glass B and glass A are the same. This is like proof by describing the right side until the shape is identical to the left side.
3. Take the other two measuring cups then fill the first measuring cup with the contents of the glass A and fill the second measuring cup with the contents of the glass B. Compare the contents. This is like proof by describing the left and right sides until an identical shape is obtained.

Conclusion

Based on the discussion above, it can be concluded that the author was able to produce a learning design about the verification of Trigonometry Identity using Problem Based Learning (PBL). The flow of learning design to prove Trigonometry identity with PBL as follows: Phase 1: Student orientation on the problem. Educators convey the topic of the material and process to be carried out. Apperception. Phase 2: Organize students to learn. Educators divide students into several groups. Educators give problems. Phase 3: Guiding individual or group experience. Educators go around to provide support to groups in need. Phase 4: Develop and present the work. Educators provide opportunities for students in groups to present the results of group discussions. Phase 5: Analyze and evaluate the problem solving process. Educators guide students to draw conclusions on the learning process. Educators confirm the conclusions made by students.

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Development of Appy Pie Learning Media Based on Metacognitive Approach for Mathematical Reflective Thinking Ability in Geometry

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Abstract: This research aims to produce appy pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are appropriate for use in geometry. Feasibility of learning media in terms of validity, practicality, and effectiveness. The research method used is the Research and Development (R & D) method with ADDIE Model, namely Analysis – Design – Development – Implementation – Evaluation. In the implementation stage, on media trial step, the One-Shot Case Study type pre-experiment design research method was used. Based on the results of validation, the learning media is categorized very well with a validity percentage of 85.66%. Based on the results of the student response questionnaire, the learning media is categorized well with a practicality percentage of 84.12%. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of $\geqslant 70$ of 79.16%. Thus, appy pie learning media based on a metacognitive approach to mathematical reflective thinking skills is declared feasible on geometry.

Keywords: learning media, appy pie, metacognitive approach, mathematical reflective ability, geometry

Introduction

Implementation In the current era of digital development, lectures are not the only face to face, but can also be done online. With this online learning needs to be developed learning materials that can also be brought by students everywhere or can also be called mobile learning. Android-based learning media is one solution. Appy Pie learning media can be one of the learning tools of students in lectures because it is enough just to install Appy Pie media that has been developed according to the subjects in their respective mobile phones, students can already learn the material wherever and whenever. Appy Pie is a program that allows people to create and monetize apps. The app was later given support for more kinds of applications, including image sharing, event platform, and social networking.

Geometry is one of the compulsory subjects for mathematics education students. The geometry covered includes the geometry of fields and the geometry of space. Geometry learning at the lecture level is also constrained by the assumption of students that geometric material is abstract. For example, in the geometry of space in determining the angle between fields in space, the distance between fields in space, or in determining the area or volume in a space like a cone is constructed. Students have imagined the representation of the problems raised so that they are also confused in determining the solution. Even though today, there are many learning materials, applications, software or virtual manipulatives that can be accessed by students on the web. For this reason, it is necessary to have media as a learning tool for students who can minimize the difficulties of students in geometry material, especially space geometry.

When planning approaches to teaching and learning geometry, it is important to ensure that the provision in the early years of secondary school encourages students to develop an enthusiasm for the subject by providing opportunities to investigate spatial ideas and solve real life problems. There is also a need to ensure that there is a good understanding of the basic concepts and language of geometry in order to provide foundations for future work and to enable students to consider geometrical problems and communicate ideas. Students should be encouraged to use descriptions, demonstrations and justifications in order to develop the reasoning skills and confidence needed to underpin the development of an ability to follow and construct geometrical proofs (Jones, 2002).

In addition, in geometry learning, mathematical reflective thinking skills need to be developed. The ability of mathematical reflective thinking is the ability to think carefully, considered active, continuous and careful in dealing with a mathematical problem. Indicators of mathematical reflective thinking skills are: (1) determining solutions/answers with full consideration; (2) checking the correctness of the answers; (3) modifying understanding in order to solve problems; (4) correcting answers; and (5) aware of errors when using calculation skills and correcting them. One way to develop mathematical reflective thinking skills is through a metacognitive approach. According to Flavell (1985), metacognitive namely knowledge and regulation on a person's cognitive activity in the learning process. Metacognition refers to one's understanding of his knowledge so that a deep understanding of his knowledge will reflect its effective use or a clear description of the knowledge at issue. The metacognitive ability is an awareness of cognitive self, how the cognitive self-works, and how to regulate it. Indicators of metacognitive abilities are: (1) identifying tasks that are being worked on; (2) supervise the progress of their work; (3) evaluate this progress; and (4) predict the results to be obtained (Lestari & Yudhanegara, 2018).

Problem-solving situations are challenges and critical moments for students in an effort to find solutions. Polya suggested heuristic, wherein the last heuristic, looking back only tested the answer and used the results obtained to solve other problems (Polya, 1975). Of course, in finding a solution, students must think critically and creatively. However, if they stop when answers are found, they lose valuable momentum in the learning process they are going through. With hard work, they build designs and various strategies to solve problems. If at the time of solving the problem they are motivated then happy with the results achieved, then this motivation and pleasure must be maintained. The teacher can give new assignments to students, namely: "Complete the problem in another way", "Ask questions ... what if", "What's wrong", and "What will you do" (Krulik & Rudnick, 1999). Problem-solving situations think critically and creatively are the scope of mathematical reflective thinking abilities.

Based on the explanation, this study aims to produce Appy Pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are feasible to use on geometry material. Feasibility of learning media in terms of validity, practicality, and effectiveness.

Research Methods

This research is R & D (Research and Development). The researcher will develop Appy Pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are feasible to use in geometry courses, especially space geometry. The media development model used is the ADDIE model, namely: Analysis - Design - Development - Implementation - Evaluation. According to Shelton et al., the ADDIE model is a generic learning design model that provides an organized process in the development of learning materials that can be used both for offline learning and online learning (Branch, 2009).

This research was conducted at Universitas Samudra mathematics education students who took geometry lectures in the even semester of the 2018/2019 academic year. The steps of the research conducted are:

Analysis

The analysis phase is a process of defining what students will learn and doing needs assessment. Activities at the analysis stage to determine the necessary components, namely: (1) determine the characteristics of students; (2) analyzing student needs in learning; (3) make concept maps based on initial research. Followed by designing a flow chart provides clear direction for making media; (4) determine the parts and contents of the media to be developed. Material is developed with a metacognitive approach; (5) analyze the constraints found; (6) designing an assessment to test student competency, in this case, mathematical reflective thinking skills. Accuracy in completing assignments, worksheets and quizzes; and (8) consider online pedagogical. Verbal, visual, tactical, auditory, and others.

Design

This stage is also known as the blueprint. Stages that need to be implemented in the media design process are: formulating learning objectives that are SMAR (specific, measurable, applicable, and

realistic). Then determine what the right learning approach should be to achieve that goal. Besides that, also consider other supporting sources, such as relevant learning resources that can be accessed offline or online.

Development

Development is the process of making blue-print or the design come true. At this stage, Appy Pie media was developed based on a metacognitive approach to geometry material. As a material for consideration, the geometry material that will be inputted in the Appy Pie media can also improve students' mathematical reflective thinking skills.

Implementation

Implementation is a real step to implement the learning system developed. That is, at this stage everything that has been developed is installed or set in such a way according to its role or function that it can be implemented. The implementation phase in this study was carried out by testing the media directly. The media trials were carried out in two stages, namely: the first stage of validity testing by material experts and learning media experts. The second stage of the practicality test was by the response of mathematics education students through filling out questionnaires. The results of this trial are used as the basis for implementing the evaluation phase.

Evaluation

The evaluation phase in this study was carried out until the formative evaluation aimed at revision needs. Based on the results of expert reviews and field trials that have been carried out at the implementation stage, the next two stages of data analysis are the analysis of qualitative and quantitative data. Qualitative data analysis is used to process data in the form of input, criticism and expert advice and field tests to be followed by gradual revisions to the development of media for the better. While the analysis of quantitative data is obtained from respondents' assessment in the form of numbers on the questionnaire given. All stages of this evaluation are aimed at the feasibility of the final product. Worth in terms of content, design, and user-friendly.

Results and Discussion

Analysis

In the analysis phase obtained:

1. Analysis of student characteristics

Based on the results of interviews, all mathematics education students who take geometry courses have smartphones, interested in web-based learning or mobile learning. In addition, students also give opinions that they are lazy to read lecture materials because they have to carry thick books, laptops or have difficulty getting learning resources. Students also like to learn interactive and virtual teaching materials.

2. Material analysis

The geometry course consists of the geometry of the field taught from the beginning of the lecture to before the midterm. Then starting from after the midterm to the final, students will study space geometry. Development of material inputted to the media is based on consideration of learning objectives in accordance with the syllabus, metacognitive approach and contains exercises or questions about mathematical reflective thinking skills.

3. Media analysis

The Appy Pie media can be accessed easily without paying on the following website: https://www.appypie.com/. Appy pie media development considers pedagogical online, for example: Verbal, visual, tactical, auditory, and others. The selected images, colors, and writing make the media Appy Pie an interactive learning resource.

Design

At this stage, the author designed the media with the contents of the material in accordance with the subject matter of geometry, specifically the geometry of space. In addition, a number of menus that will be displayed on the application, such as menu material, syllabus, videos, software, teaching materials on the web, exercises/quizzes and author profiles. In the material, section will be directed by

a metacognitive approach. It is intended that students have the ability to reflect on how their knowledge of the material presented. In the syllabus section, it is adjusted to the competency standards, indicators and learning objectives of the geometry course and is relevant to the learning implementation plan. On the video menu, software and teaching materials related to the material will be presented in the form of files can be directly downloaded or in the form of a URL. On the exercise or questions menu, students will be directed to answer questions that are adapted to indicators of mathematical reflective thinking ability on geometry material.

Development

The steps to create an application using Appy Pie are: (1) Open the web www.appypie.com; (2) Click Sign Up to register; (3) Fill in the identity according to the complete column; When you have signed up, then open the e-mail to enter the verification code sent by Appy Pie. Enter the verification code that was sent via e-mail then click verify, then Create App to create the application; (4) Fill in the application name (e.g. Geometry Space) and select the category "education" then click next; (5) Select the theme as desired, then click next. After that, a dialog box will appear; (6) Delete all pages that are not used by clicking on one page at a time and then selecting the trash button. After all, pages have been deleted, then add Text page. Then replace the image icon in accordance with what we want by uploading images, and giving the name of the page with material, syllabus, concept maps etc.; (7) Next fill out the profile application, and to see the display on the mobile screen click the android button; (8) Making the contents of the syllabus, concept maps, material, videos, software, teaching materials; (9) Making the contents of the Simulation by uploading learning videos that are in accordance with the material; (10) Making an Evaluation with Quiz, To make a quiz it is necessary to arrange according to the image below, namely by giving the name of the quiz and triggering all the small boxes on the quiz page. The quiz can be made if all applications have been completed (save and finish); (11) Creating a Banner (image running) Select the theme customization page then look for the advanced list setting then check the show banner then add images. After that, a dialog box will appear to upload the image. To set the font, font color, font size, and background colors in headings, click theme customization then style & navigation. To set the font, font color and font size for the material to be created, click theme customization then page style & color scheme; (12). Change the application icon and display splash, select theme customization. To replace the icon you can by uploading an image or selecting an icon that already exists on the web; (13) If all programs have finished waiting a few minutes, the application file will be sent to e-mail; (14) After receiving the application e-mail from Appy Pie the next step is to download the file by clicking URL is given; (15) After the download is done, the application file is moved to an android cell for installation; (16) The next step is to install the application on an android phone (install) by pressing the .apk file; (17) The application has been successfully installed and is ready to run.

Implementation

The implementation is done by installing the Appy Pie application on each student's cellphone, then testing the product includes: validity test, practicality test, and effectiveness test.

1. Validity test results

Test the validity of the media using a questionnaire instrument. The validation questionnaire instrument was filled by two design experts and multimedia experts who were competent in their fields, namely lecturers of Information and Communication Technology at Universitas Samudra and two material experts, namely lecturers of the Universitas Samudra mathematics education. Questionnaire for validity test to media experts consists of 20 items, which are divided into four aspects, namely: aspects of content validity, instructional aspects of design, aspects of appearance and aspects of language. In addition, in the validity test questionnaire, there is also a column for descriptive suggestions and criticisms that will be filled by experts as an evaluation for the perfection of the application developer. Overall the average rating obtained from two media experts shows a value of 85.66% in the Very Valid category.

2. Practical test results

The product practicality test also uses a response questionnaire instrument filled by 25 students. The questionnaire validity test sheet to media experts consists of 12 items, which are divided into 3 aspects, namely aspects of the media display, aspects of material content and aspects of application benefits. In addition, in the practicality test questionnaire, there was also a column for descriptive suggestions and criticisms that would be filled by students as evaluations for the perfection of the applications developed. Overall, the average rating obtained from two material experts shows the value of 84.12% with the Practical category.

3. Effectiveness test results

Effectiveness test was obtained by giving questions about mathematical reflective thinking skills to 25 mathematics education students at the end of the geometry lecture. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of ≥ 70 of 79.16%.

Evaluation

After the author tests the product which includes validity test, practicality test, and effectiveness test, there are several things that are revised according to comments or suggestions from media experts and material experts in the assessment sheet, namely: (a) Media Experts, suggest: 1) Revision on the menu display it is recommended that you use a more interactive and interesting model; 2) Images, colors and sizes of writing in the media are better clarified; and 3) The meeting material for one and so on is arranged or grouped so that the material presentation becomes more sequential and systematic. In other words, it is used as a sub menu from the Material menu. (b) Material Experts, suggest: (1) In the example questions and questions it is recommended to contain contextual issues and the ability of High Order Thinking Skills (HOTS); (2) Display of material one and so on is recommended so that there are additional downloads of material, videos, and software related to the geometry material of space that can be accessed by students.

Conclusion

The development of Appy Pie learning media based on a metacognitive approach to mathematical reflective thinking skills that is feasible to use on geometry. Development is carried out using the ADDIE model. Based on the results of validation, the learning media is categorized as very valid with a validity percentage of 85.66%. Based on the results of the student response questionnaire, the learning media is categorized as practical with a practical percentage of 84.12%. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of ≥ 70 of 79.16%.

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Analysis of Student Learning Outcomes in Proving Trigonometric Identities from Problem Based Learning Class

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Abstract: The topic of trigonometric identity verification given by researchers through problem-based learning in a high school in Yogyakarta has provided opportunities for students to conclude that in solving trigonometric identity verification problems three strategies can be used. This research aims to determine the learning outcomes of students in solving trigonometric identity verification questions after the learning. Observation of learning outcomes is done by analyzing the abilities and failures of students based on Indicators of Achievement of Competence. The research conducted was qualitative research with data obtained through give a 15-minutes test containing two problems, which given to students, and interviews to three students chosen based on variations in different answers. The results obtained are from the three students, only one student can solve all the problems. Two other students were unable to complete those problems, both the first and the second. The reason for this is not because the two students did not understand how to prove trigonometric identity, but because the two students were less skilled in performing basic algebraic operations related to fraction forms.

Keywords: learning outcomes; proving; strategies; trigonometric identities; problem-based learning.

Introduction

The fact that occurred in one of the high schools in Yogyakarta to students in the two classes of grade 10 in the 2016-2017 school year showed that the learning outcomes of students on the topic of trigonometric identity verification were unsatisfying for teacher. Based on the evaluation of learning outcomes in the form of daily tests, from 35 Math and Science students in grade 10-6 there were 19 students who did not pass. In grade 10-7, the number of students who did not pass the evaluation was more, namely from 34 Math and Science students there were 28 students who did not pass. The failure of students in the daily test can also be seen from the average test scores of the trigonometric identity of the two classes. The average score of grade 10-6 is 71, while the average score of grade 10-7 is 64.

On March 21 to April 8, 2018, researchers tried to teach the topic of trigonometric identity verification in one class in the same high school using Problem Based Learning based on the Hypothetical Learning Trajectory (HLT) that had been created. The purposes of learning listed in HLT are that students can (1) find strategies to prove trigonometric identity and (2) prove trigonometric identity.

To find out whether the learning goal is achieved or not, the researchers set The Indicator of Competency Achievement (ICA): Students can prove trigonometric identity if (1) students can choose strategies to prove trigonometric identity and (2) students are able to apply the chosen strategy correctly.

One of the results obtained from the learning is that students are able to draw conclusions about strategies that can be used to solve trigonometric verification problems; namely (1) decipher the right side to obtain the mathematical expression equal to the left side, (2) decipher the left side to obtain the mathematical expression equal to the right side, and (3) decipher the right and left sides together so that the mathematical expressions are equal. Before reaching these conclusions there are other strategies that are also used by students; namely (1) visualize with a right triangle image and then analyze analytically (with certain variables or/and directly with certain numbers) and (2) use direct examples using certain special angles.

Research related to the verification of trigonometric identities was also carried out by Huljannah et al. (2015), who found that students could make mistakes when proving trigonometric identities. The mistakes in solve problems include improper procedures and skills hierarchy problems. On the other hand, Stefanowicz (2014: 32) states that students can make mistakes in doing mathematical proof. The

mistakes made include misunderstanding of definitions, not enough words, lack of understanding, and incorrect steps.

Based on the description above, researchers are interested in analyzing the learning outcomes of students in solving trigonometric identity verification problems. The aim of this research is to determine the ability of students in solving trigonometric identity verification problems. Therefore, researchers asked questions about how student learning outcomes in solving trigonometric identity verification problems after being given problem-based learning on the topic of trigonometric identity verification.

Problem Based Learning, Proof in Mathematics Learning, and Trigonometric Identity Verification

Linda Torp and Sara Sage (in Rusman, 2016) point out that problem-based learning is focused, experiential learning (minds-on, hands-on) organized around the investigation and resolution of messy, real-world problem. PBL—which incorporates two complementary processes, curriculum organization and instructional strategy—includes three main characteristic, namely (1) engages students as stakeholders in a problem situation, (2) organizes curriculum around a given holistic problem, enabling students learning in relevant and connected ways, and (3) creates a learning environment in which teachers coach student thinking and guide student inquiry, facilitating deeper levels of understanding.

A proof is a sequence of logical statements, one implying another, which gives an explanation of why a given statement is true (Stefanowicz, 2014). Mathematical proof is a formal way to express certain types of reasoning and justification (NCTM, 2000). By developing ideas, exploring phenomena, justifying results, and using mathematical conjectures in all content, students can see and think that mathematics gives meaning. The purpose of standard reasoning and proof in mathematics learning according to NCTM (2000) is that students can (1) view reasoning and proof as fundamental aspects of mathematics, (2) create and investigate mathematical conjectures, (3) develop and evaluate arguments and mathematical proofs, and (4) choosing and using various kinds of reasoning and proof methods.

In proving the identity of trigonometry there are several types of methods. Some methods of verifying trigonometric identities include using fundamental trigonometric identities (Abramson, 2017); namely Pythagoras identity, odd-even identity, opposite identity, and comparative identity.

To verify the trigonometric identities, we usually start with the more complicated side of the equation and essentially rewrite the expression until it has been transformed into the same expression as the other side of the equation. Sometimes we have to factor expressions, expand expressions, find common denominators, or use other algebraic strategies to obtain the desired result. In this first section, we will work with the fundamental identities: the Pythagorean identities, the even-odd identities, the reciprocal identities, and the quotient identities.

Research Methods

This research was a qualitative research according to Moleong (2009), whose purpose was to understand the phenomenon of what was experienced by the subject of research with the phenomenon was described in the form of words. The subjects observed were three students from one of grade 10th classes in one of high schools, in Yogyakarta. The selection of the three students as subjects was conducted based on variations in different answers. Data collection was carried out, in addition to giving 15-minutes test problems, interviews were also conducted with the three subjects for the answers given. Data analysis techniques are based on data analysis techniques according to Miles and Huberman (Sugiyono, 2014); namely data reduction, data presentation, and conclusion drawing.

Results and Discussion

Analysis of students' answers is done based on the ICA that has been created; i.e. students can prove trigonometric identity if students (1) can choose a strategy to prove trigonometric identity and (2) be able to apply a correctly chosen strategy. The ICA is then described into the problem indicators. The ICA is that students are categorized as fulfilling trigonometric identity verification competencies if: (1) Students can choose a strategy to prove trigonometric identity. For example, to prove $\sin\alpha + \cos\alpha\cot\alpha = \csc\alpha$ students can choose the strategy of deciphering the left side until the results of the right side are obtained. (2) Students are able to use basic identities to solve problems. For example,

students can use a basic identity $\frac{\sin\alpha}{\cos\alpha}$ to replace the left side equal to $\tan\alpha\sin\alpha+\cos\alpha=\left(\frac{\sin\alpha}{\cos\alpha}\right)\sin\alpha+\cos\alpha$ and so on. (3) Students can operate mathematically one or both sides so that the proof of trigonometric identity is obtained. For example, the left side equal to $\tan\alpha\sin\alpha+\cos\alpha=\frac{\sin\alpha}{\cos\alpha}\sin\alpha+\cos\alpha=\frac{\sin^2\alpha+\cos^2\alpha}{\cos\alpha}=\frac{1}{\cos\alpha}=\sec\alpha$ equal to right side. Students are said to not fulfill the ICA if they cannot fulfill one of the indicators of the problem. The following is a 15-minutes test problem given to students.

Prove that
(1) $\sin\alpha+\cos\alpha\cot\alpha=\csc\alpha$
(2) $\tan\alpha=\frac{\sin\alpha+\tan\alpha}{1+\cos\alpha}$

The Answers of Problem Number 1

The following are described answers to problems number 1 given by three students named Vian, Dodi, and Maman (all three names are not real names).

1. *Vian's answer to Problem Number 1*. At the beginning of the interview Vian said that he knew three strategies for solving trigonometric identity verification problems; namely deciphering the left side until the result is equal to the right side, deciphering the right side until the result is equal to the left side, and decipher the left and right sides together until the equal result is obtained. Besides that, Vian also said that there was another strategy that could be used, namely using a help triangle.
   In the answer to the first problem Vian uses the strategy of deciphering the left side to get the same result as the right side. The reason for choosing the strategy is because according to him the left side contains complicated mathematical expressions so that it can be simplified. In addition, it is also seen that Vian uses Reverse Identity like $\cos\alpha=\frac{1}{\sec\alpha}$ and $\cot\alpha=\frac{1}{\tan\alpha}$ and Pythagoras Identity like $\sin^2\alpha+\cos^2\alpha=1$. Until this stage, Vian had fulfilled the first and second problem indicators. By doing algebraic manipulation, Vian can find that from the results of the decomposition of the left side is the same as the mathematical expression on the right side. From the results of the breakdown, Vian can also conclude that the statement given to problem number 1 proved to be true. This stage shows that the third problem indicator is fulfilled.

Interviewer	*This number one, what strategy do you use? Can you explain how to solve it?*
Vian	*This, I outline the left section so that the left segment is the same as the right segment. So, sin alpha plus cos alpha multiplied by cotan alpha, it is to be equal to cosec alpha.*
Interviewer	*Why on this matter do you decipher the left? Why not right?*
Vian	*Because it is complicated and can be simplified.*

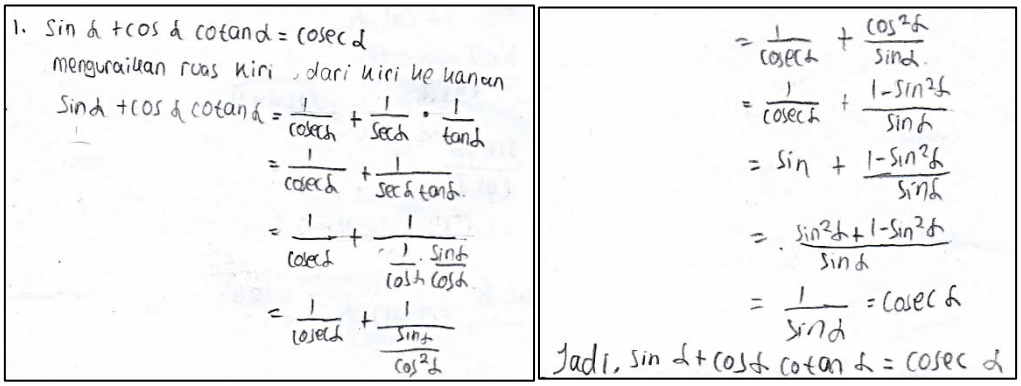

Figure 1. Vian's answer to question Number 1

Even so it is seen that to obtain $\csc \alpha$, Vian changed form $\sin \alpha$ into form $\frac{1}{\csc \alpha}$. However, after a few steps Vian changed $\frac{1}{\csc \alpha}$ back to being $\sin \alpha$. This shows that the algebraic manipulation process undertaken by students in solving the trigonometric identity verification questions for number 1 also involves a trial and error process.

Interviewer	*Why do you change this (sin α) to cosec?*
Vian	*Because I'm using the opposite formula, sir. Because I think, this will result in cosec, so I change it to cosec. This is back again, sir. Hehe. Because this is a sin, I think it's easier to turn it around again.*

Part of Vian's answer to number 1 shows that students are able to fulfill all three problem indicators. Thus, the ICA for number 1 is also fulfilled so that it can be said that for Vian the second HLT goal for number 1 has been reached.

2. *Dodi's answer to Problem Number 1.* At the beginning of the interview, Dodi said that there were three strategies that could be used to solve trigonometric verification questions. Dodi's strategy is to use aid triangles which are then analysed analytically, using three strategies to decipher a complicated mathematical expression into a simpler mathematical expression (called by Dodi with other terms or names of sine, cosine, and tangent), and use direct evidence with certain numbers.

Interviewer	*How many types of strategies do you know to prove?*
Dodi	*I think there are three, sir. Which uses x y x y, triangle. Then this is, uses numbers.*
Interviewer	*How is this?*
Dodi	*Here, I use sin cos tan which is another name.*

In the process of proof, Dodi chose to use the strategy of deciphering the left section until the same result was obtained with the right segment. The reason for choosing the strategy is because according to him the left side contains complicated mathematical expressions compared to the right side so that it can be simplified. In the answer it can be seen that Dodi was able to use a basic identity in performing algebraic manipulations to prove the statement given so as to obtain evidence that the left side is the same as the right segment.

But at the end of the proof, Dodi was not complete in giving an evaluation of the results of proof. The truth of the statement given is only expressed by students through the word "TERBUKTI" (PROVEN). This does not provide an explanation of the truth of the statement given to the question explicitly. Even so in the interview, Dodi can provide an evaluation of the results of the evidence.

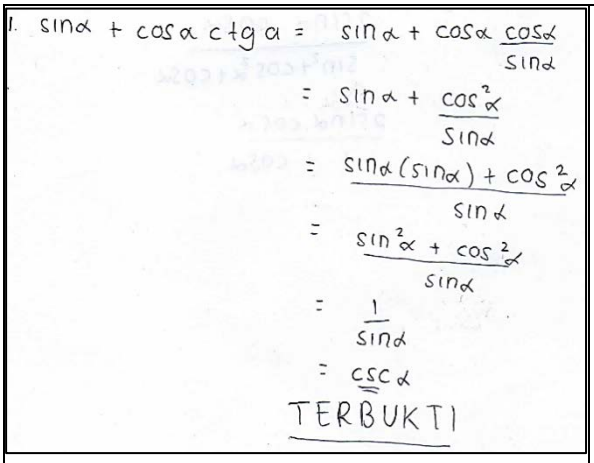

Figure 2. Dodi's answer to question number 1

Interviewer	*Then, number one? Try to explain your answer.*
Dodi	*This is cotangen, it can be changed to cos per sin, sir. Then cos times cos so it's cos squared. Then let it be added, we equate the denominator, sir. So sin times sin plus cos squared per sin. Let sin be squared per cos squared per sin. Sin squared plus cos squared equal to one. So one sin, same as cosecan teta. So it is proven that this (pointing to the left hand side of the question) is the same as this (pointing to the right side of the question).*
Interviewer	*So you decipher this (pointing to the left side)?*
Dodi	*Yes. The left side.*
Interviewer	*Why are you using this strategy?*
Dodi	*Because I mastered this strategy the most, sir.*
Interviewer	*If what is deciphered right, can it or not?*
Dodi	*You can, but the way is more complicated, sir. If the left side is easier to break.*
Interviewer	*More complicated where are the left and right segments?*
Dodi	*The left one, sir. So it can be simplified more easily.*
Interviewer	*This is where, how come there are sin times sin?*
Dodi	*It's added, so the denominator is equated. So sin multiplied by sin divided by sin, so that together sin.*

From Dodi's answer, it was seen that students were able to fulfill the three problem indicators. Thus, for Dodi in number 1, the ICA is fulfilled and the goal of the second HLT is achieved.

3. Maman's answer to Problem Number 1. At the beginning of the interview, Maman said that he knew three strategies for solving trigonometric identity verification questions. The three strategies that Maman refers to are outlining the left section so that the same result is obtained with the right segment, describing the right segment so that the same result is obtained with the left segment, and describing the two segments so that the same result is obtained. In addition, Maman also said that there are other strategies that can be used, namely using a help triangle which is then analyzed analytically.

   In solving question number 1, Maman deciphered the left and right segments together so that the same results were obtained. The reason for choosing this strategy is because Maman considers that the two segments are complicated, so they need to be simplified. From Maman's answer, it can be seen that students can apply their strategies correctly as indicated by their ability to perform algebraic manipulations accompanied by the use of the correct basic identity so that evidence can be obtained. Until that stage, students have fulfilled all three problem indicators. The results of the interview also show that students can draw conclusions about the truth of statement number 1. However, in the settlement the students do not explicitly provide conclusions about the truth of the statement given to the question. Nevertheless, the truth of the statement given is shown by giving

an expression in the form of a symbol of truth. Thus, for question number 1, Maman has fulfilled the ICA and the second HLT goal is reached.

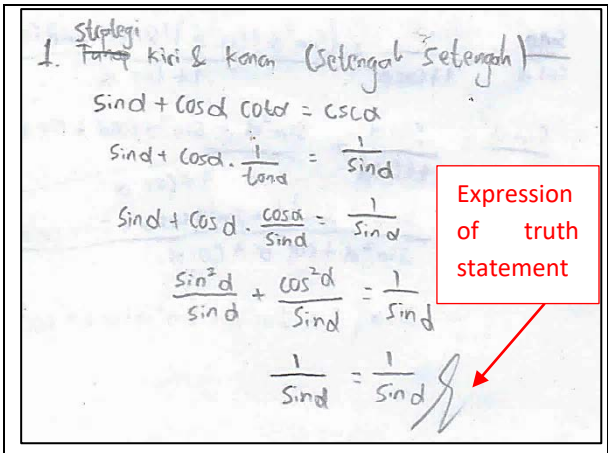

Figure 3. Maman's answer to question Number 1

Interviewer	*From this problem, what were you told?*
Maman	*Ask to prove that on the left hand side you can get the right side.*
Interviewer	*Do you know how many strategies to prove this?*
Maman	*The first can be from left to right. So the left side is manipulated. The second from right to left. Right manipulated. Otherwise it means half-half, both are manipulated.*
Interviewer	*Try to explain how you found this.*
Maman	*(Maman explains step by step).*
Interviewer	*What can you conclude?*
Maman	*Yeah, if this is the case, it means that the left side is the same as the right side. Because the results are the same.*
Interviewer	*What is the reason for manipulating the two segments?*
Maman	*How about ... For example eight subtract seven equals one. One can be changed to any value. For example, five subtracts four. You can, too. Well, what can be simplified is the complicated one, the left side. The right one changes a little, giving capital is small, simplified.*
Interviewer	*So do you think everything is complicated?*
Maman	*Em ... it's more complicated on the left.*

From the answers to questions number 1 above, the three students have met the three problem indicators. Therefore, for question number 1, the three students have fulfilled the ICA and the second HLT goal has been achieved, noting that one student also uses trial and error when doing algebraic manipulation. That is, students make mathematical conjectures with trial and error strategies. In addition, from the three students there are two students who are less complete in giving an evaluation of the results of the evidence obtained from the resolution so that it can be said that for question number two, two students are less able to evaluate mathematical proofs.

The Answers of Problem Number 2

The following are outlined answers to the number 2 questions given by the three students.

1. *Vian's answer to Problem Number 2.* In answer number 2, students use a strategy outlining the right segment to obtain the same shape as the left side. When interviewing students also explained that the strategy was chosen because the right section contained complicated mathematical expressions that needed to be simplified. At that stage the students have fulfilled the first indicator of the problem.

Interviewer	*Number 2, how? What strategy do you use?*
Vian	*If this, I decipher the right section so that the result is the same as the left section.*
Interviewer	*Why are you deciphering the right side? How come it's not the left side?*
Vian	*Because the right is more complicated, so that can be simplified.*

Seen in the answer, Vian's next process of completion was to use comparative identities such as $\tan \alpha = \frac{\sin \alpha}{\cos \alpha}$. This shows that students have fulfilled the second indicator. By doing algebraic manipulation, Vian found that mathematical expressions on the right segment are the same as mathematical expressions on the left side. At that stage, it can be said that Vian has fulfilled the third indicator of the problem. At the end of the settlement, Vian concluded that $\frac{\sin \alpha + \tan \alpha}{1+\cos \alpha} = \tan \alpha$. That is, Vian was able to provide an evaluation of the results of the evidence made.

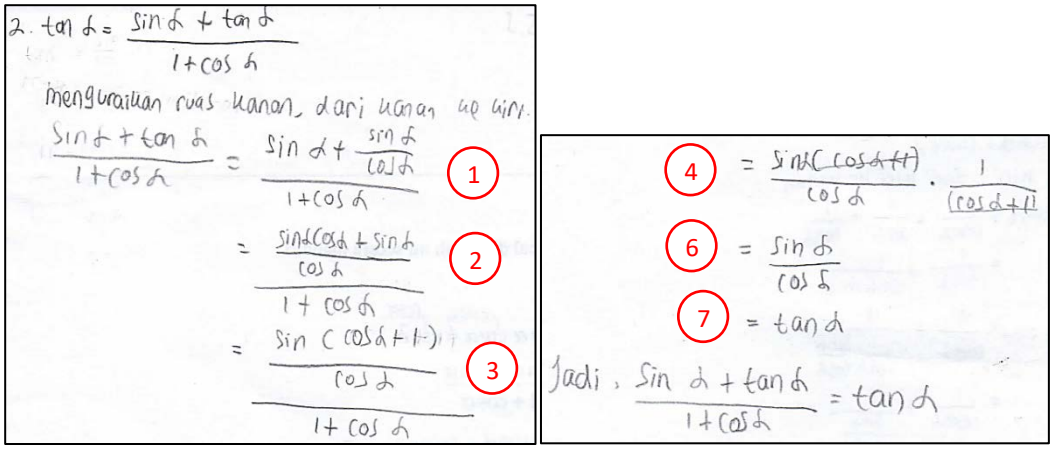

Figure 4. Vian's answer to question Number 2

Although Vian has fulfilled the three indicators of the problem, there are inaccuracies in writing the notation or symbol "equal to" (clearly seen in the second and third steps). In the answers of students, the symbol is not exactly parallel to the main fraction symbol, but rather parallel to the numerator fraction symbol.

From Vian's answer to question number 2, because students are able to fulfil all three problem indicators, the ICA is also fulfilled so that it can be said that for Vian the second HLT goal has been achieved.

2. *Dodi's answer to Problem Number 2.* In the answer to question number 2, Dodi uses a strategy to decipher the right segment to become a simpler form. Dodi also uses a basic identity to solve problems but has difficulty in the middle of the road. Seen in Dodi's answer in the third step, students make mistakes related to algebraic manipulation. This error is indicated by crossing out $cos\ \alpha$ which violates the rules of algebra.

Interviewer	*Why did you choose this strategy, outline the right side?*
Dodi	*The problem is that the right is more complicated, sir. So it can be simplified.*

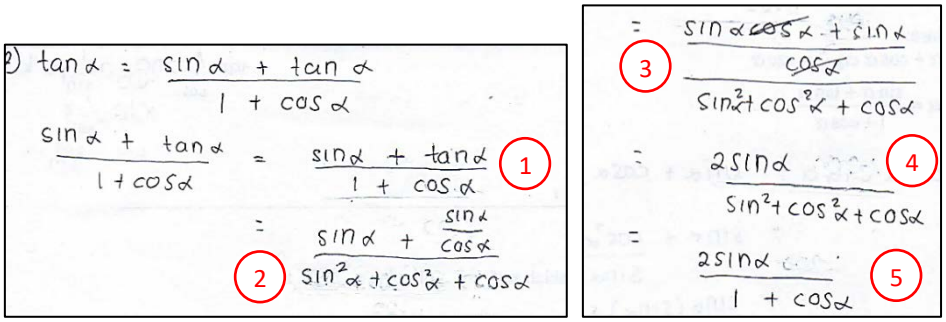

Figure 5. Dodi's answer to question Number 2

Interviewer	*This number two, how?*
Dodi	*I haven't solved it yet, sir.*
Interviewer	*How do you do it?*
Dodi	*What I have done is, sir. This changes the right side. I changed the tan, sir. So sin per cos. The bottom one, this one, I'm describing to be sin squared plus cos squared, per this. This (pointing to the third step) is wrong here, sir. The upper one can be added together, equalized by the denominator. So sin cos plus sin divided by cos, divided by sin squared plus cos squared ... Well, it should not be crossed out, but I crossed it out. So wrong.*
Interviewer	*Do you think you can make the right one? Try to do it again starting from this, which should not be crossed out earlier.*
Dodi	*(Trying to work again according to the instructions of the researcher)*

In further investigation, through interviews and improvements made by students, Dodi turned out to have a basic algebraic operating ability that was not strong enough to make mistakes as mentioned above. Therefore, the researchers tried to provide scaffolding so that eventually the students were able to answer correctly.

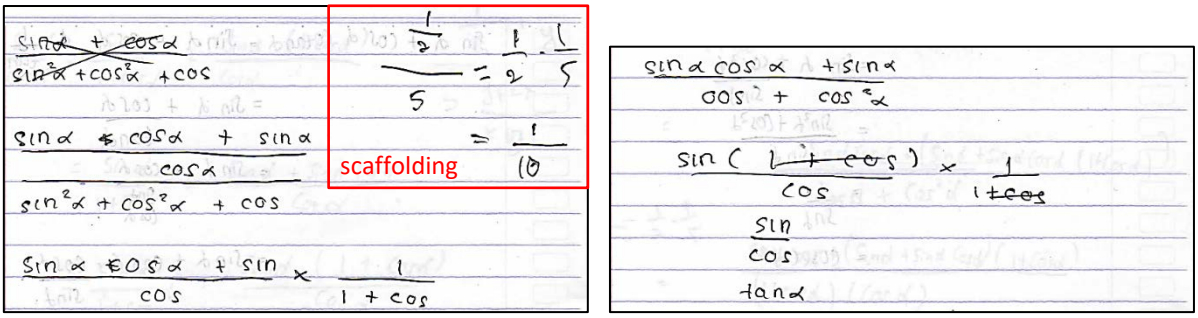

Figure 6. Dodi's answer to question Number 2 after being given a scaffolding

Dodi	*I'm confused, sir.*
Interviewer	*How confused?*
Dodi	(tried to think again for some time and didn't seem to know what to do).
Interviewer	*If there is one by two per fifth. What does this change per what, how?*
Dodi	*This (5) is raised, sir. (thinking by trying to apply it to the problem). Confused, sir.*
Interviewer	*Look at this again (pointing* $(1/2)/5$, while writing $\frac{1}{2} \cdot \frac{1}{5}$*). From this, how?*
Dodi	*This is one tenth, sir.*
Interviewer	*Okay. Can this be applied in the matter of no?*
Dodi	*This means ... (trying to think and not being able to immediately apply the scaffolding to the problem).*
Interviewer	*Try this sin alpha cos plus alpha sin can be changed no?*
Dodi	*Oh ... you can, sir. This should be (pointing cos times one plus cos) don't multiply first, sir? (continuing to finish) This is meeting ... the solution is like this, sir.*
Interviewer	*So what conclusion?*
Dodi	*Em ... So the conclusion is proven ... sin but plus tan per one plus cos the teta is the same as tan teta.*
Interviewer	*Okay. This is alpha.. Not teta.*
Dodi	*Oh yeah, sir.*

Another thing that attracts the attention of researchers besides the things mentioned above, it turns out that Dodi also does not memorize the names of mathematical symbols. This can be seen from the results of interviews with students who refer to the alpha symbol as a symbol of teta.

From Dodi's answer, the problem indicators that are fulfilled are only the first indicator. The second indicator has also been carried out through trial and error, but in carrying out algebraic operations it

cannot carry out correctly. Thus, for question number 2, it can be said that Dodi did not fulfill the ICA and the second HLT goal was not reached.

3. *Maman's answer to Problem Number 2*. In solving question number 2, Maman chose a strategy to decipher the left and right segments at the same time. In the answer it appears that Maman has difficulty in the third step where despite difficulties, students continue to complete the solution until the seventh step. In the seventh step, students seem unable to continue the settlement.

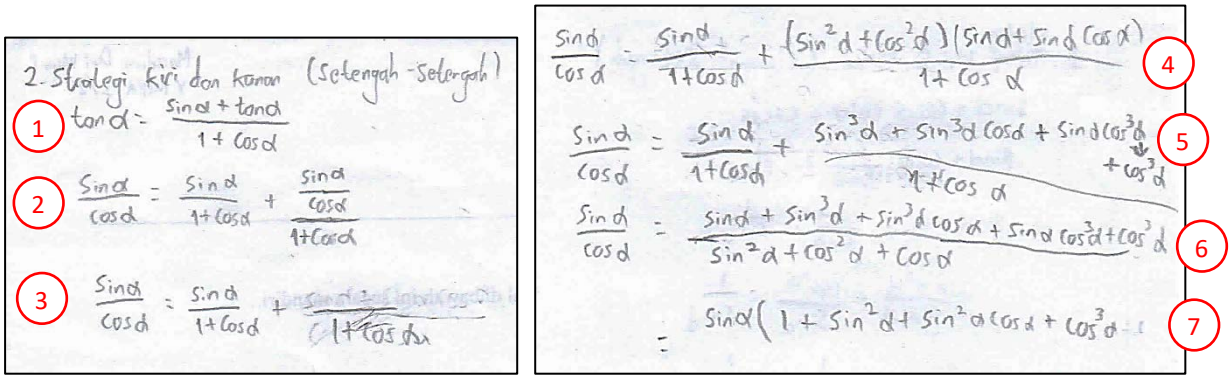

Figure 7. Maman's answer to question Number 2

Interviewer	*Number two, how?*
Maman	*Wrong.*
Interviewer	*How is that wrong?*
Maman	*Confused how to release this plus sign.*
Interviewer	*What strategy do you use?*
Maman	*Left and right. Only the problem was, releasing one plus cos alfa. That's what makes me confused.*

In further investigation to find out where the students were wrong, interviews were conducted. It turns out that Maman is the same as Dodi. Learners make mistakes in basic algebraic operations related to the fractions deciphered by saying that it is difficult for him to decipher the denominator $(1 + \cos \alpha)$. Then educators ask students to try to correct their mistakes.

When correcting the third step, students continue to experience difficulties so that educators provide scaffolding as follows.

Interviewer	*Half divided by five, what is the result?*
Maman	*five by two.*
Interviewer	*If it's half divided by two, what is the result? You have half bread, divided by two, how much?*
Maman	*A quarter.*
Interviewer	*Well, if one per x plus two per y, what is the result?*
Maman	*Y add two x per x y.*
Interviewer	*Now, try to apply it to the problem.*

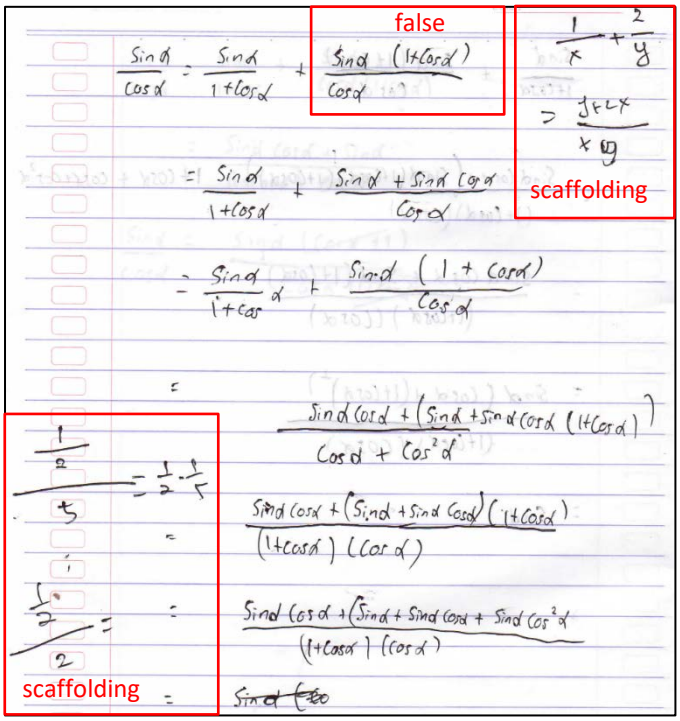

Figure 8. Maman's answer to question Number 2 after trying to do it again but is still wrong so it is given a scaffolding

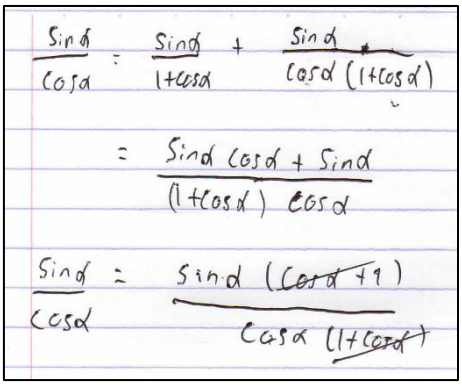

Figure 9. Maman's answer to question Number 2 is correct

By giving the scaffolding, students can finally correct the mistakes in the third step and continue to resolve.

From Maman's answer, it can be seen that the third problem indicator is not fulfilled. Therefore, it can be said that for Maman for question number 2, the ICA was not reached so that the second HLT goal for Maman was also not achieved.

From the answers to questions number 2 above, of the three students, two students could not fulfill the third indicator of the problem so that they did not fulfill the ICA. A common cause that results in an unmet CPI is that students experience difficulties related to algebraic manipulation, especially in the form of fractions. Therefore, for question number 2, the overall goal of the second HLT for the three students was not achieved.

Conclusion

Based on the descriptions above, the number 1 question can be solved by the three students while the second question can only be solved by one student. Thus, it can be concluded that of the three students selected as research subjects only one student fulfilled the ICA for both trigonometric identity verification questions. Therefore, it can be said that the second HLT goal of learning about the verification of trigonometry identity through Problem Based Learning for two students is not achieved.

A common cause that results in two students' ICAs not being fulfilled in both questions is not because students do not understand how to prove trigonometric identity, but because students have the ability to be less skilled in performing basic algebraic operations, especially algebra related to fractional forms.

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The Implementation of Blended Learning Mediated by Edmodo to Learn about Work and Energy at Advent Nusra High School Kupang

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Abstract: Blended learning is considered as a relevant learning method to be applied today where technology is being and will continue to grow rapidly, but also does not eliminate the interactions that are supposed to be built between teachers and students. In this study researchers chose to use Edmodo media because Edmodo is a social networking-based educational platform that is rich in learning features for the sake of learning activities that better support the fulfillment of student learning needs.
This study aims to find out: (1) Effectiveness of the application of blended learning methods that utilize Edmodo media in terms of student involvement in the topic work and energy for class X MIA Nusra Kupang Advent High School Academic Year 2018/2019. (2) Effectiveness of applying blended learning methods that utilize Edmodo media in terms of learning achievement on work and energy material in class X MIA Nusra Kupang Advent High School Academic Year 2018/2019.
The type of research used in this study is descriptive research using a quantitative approach. The subjects of this study were 18 X grade students of MIA Nusra Kupang Advent High School 2018/2019 academic year. The object of this research is physics learning with blended learning method that uses Edmodo media on work and energy. Data in this study include student involvement data, student learning outcomes test data, and student response data. Data in this study were collected through questionnaires and written tests based online.
The results of the research obtained are: (1) The application of blended learning methods that utilize Edmodo media is effective in terms of student involvement. Student involvement obtained through questionnaires is very high with a percentage of 67%. (2) The application of blended learning methods that utilize Edmodo media is effective in terms of student learning outcomes. Student learning outcomes show a good category, with a percentage of 72% where the average value is 81.

Keywords: Blended learning, Edmodo, effort and energy, learning methods, student involvement, student learning outcomes, student responses.

Introduction

The challenge of today's physics teacher is to present interesting physics learning so as to increase student involvement and learning outcomes in learning physics. The use of information and communication technology media (Information and Communication Technology [ICT]) is one way to overcome the above challenges. In this ICT media learning pattern, learners can choose learning materials based on their own interests, so learning becomes fun, not boring, full of motivation, enthusiasm, attract attention and so on (Husamah, 2014).

Unfortunately, in many schools the use of technology in learning is still not optimal. One of them is in Nusra Kupang Advent High School where the use of technology in learning is still rare. Teachers still feel comfortable with conventional learning methods that tend to rely on the lecture method. Based on the interview of the researcher with one of the students at Nusra Advent High School, it was said that almost all students in the school already had smartphone or smartphone technology. According to them smartphones (which are connected online) really help them in their daily lives, including those related to learning. For example, working on a task by utilizing the internet or discussing a material by utilizing an online group. So, this is actually a good opportunity to present interesting and fun physics learning, using the smartphone that students have.

Although the ease of accessing information can be done using a smartphone, students still need guidance from the teacher so that student learning remains focused and in accordance with the learning objectives. For this reason, direct guidance and supervision by the teacher in a face-to-face manner is still needed. So, the best solution does have to combine face-to-face learning with learning using technology media that is connected online. This mixed learning is called blended learning. According to Faizal (in Husamah, 2014), the benefits of blended learning are not only face to face, but there are additional learning times by utilizing online media, facilitating and accelerating the communication process between instructors and students (learning partners), and helping the process of accelerating teaching, help motivate students to be involved in the learning process.

By paying attention to the things described above, the teacher must see this as an opportunity to increase student involvement and learning outcomes by utilizing blended learning methods that utilize Edmodo media in learning. It is on this basis that the researcher decided to conduct a study entitled "Learning About Work and Energy at Nusra Kupang Advent High School with Blended Learning Method that Utilizes Edmodo Media."

The purpose of this study was to find out: (1) Effectiveness of the application of blended learning methods that utilize Edmodo media in terms of student involvement in work and energy in class X MIA Nusra Kupang Advent High School Academic Year 2018/2019. (2) Effectiveness of applying blended learning methods that utilize Edmodo media in terms of learning achievement on work and energy material in class X MIA Nusra Kupang Advent High School Academic Year 2018/2019.

Literature Review

According to Bielawski and Metcalf (in Husamah, 2014) blended learning is a relatively new concept in learning where teaching is delivered through a combination of online and traditional learning which is carried out by instructors or instructors. According to Dwiyogo (2011), blended-based learning has at least 6 elements, namely: (a) face-to-face (b) independent learning, (c) application, (d) tutorial, (e) collaboration, and (f) evaluation.

The application of the blended learning method to the topic of work and energy is supported by Edmodo application which is a social networking-based educational platform that is rich in learning features for the sake of learning activities that better support the fulfillment of student learning needs.

Student engagement is a manifestation of motivation seen through actions, cognitive, and emotions displayed by students, referring to energetic, directed, and persistent actions when getting students' difficulties or qualities in their interactions with academic tasks (Connell & Wellborn, in Handelsman, 2005)

According to Fredircks et al., (2004) student engagement consists of three dimensions. Student engagement is a multidimensional construct that consists of three dimensions, namely behavioral engagement, emotional engagement, and cognitive engagement.

Learning outcomes, according to Mulyasa (2008) are overall student learning achievement which is an indicator of competence and the degree of change in behavior in question. Competencies that must be mastered by students need to be expressed in such a way that they can be assessed as a manifestation of student learning outcomes that refer to direct experience. Meanwhile, the object of assessment of learning outcomes according to Sudjana (2013) can be divided into three domains, namely the cognitive, affective, and psychomotor domains. The object of research learning outcomes used in this study focused on the cognitive domain of knowledge, understanding, application, analysis, synthesis, and evaluation.

Indicators of achievement of competency (GPA) on work material and energy in this study are: (1) Analyzing the relationship between effort, style, and displacement; (2) Calculating the amount of work based on the graph; (3) Calculating negative efforts; (4) Calculating total effort by many styles; (5) Calculating the amount of kinetic energy and potential energy; (6) Analyzing the relationship between work and kinetic energy; (7) Analyzing the relationship between work and potential energy; (8) Formulate the legal form of conservation of mechanical energy.

Research Method

The research was conducted in class X MIA Nusra Kupang Advent High School 2018/2019 academic year. The object to be measured of this research was the involvement, and student learning outcomes in the application of the blended learning method by using Edmodo's media on work material and energy.

Learning instruments in the form of Lesson Plan (RPP) and Student Worksheets (LKS). RPP about work and energy was prepared by researchers using the 2013 curriculum in accordance with the curriculum used by Nusra Kupang Advent High School.

The instruments to collect data was consisted of two types, namely involvement instruments, and student learning outcomes instruments. The instrument of student involvement and was a questionnaire filled out by students after following a series of learning processes. While the instrument of student learning outcomes in the form of questions about the test of work material and energy.

The analysis of the results of the student involvement questionnaires was done by summing the scores according to the students' answers. The questionnaire uses a Likert scale with the score assessment as follows (Riduwan, 2012).

Table 1. Questioner Scoring Guidelines

Statement	Positive	Negative
Strongly Agree (SS)	4	1
Agree(S)	3	2
Disagree (TS)	2	3
Strongly Disagree (STS)	1	4

The percentage score of each student was obtained by:

$$P_s = \frac{s_s}{s_t} \text{ x } 100\%$$

Ps = Percentage of each student

Ss = Student real score

St = Maximum score

The student's respond the classified into five groups (Suharsimi, 2009):

Table 2. Classification of Student's Score

Student's Score Percentage	Classification
0% - 20%	Very Low
21% - 40%	Low
41% - 60%	Fair
61% - 80%	High
81% - 100%	Very High

The total students' learning achievement was obtained by using formula:

$$P_k = \frac{s_t}{s} \text{ x } 100\%$$

Pk = Total percentage

St = Number of students that meet the minimum score

S = Total students number

Student learning outcomes were analyzed quantitatively to determine the predicate achievement of student learning outcomes by referring to the following table (Kartika Budi, 2001):

Table 3. Norm Criteria of Student's Learning Achievement

Norm Criteria	Interval
Very Good (VG)	B+4C < X ≤ B+5C
Good (G)	B+3C < X ≤ B+4C
Fair (F)	B+2C < X ≤ B+3C
Lass Good (LG)	B+C < X ≤ B+2C
Bad (B)	B < X ≤ B+C

X = Student's final score
A = Student's highest score
B = Student's lowest score
C = The difference i.e. $\frac{A-B}{5}$

Table 4. Classification of Student's Learning Achievement (Kartika Budi, 2001)

Norm Criteria					
VG	**VG + G**	**VG + G + F**	**VG + G + F + LG**	**VG + G + F + LG + B**	**Accumulative Criteria**
≥75%					Very Good (VG)
	≥75%				Good (G)
		≥65%			Fair GB)
			≥65%		Less Good (LG)
				≥65%	Bad (B)

The Effectiveness Criteria

In this case the effectiveness is seen from the involvement and learning outcomes of students. The following explanation:

1. Learning Involvement

The results of the questionnaire that have been filled out by students will be analyzed later Table 3.5. The application of the blended learning method that utilizes Edmodo media is said to be effective in terms of student involvement if at least 75% of students have an involvement with a high minimum category.

2. Learning outcomes

The value of learning outcomes is the value obtained through written tests. The final values obtained are then compared with Table 3.7. The application of the blended learning method that utilizes Edmodo media is said to be effective in terms of student learning outcomes if at least 75% of students have learning outcomes with a minimal good category.

Student's Involvement

The following is a summary of questionnaire data as a result of student involvement in the blended learning method that utilizes Edmodo's media on work material and energy after going through the scoring process, which has been categorized as referring to Table 2:

Table 7. Student's Involvement in Learning

Student's Code	Student's Score	Percentage	Classification
1	60	100%	VH
2	57	95%	VH
3	58	97%	VH
4	60	100%	VH
5	59	98%	VH
6	59	98%	VH
7	59	98%	VH
8	54	90%	VH
9	49	82%	VH
10	31	52%	F
11	59	98%	VH
12	49	82%	VH
13	51	85%	VH
14	57	95%	VH
15	55	92%	VH
16	60	100%	VH
17	32	53%	F
18	53	88%	VH

F = Fair

VH = Very High

Following are the qualities of student responses related to the use of blended learning methods that utilize Edmodo media based on Table 7 which are analyzed by using classification in Table 2.

Table 8. Quality of Student's Involvement

Classification	Frequency
Very Low (VL)	0
Low (L)	0
Fair (F)	2
High(H)	0
Very High (VH)	16

Following is the chart representing the student's involvement

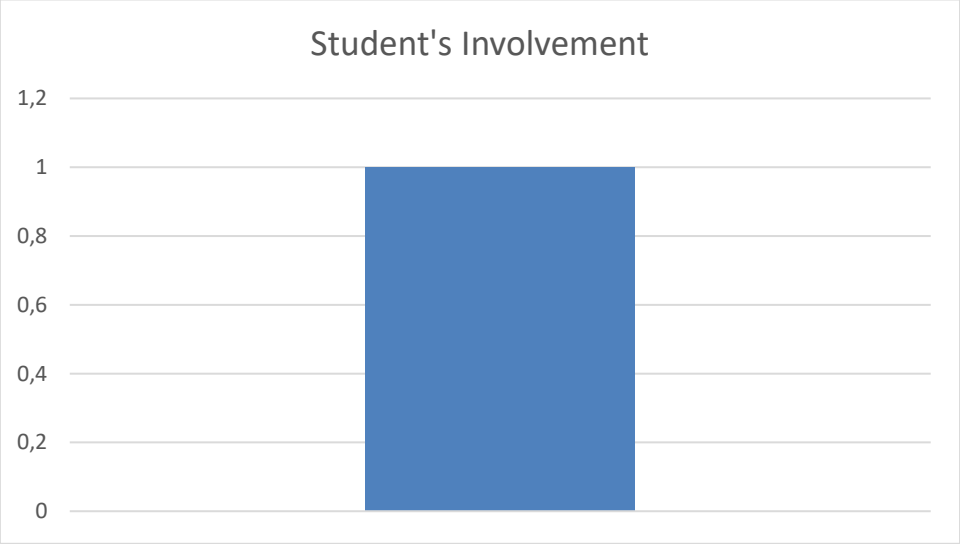

Figure 1. Percentage of Student's Involvement

Table 8 and Chart 2 show that 16 students reached the target with a very high category. So as a whole, based on the grouping in Table 2, it was found that the involvement of students in the XIA class of Nusra Kupang Advent High School towards the use of blended learning methods that utilize Edmodo media was included in the very high category with a percentage of 89%.

Student's Learning Achievement

The following is a summary of the student learning outcomes test that has gone through the scoring process and has been converted into a value:

Table 9. Students Learning Achievement

Student's Code	Final Score
1	79
2	82
3	52
4	85
5	88
6	69
7	80
8	47
9	62
10	42
11	72
12	72
13	62
14	80
15	37
16	71
17	47
18	75

Maximum score: 100

Student learning outcomes test data that have been obtained in Table 9 shows that the highest value of students is 88 and the lowest value of students is 37. For the class average value is 67. Referring to Table III can be obtained achievement of all students' learning outcomes as follows:

Table 10. Students Learning Achievement Classification

Classification	Percentage	Frequency
Very Good (VG)	33%	6
Good (G)	28%	5
Fair (F)	11%	2
Lass Good (LG)	6%	1
Bad (B)	22%	4

After obtaining these percentages, by referring to Table IV, the achievement of student learning outcomes tests is as follows:

Table 11. Norm Classification of Student's Learning achievement

Norm Classification					
VG	VG + G	VG + G + F	VG + G + F + LG	VG + G + F + LG + B	Accumulative Classification
33%					Very Good (VG)
	61%				Good (G)
		72%			Fair GB)
			78%		Less Good (LG)
				100%	Bad (B)

Following chart representing the proportion of student's learning achievement.

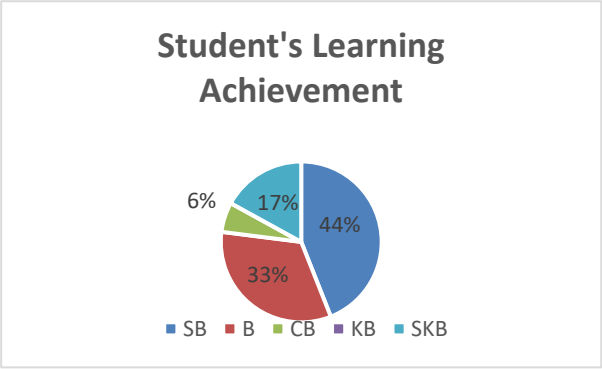

Figure 2. Percentage of Student's Learning Achievement

The results of the analysis of student learning outcomes test data Table 11, with reference to Table 4, it was found that the achievement of learning outcomes of all students of class X MIA Nusra Kupang Advent High School included in the good category with a percentage of 77%.

Results and Discussion

Student involvement in learning is very important to provide a better learning experience for students, it makes students rich in learning experiences. Students who are more often involved in learning are expected to be able to achieve the success of the learning itself. This is evident in this study that students who have a high percentage of involvement tend to have high learning outcomes.

Students also give a good response to the use of Edmodo as a learning medium in the blended learning method. This is also evident in learning where students do not have significant difficulties in operating Edmodo or utilizing Edmodo for learning purposes. Like sending assignments, looking for material, to working on online tests, and find learning resources. Throughout class learning many students use Edmodo as a reference to do the assigned tasks. This means that students enjoy the use of Edmodo media in learning.

The following is a description of the data outlined from the results of the study, which includes data on response, involvement, and student learning outcomes.

Conclusion

The results of this research revealed that:

1. The involvement of students in class X MIA Advent Nusra Kupang High School in learning about business and energy using blended learning methods that use Edmodo media can be said to be effective. This is evident from the results of the questionnaire analysis of student involvement which is included in the very high category with a percentage of 89% which already meets the effectiveness criteria of at least 75% of students included in the minimal high category.
2. Achievement of student class X MIA Advent Nusra Kupang learning outcomes in learning about business and energy using blended learning methods that utilize Edmodo media can be said to be ineffective. This is evident from the results of the analysis of student learning outcomes tests where only 61% achieved effectiveness criteria with a minimal good category. This result does not meet the effectiveness criteria, which is that at least 75% of students fall into the high minimum category. Overall the percentage of this class is quite good with a percentage of 72%.

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Design Research for Business Introduction Subject: Developing Think Pair and Share Method to Improving Student's Sharing Skills and Student's Participation Skills

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Abstract: Discussion is one of method in learning process to provide direct experience for students. Through discussion, students can develop their sharing skills and participation skills. However, in a discussion group, sometimes there are students who are too active or dominant, while there are students who are too passive and do not contribute to discussion groups. This situation makes the discussion ineffective. In business introduction subject in Economic Education Study Program, Sanata Dharma University, one of methods used by lecture is group discussion. Lecturer develop design research. This design research aims to developing think pair and share methods to improving student's sharing skills and student's participation skills. This design research is divided into three stages: design, implementation and evaluation. At design stage, researchers design learning using think pair and share method. Through this method, it is expected that group discussions conducted by students can be effective. No student is too dominant, and no student is too passive in the discussion. The next stage is implementation. At this stage, lecturer applies think pair and share method in business introduction subject. And at evaluation stage, lecture evaluated the implementation of applied method. Result of this research showed that think pair and share method can improving student's sharing skills and student's participation skills.

Keywords: cooperative learning, think pair and share, sharing skills and participation skills.

Introduction

Learning methods are one of the factors that encourage student learning. The use of appropriate and varied learning methods can help students understand the material so that learning objectives can be achieved. In the learning process, lecturers can design a learning method that is appropriate for the students' character and class conditions. Thus, the learning process becomes more enjoyable and students can absorb the material more easily.

Business introduction **s**ubject is one of the subjects in Economic Education Department in Sanata Dharma University. This class consists of 44 students. This subject provides students with concepts of business, marketing mix, business social responsibility and their impact on the economic life of the community, forming graduates who have social skills, especially sharing skills and student participation skills.

One way to improve social skills through discussion methods. In the discussion method, there are often group members who are passive or do not contribute to the team, and there are also members of the dominant group.

Based on these problems, the author is interested to develop design research for Business Introduction subject, such as developing think pair and share method to improving student's sharing skills and student's participation skills.

Social skills

Social skills are behaviors that support the success of social relationships and enable students to work with people more effectively (Arends, 2008). According to Arends (2008), there are four social skills, which are: (1) sharing skills: skills to teach how students can share with other students, (2) participation skills: students' skills to be able to participate in their teams/group, (3) communication skills: students' to be able to communicate with other students, and (4) group skills: students' skills to be able to work in groups.

Design Research for Business Introduction Subject

Focusing social skills in this research are students' sharing skills and students' participation skills. Lecturer develop research design by developing think pair and share method in Business Introduction subject. Think pair and share is a collaborative teaching strategy first proposed by Frank Lyman of the University of Maryland in 1981. It can be used to help students form individual ideas, discuss and share with the others in-group. It can be used before reading or teaching a concept and works better with smaller groups (Wikipedia.org).

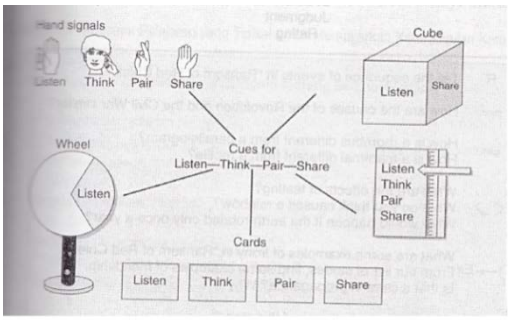

Figure 1. Think Pair and Share Method

Characteristics of think pair and share method (Lyman, in Arends, 2008) are: (1) think (think individually), lecturer asks students and students are given sufficient time to think and gather their thoughts, (2) pair (think with friends at a table), students begin to share their thoughts and views with their pair, each learns to see the different perspective of thinking among their peers, and (3) share (share their answer with groups and classes), students share their answers to group or class. Students learning is enhanced by the formation and articulation of an idea. This also enables the students to have clarity of thought and have the ability to communicate their thoughts and ideas to another student in group and class.

Research Method

This research development is done on the even semester of academic year 2018/2019, that is in February - June 2019. Subjects in this study are students who take the Business Introduction course.

Data in this research is primary data. To collect data for students' sharing skills and students' participation skills, this research use questionnaire. Questionnaire instrument in this research used an instrument developed by Wiggins (Arends, 2008). Analytical technique is described from the students' perception based on questionnaire instrument.

Table 1. Instrument for students' sharing skills and students' participation skills

No	Statement
1	Classroom treatment of various issues
	Superficial 1 2 3 4 5 Very Complete and Deep
2	How helpful is the discussion for your understanding?
	Very Low 1 2 3 4 5 Very High
3.	Level of your participation:
	Very Low 1 2 3 4 5 Very High
4.	Overall class participation
	Very Low 1 2 3 4 5 Very High
5.	Your quality participation
	Very Good 1 2 3 4 5 Very Bad

Wiggin (Arends, 2008)

Results and Discussion

Think and Pair Design

Lecture applies think pair and share method in Business Introduction lectures. The lecturer applies two lectures with think pair and share method. The steps for implementing think and pair method in this design research are as follows.

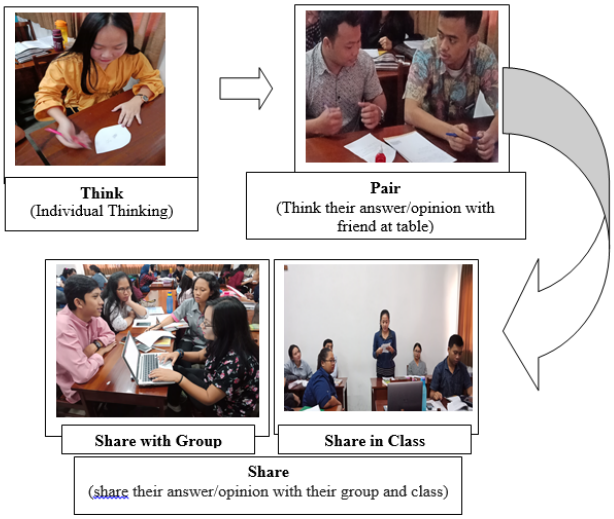

Figure 2. Think Pair and Share Design

Results for Student's Sharing Skills and Student's Participation Skills

After lecturer applies think pair and share method, lecturer distributes questionnaires filled by students through google form to find out whether there is an improving in student sharing skills and student participation skills. The results are as follows.

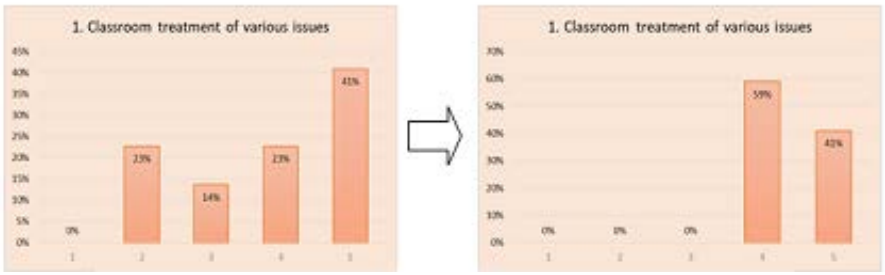

Figure 3. Result of classroom treatment of various issues

First statement in this research instrument is students' perception of classroom treatment of various issues. Based on graph 1, it was found that in first cycle, result of students' classroom treatment of various issues in middle to low category (score 2 and 3) as much as 37% while those in second cycle did not choose a score of 1,2 or 3. In second cycle, classroom treatment of various issues in the complete and deep category with 59% of students choosing a score of 4 and 41% choosing a score of 5. Thus, it can be concluded that there is improving from first cycle to second cycle for classroom treatment of various issues.

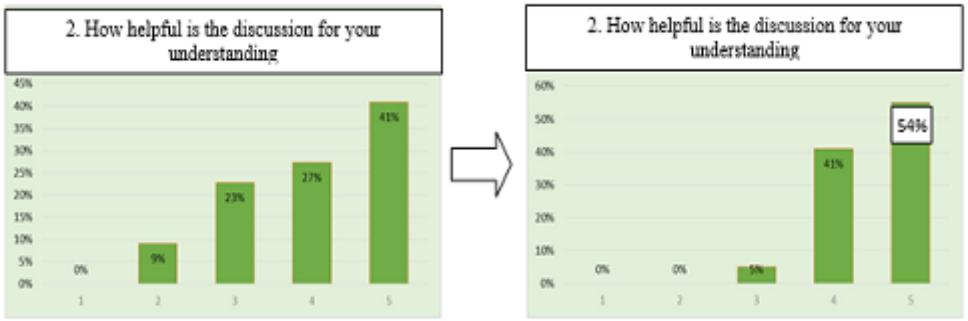

Figure 4. Result of how helpful the discussion for students' understanding is

Second statement in this research instrument is perception students about how helpful the discussion for students' understanding is. Based on graph 2, it was found that in first cycle, result of how helpful is the discussion for students' understanding in low to middle category (score 2 and 3) as much as 32% while those in second cycle, student did not choose a score of 1 or 2. In second cycle, how helpful is the discussion for students' understanding in middle category was 5%, high category and above was 41% of students choosing a score of 4 and 54% choosing a score of 5. Thus, it can be concluded that there is improving from first cycle to second cycle for how helpful the discussion for students' understanding is.

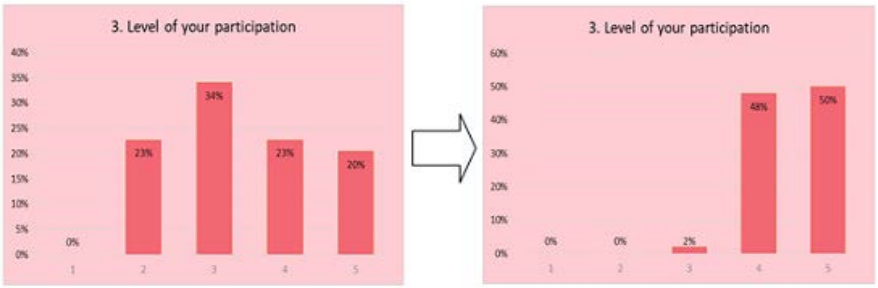

Figure 5. Result of level of students' participation

Third statement in this research instrument is perception students about level of students' participation. Based on graph 3, it was found that in first cycle, result of level of students' participation in low to middle category (score 2 and 3) as much as 57% while those in second cycle, there is no student choose a score of 1 or 2. In second cycle, level of students' participation in middle category was 2%, high category and above was 48% of students choosing a score of 4 and 50% choosing a score of 5. Thus, it can be concluded that there is improving from first cycle to second cycle for statement of level of students' participation.

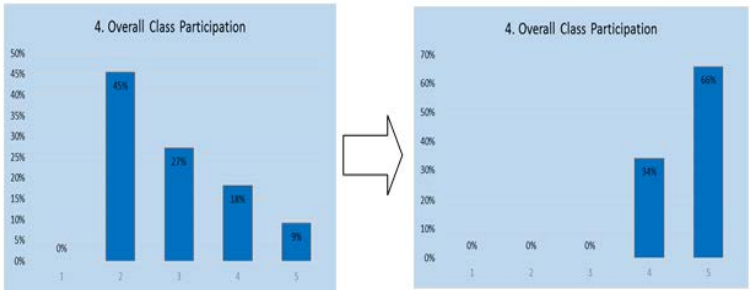

Figure 6. Result of overall class participation

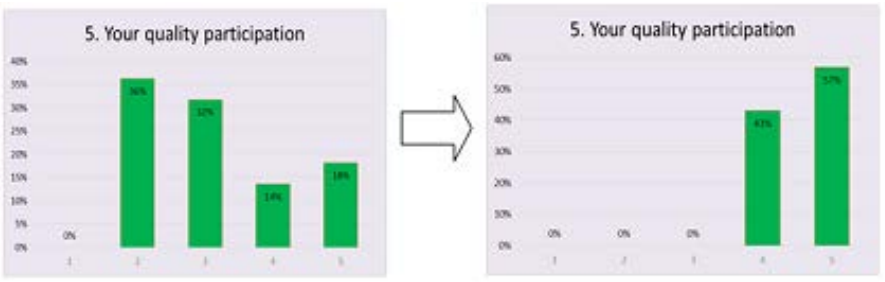

Figure 7. Result of students' quality participation

Fourth statement in this research instrument is perception students about overall class participation. Based on graph 4, it was found that in first cycle, result of overall class participation in low to middle category (score 2 and 3) as much as 72% while those in second cycle, there is no student choose a score of 1 or 2 or 3. In second cycle, overall class participation high category was 34% (students choose 4) and very high was 66% (students choose 5). Thus, it can be concluded that there is improving from first cycle to second cycle for statement of overall class participation.

Fifth statement in this research instrument is perception students about students' quality participation. Based on graph 5, it was found that in first cycle, result of students' quality participation in bad to middle category (score 2 and 3) as much as 68% while those in second cycle, there is no student choose a score of 1 or 2 or 3. In second cycle, students' quality participation in good category was 43% (students choose 4) and very good was 57% (students choose 5). Thus, it can be concluded that there is improving from first cycle to second cycle for statement of students' quality participation.

Based on results of five questionnaire statements above (Figure 1 – Figure 5), it can be concluded that there are improving in students' sharing skills and student participation skills from the first cycle to the second cycle. There are several factors. First, in the first cycle, students did not fully understand the procedure for implementing think pair and share method. Secondly, students in first cycle did not prepare themselves to learn and explore current issues, and content of chapter, but in second cycle, students were more prepared. Third, students who are usually passive, with this method, students become active and participate in groups and class. In first cycle, students who are usually passive, still lack confidence to express their opinions and participate actively both in groups and in class. But in the second cycle, students who are usually passive, more confident and actively participate. Likewise, with students who are accustomed to being dominant in group and class discussions. From the first cycle to the second cycle, students who are usually dominant also become less dominant in class and encourage and provide opportunities for passive students to actively participate.

Conclusion

Based on results of this design research, developing think pair and share in Business Introduction subject can improving student's sharing skills and student's participation skills. For that, this research design can be use as an alternative for developing research design to improve students' sharing skills and students' participation skills.

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STEM Education for Prospective Teachers

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Abstract: The aim of this research is to determine the perception of prospective teachers, especially in the field of mathematics studies on STEM-based learning. The sample in this study were final students majoring in Mathematics Education at the Nineteenth University of November. This research was using a survey method. The research sample is prospective teachers especially in the field of mathematics studies. Research result show that the enthusiasm of perception teachers towards STEM education is very high. STEM education is able to improve the creativity of using learning media very well. Prospective teachers still have integrity in their knowledge. Thus, STEM education is very much needed in the world of education.

Keywords: STEM, mathematics education, prospective teachers

Introduction

Education has been in an era where various innovations about learning have grown to help and make things easier, especially in the learning process. These facilities have an impact on life, which is the world of education such as learning media will experience the change. With the development of the electronic world, the era of computer-based learning has replaced the forms of learning that have been applied all this time. These developments must be accompanied by developments in the learning process. STEM education is teaching and learning that refers to the fields of science, technology, engineering, and mathematics (Valerio, 2014). Therefore, STEM education is more important in preparing students to work in the technologically advanced world and is very important for the nation's competitiveness in the global economy (Wu & Anderson, 2015).

STEM as a form of teaching based on science, technology, engineering, and mathematics has received various attention and has been widely recognized as one of the contemporary forms of science that deserves to be improved. STEM is one of the solutions to problems in the world, especially in the field of education (Sheffield, Koul, Blackley, Fitriani, & Rahmawati, 2018). One of the STEM roles is as means to overcome student achievement both nationally and internationally and prepare students to be competitive in the global economy (English & King, 2015). STEM education has an important role in the development of education today. Therefore, students as the next generation who face complex problems in the future will no longer have problems and they are able to compete globally, especially as a workforce that tends towards the technological era.

The success or failure of STEM learning also lies in the teacher's ability. Not only students who will face these changes, but for prospective teachers must also be able to adjust to various changes that exist. STEM-based learning is expected to be applied by prospective teachers so that what has become the goal of education today can be fulfilled. The success of students in facing the global world today certainly has a teacher's role in it. The application of STEM can be supported by various learning methods. Integrative STEM allows various learning methods to be used to support its application (Ruiz-Gallardo, Castaño, Gómez-Alday, & Valdés, 2010; Jo & Ku, 2011; Wirkala & Kuhn, 2011; Mayer, Moeller, Kaliwata, Zweber, Stone, & Frank, 2012; Sandi, Cooper, & Stevans, 2012).

In education, STEM has been integrated into the curriculum using a holistic approach to teaching students to analyze and solve problems using technology and collaborative learning strategies. However, developed and developing countries, including Indonesia, face challenges in improving STEM education (Caprile, Palmen, Sanz, & Dente, 2015). In Indonesia, STEM is taught separately in science and math lessons (Sheffield et al., 2018). Although these subjects are considered important and highly valued, STEM as an integrated subject itself has not been well developed. STEM can be seen as the integration of subjects through a paradigm shift that focuses on mathematics and the development of

ICT literacy. Therefore, to successfully integrate STEM into the curriculum, adjustments are needed. STEM has been widely applied in learning. This situation is shown from the results of research that reveal that the application of STEM can improve students' academic and non-academic achievements (Cancilla, 2001; Bigelow, 2004; Gijbels, Dochy, Bossche, & Segers, 2005; Lam, Doverspike, Zhao, Zhe, & Menzemer, 2008; Lou, Iu, & Shih, 2011; Massa, Dischino, Donelly, & Hanes, 2011; Reynolds, Yazdani, and Manzur, 2013).

In 2015, Australia established a "National STEM School Education Strategy 2016-2026" program on STEM education strategies to improve students' STEM abilities and aspirations (Murphy, MacDonald, Danaia, and Wang, 2019). The research explains about the capacity of educators in learning STEM. The results show that the STEM education strategy that has been applied has a great influence in building students' STEM abilities. Çalisici, Sümen (2018) conducted a study of the perceptions of prospective teachers about the STEM approach, showing that prospective teachers consider STEM to be a useful and necessary and highly valued approach that involves additional fields. In several categories, it was found that there were significant differences in the level of participants based on gender and grade level. In addition, Deveci (2019) conducted a study to examine reflections on STEM teacher teacher awareness. The results showed that STEM teacher candidates' awareness was greatly influenced by what they had done before. This explains that a person's understanding of something is influenced by what they learned before. From several studies that have been explained it is important to review the extent of STEM perceptions for prospective teachers, if viewed from the initial knowledge, readiness to their career path.

Research Method

This study uses descriptive analysis, to reveal the importance of STEM education. The instrument used is the Perception Instrument for Mathematics Teachers in STEM Education-Based Learning. This instrument consists of 20 questions that contain the views and knowledge of prospective teachers towards STEM. The item on the instrument contain several aspects including the initial knowledge of STEM, readiness in implementing STEM, and the effect of STEM on career paths. The sample in the study were the final semester students in the education department with 30 people. The sample selection aims to determine the extent of knowledge about STEM and their readiness in implementing STEM-based learning after graduation. Final semester students have gone through a whole series of lectures about the learning process in the classroom and microteaching, so that armed with that knowledge will make them understand about the application of STEM. The selection of this sample is in accordance with the initial objectives of the study, which is to determine the perceptions of prospective teachers who will later become teaching staff in various schools.

Discussion

The role of STEM education greatly contributes greatly to improving the quality of education. The following are the results of the research in the form of descriptions of the attitudes of prospective teachers towards STEM education.

Table 1.

Item	1	2	3	4	5	6	7	8	9	10
Statement	+	+	+	-	+	-	+	-	+	-
Median	3	3	4	2	3	2	4	2	3	2
Modus	3	3	4	2	3	2	4	2	3	2
Percentage	39%	55%	55%	71%	39%	71%	61%	52%	48%	61%

Table 2.

Item	11	12	13	14	15	16	17	18	19	20
Statement	+	-	+	+	+	-	+	+	+	+
Median	3	3	3	3	3	2	3	3	3	4

Modus	3	3	3	3	3	2	3	3	3	4
Percentage	45%	29%	42%	61%	68%	65%	68%	19%	35%	52%

More than 50% of prospective teachers agree that STEM education needs to be studied from the elementary to tertiary level. In addition, prospective teachers strongly agree that STEM education is an integrated learning between science, technology and mathematics. Prospective teachers do not agree that STEM education cannot develop students' creativity through a problem-solving process and prospective teachers agree that STEM education for students is expected to deliver students to fulfill 21st century abilities and skills. Prospective teachers do not agree that STEM education cannot provide learning and innovation skills that include critical, creative, innovative thinking and being able to collaborate. The next response, prospective teachers agreed that STEM education students will be able to use media, technology, information and communication.

From the results of the research conducted, around 98.8% of respondents knew the importance of STEM education. This shows that until now STEM has been widely known to the public and certainly has been applied. Thus, the problems that arise in the world of education and the global world can be solved and able to make changes, discover new things, understand themselves, and be able to master technology (Lantz, 2009). Awareness of the need for STEM education was also shown by respondents with a percentage of 96.7%. This shows that teachers in the future are expected to be able to become a pioneer for the development of science and technology that is more fundamental to the needs of the moment. In line with this, 73% answered strongly disagree if STEM education cannot develop students' creativity through problem solving processes. This shows that awareness of the importance of STEM education has grown in prospective educators. Thus, the hope of forming a generation that meets the capabilities and skills of the 21st century will be achieved.

The results of the research described above show that STEM education is very necessary to support the achievement of the goals of 21st century education. The assessment of 21st century education places more emphasis on active student learning in terms of education in schools. The process shifts the role of the teacher who used to be the center of learning now to become a student. Besides that, the forms of learning that are critical thinking and problem solving, communication, collaboration, creativity and innovation are also characteristics of 21st century learning. According to Koenig (2011) that the demands of work require a person to have broad cognitive and affective skills that often referred to as 21st century skills. These skills include the ability to solve complex problems, to think critically about tasks, to communicate effectively with people from different cultures and to use different techniques, to work together with others, to adapt to the environment and conditions that change quickly to do tasks, to effectively manage one’s work, and to acquire new skills and information on their own. As we know that STEM education emphasizes students to be more active because the learning process that is initially teacher-centered is now centered on students who rely on the activeness and collaboration of students. This is in line with the 21st century education pattern which requires students to be more active in every learning.

Education in the 21st century demands a significant amount caused by the global economic climate that focuses on innovation and creativity. Creativity is an ability that has an important enough position to be owned by every person, organization, or a nation, this is a provision to be able to survive in competition in the 21st century. To create the ability of creativity, the mastery of concepts is needed as a basis for producing creative change. Mastery of the concept of knowledge in solving problems is the main prerequisite to produce creativity (Lubart & Sternberg, 1995) & Cropley, 2009). In addition, research results prove that mastery of the concept of knowledge is very important in realizing creativity, among others, Baer (2003) Then, the results of research by Amabile & Gryskiewicz (1989) which states that it takes three variables for creativity to be formed: domain-relevant skills, creativity relevant skills, and task motivation.

Prospective teacher awareness about this makes the STEM-based education process easy to implement. Based on the results of research that has been done, almost all respondents showed agree on the importance of STEM education. A qualified teacher can help students achieve a higher level of

knowledge. Some researchers have proven this. Through his research shows that the readiness of an education will have a major impact on the progress of student achievement (Rule & Hallagan, 2006; Hibpshman in Ejiwale, 2013). The aim of STEM education is to prepare students to face 21st century competition.

For prospective teachers, provisions for STEM learning are needed. The current phenomenon shows the lack of development about teacher professionalism on this subject. Support from the leadership is also needed for the success of the program. The ability of teachers to manage classes is also one of the determinants of the success of STEM education. Teaching methods determine the extent to which students can understand teaching material well. The teacher as a facilitator in the class besides having to have knowledge of the content / material to be taught also must have the ability to deliver lessons. These two things are something that is "mandatory" owned by the teacher.

Conclusion

From the explanation that has been described shows that the importance of STEM education is to achieve the goals of 21st century education. Teacher's ability is one of the determinants of student success. Nevertheless, it is not entirely the responsibility of teacher, environmental factors also have an important role. Support from sharing parties is also needed especially from stakeholders in order to issue policies that support STEM education including the provision of adequate facilities and infrastructure.

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Development of Computer-Based Learning Media Using Mind Map for Learning Mathematics in Topics of Rectangle and Triangle at Secondary School

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Abstract: Computer-based learning media in this rectangle and triangle subject matter uses mind map. Mind map is a technique for delivering information that emphasizes the relationship between one subject and another so that it can help convey rectangle and triangle material. Mind map presentation on rectangle and triangle material is more optimal if presented with a computer because it can provide animation that can generate motivation, help the effectiveness of the learning process, attract and direct the attention of students to concentrate on the content, facilitate the achievement of learning goals and most importantly help students to understand material that is rectangle and triangle. The research model used is a model of research and development adapted according to Borg and Gall. The aim of the study was to develop computer-based mathematics learning media using mind maps on rectangle and triangular subject matter for class VII SMP / MTs students who had met the requirements for validity and practicality. Large group trials were conducted in class VII2 MTsN 3 Pekanbaru with a total of 36 students. Based on data analysis and discussion it can be concluded that this computer-based mathematics learning media is very valid in terms of curriculum, learning, display and programs with validation results of 3.45. This learning media also meets practical requirements with an average student response of 3.47.

Keywords: Computer Based Learning Media, mind map, rectangle, triangle.

Introduction

One form of application of technology to education is the use of computer-based learning media in learning in the classroom. The use of computers in learning can help explain concepts in a simple manner with a variety of interesting animations so that they can help students to learn independently (Siswanah, 2013). The presentation of mathematical material with an attractive appearance is expected to be able to attract students' interest in learning mathematics.

The advantages of computer-based learning media should make computer-based learning media widely used in schools, but the facts on the ground are not so. The observations conducted by researchers in three junior high schools in Pekanbaru provided information that although the facilities and infrastructure for utilizing computer-based learning media had been supportive, teachers were not yet optimally utilizing computer-based learning media. Not yet optimal, the teacher utilizes computer-based learning media because the teacher does not have time to create and design media for each material. The less optimal use of computer-based learning media indirectly results in students having difficulty in planting lesson material concepts well, because students only record material presented on the board that makes students bored and not motivated in learning which ultimately makes students less understanding the concept of learning given by the teacher.

Based on the results of interviews with students, researchers found information that in studying the rectangle flat material and triangle students had difficulty in choosing and using the broad and perimeter formula. The results of interviews with these students are in line with the information from class VII mathematics teachers who interviewed the researcher. The teacher explains, students are often wrong in choosing and using the formula on the question that asks for the width of the rectangular and triangular flat building as shown below.

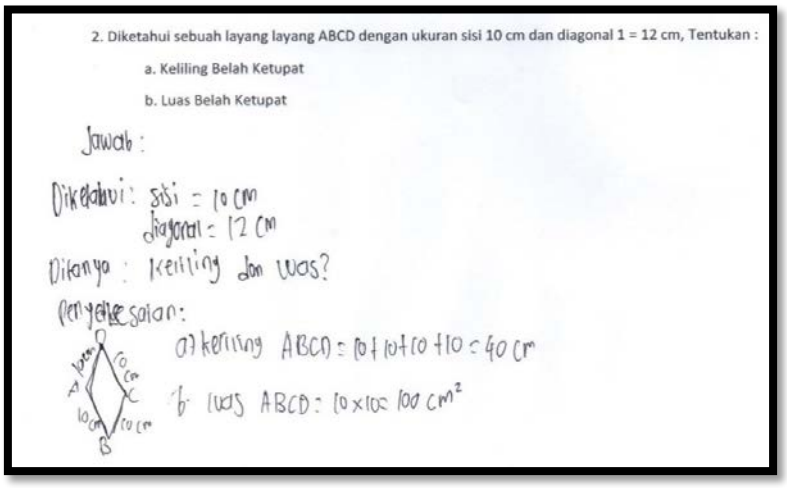


Figure 1. One form of problem solving by students

The criteria for rectangle and triangle material are divided into various types of building, namely rectangle, square, length, trapezoid, rhombus, kite and triangle and the basic competencies requested are able to associate the circumference formula and the area between one wake and another can be helped the delivery process using mind map. Mind map is a technique for delivering information that emphasizes the relationship between one subject and another subject, with the main topic being the core associated with subtopics and branches as details (Buzan, 2007)

Some relevant studies for writing this article, namely 1) Adhisty that students' responses to the use of computer media using mind map tend to be positive (Radina, Hamid, & Yusrizal, 2016). 2) Melati that the use of mind map based learning media can increase student learning motivation (Siwi, 2010). 3) David Yoga Hardiyanto that applying mind map to learning can improve student learning achievement (Hardiyanto, 2013). 4) learning media in the form of mind maps have potency effects on student learning outcomes (Aulia, Basir, & Rusmin, 2014). 5) Students' responses in the application of the mind map learning model are very good (Tiharita & Anix, 2017).

In the rectangle and triangle material, there are various geometric shapes, namely, rectangle, square, length, trapezoid, diagonal, kite and triangle. The presentation of concepts about rectangle and triangular material can be made interesting by computer-based learning media because geometric shapes can be made moving animated images that make it easier for students to understand the nature, perimeter and area of each square and triangle. The mind map concept that emphasizes the relationship between a main idea and another main idea is also in accordance with the building material of flat rectangles and triangles. Based on this background the researchers developed computer-based learning media using mind maps on the subject matter of building a flat rectangle and triangle.

Research on the development of computer-based learning media refers to the steps of research development according to Borg & Gall (Sugiyono, 2011). The development steps are as follows.

Research Method

The Directorate General of Primary and Secondary Education of the Ministry of National Education (2005) follows several alternatives for the Teacher Professional Development Program, as follows:

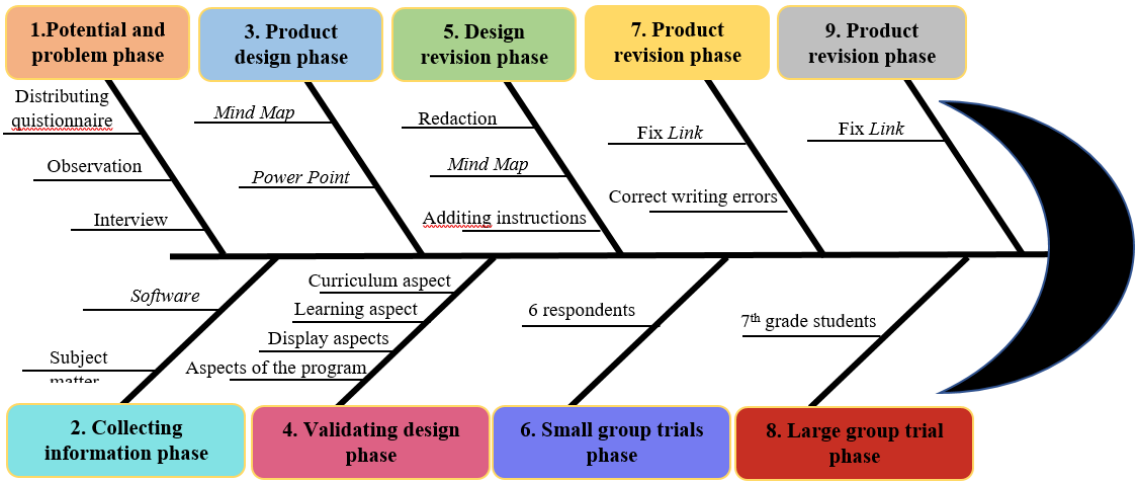


Figure 2. Stage diagram of the research

At the potential search stage and problem, questionnaires were distributed to 12 SMP / MTs in Pekanbaru to see the availability of facilities and infrastructure needed in the use of computer-based learning media, making observations on rectangle and triangle material, and interviewing teachers and students to find out the needs of teachers and students . The information obtained is then used to analyze the needs of teachers, students, materials and infrastructure.

At the information collection stage, the activities carried out are gathering information that can be used as a reference in making learning media such as rectangle and triangle material, namely: 1) Permendikbud in 2016; 2) 2013 Grade VII Curriculum mathematics textbook by the Ministry of Education and Culture; 3) Mathematics class VII KTSP textbooks by the Ministry of Education and Culture and guidebooks for making mind maps, namely; 1) Smart mind map book for children by Buzan ; 2) 1st Mind map book for students, teachers and parents by Windura The design stage is the stage of designing the product, but at this stage the design of computer-based learning media is carried out. The media format used is mind map and power point. This learning media product uses XmindPro software to create mind maps and Microsoft power points to make presentations. The activities carried out in three main stages, namely; 1) Preparation of material for each meeting; 2) Mind map design; 3) Design of rectangle and triangle material power points.

In the design validation stage, the researcher validated the product design by involving three validators who were lecturers of mathematics education. This stage is done using a validation sheet. Broadly speaking, the validation sheet is divided into four aspects, namely; 1) Curriculum aspects; 2) Learning aspects; 3) Display aspects; 4) Program aspects. The validation sheet uses a Likert scale with the answer choice criteria very suitable, appropriate, not suitable and not in accordance with the consecutive values 4,3,2,1. In addition to loading the Likert scale according to the statement, on the validation sheet there is also a suggestion column for improvement by the validator.

At the design revision stage, the researcher made improvements related to the validator's suggestions on the design of the learning media that had been designed previously. The researcher made improvements by correcting the editorial questions that mixed variables that have different units, adding a special power point to the properties of each - flat building, improving the center view of the mind map, and adding direction to the user's actions at the end of each slide.

At the small group trial stage, researchers conducted product trials with six respondents who were VII grade students of junior high school who had not studied rectangle and triangle material. This stage is done by asking students to use learning media and fill out student response questionnaires. On the student response questionnaire sheet there are 16 statements divided into five aspects of assessment, namely; 1) clarity of instructions / instructions; 2) Aspects of accuracy of information; 3) Aspects of presenting images / graphics; 4) Aspects of presentation format; 5) Benefits of learning media for students. In addition to the statement, on the student response questionnaire sheet there is also a

suggestion column containing input improvements by students on the learning media. In the product revision phase, researchers made improvements to the learning media based on the results of small group trials, namely fixing links that were not functioning properly and correcting writing errors.

The large group trial phase was carried out by involving 36 respondents who were VII2 grade students of MTsN 3 Pekanbaru. The teacher uses learning media in learning in class. Students are asked to use the learning media that the researcher developed. At the end of the trial, students were asked to fill out the student response questionnaire in accordance with their respective opinions. In large group trials, links were found that did not function correctly. In the final revision, improvements were made to all links that did not function properly.

Discussion

At the potential and problem stage, information is obtained that in learning rectangle and triangular flat material, learning media are needed that can display animations to demonstrate the process of forming formulas around and the width of rectangles and triangles and linking formulas around and between one flat and flat other. One solution to answer this need is to use computer-based learning media that can display the animation of the formation of a rectangle and triangular flat formulas and use the mind map to help illustrate the relationship between the formula of one flat and other flat shapes. This solution is very possible to use, because most teachers and students already have personal computers and also have the ability to operate computers properly. Based on the results of the questionnaire that had been distributed by 10 researchers from 12 junior high schools / MTs in Pekanbaru, they have had computer laboratories and projectors, so they found the potential to use learning media in the classroom.

At the stage of gathering information, information about basic competencies is obtained in accordance with the 2013 curriculum (Peraturan Menteri Pendidikan dan Kebudayaan, 2016), namely KD 3.11 Linking circumference and area formulas for various types of squares (square, rectangular, diagonal, square, trapezoidal and kite) and triangles and KD 4.11 Resolves contextual problems related to area and circumference of rectangles (square, rectangle, divisions of squares, margins, trapezoidal, and kites) and triangles. Other information obtained is the rules for making mind maps (Windura, 2013), namely; 1) The mind map center must be in the form of an image reflecting the main topic, colorful with a proportional size and located in the middle; 2) Mind map branches must radiate in all directions, stick directly to the center of the mind map, have different colors; 3) Using keywords and explanations with letter sizes that are getting smaller when getting away from the center of the mind map and not using connecting letters. 4) Using as many images as possible that can strengthen keywords.

At the product design stage, material preparation is carried out for each consecutive meeting as follows; 1) Rectangle; 2) square; 3) Distance; 4) Trapezoid; 5) Rhombus; 6) Kites; 7) triangle. The mind map design can be seen in the following picture:

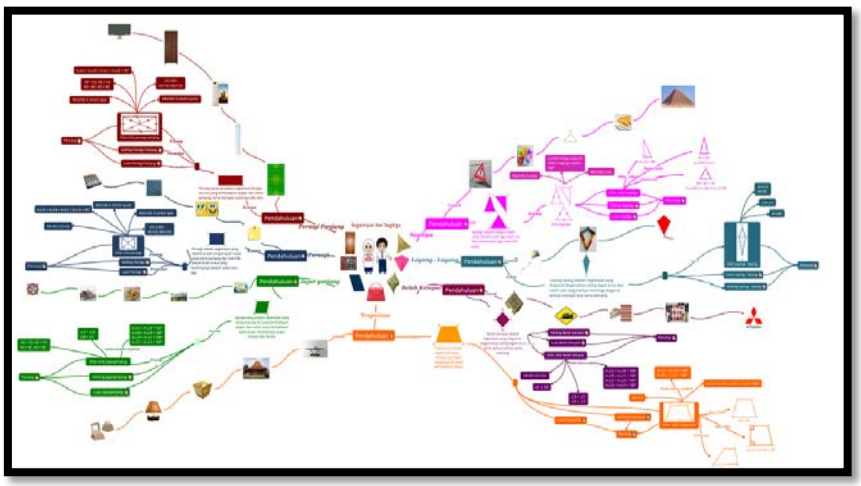


Figure 3. Mind map design

Next is the power point slide show on the learning media

Figure 4. Welcome Slide Show

The welcome slide contains the title of learning media, the introduction from the researcher and an interactive "start" button to start using the learning media.

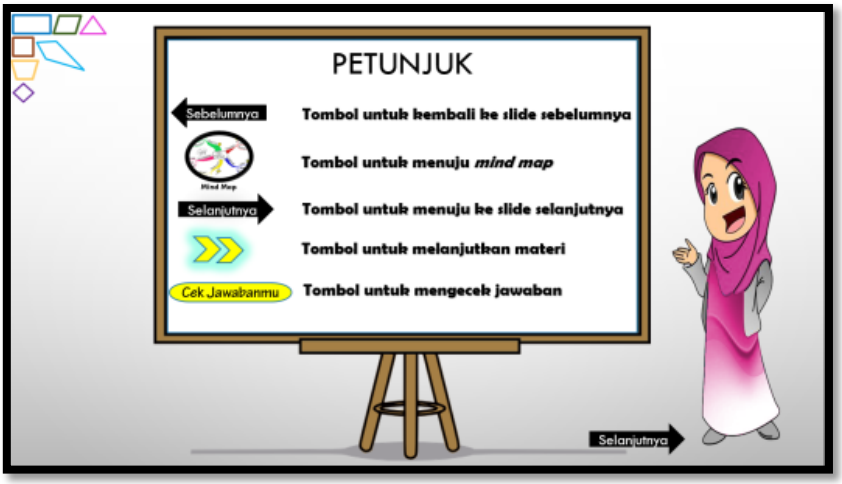


Figure 5. Slide instructions

Instructions slides contain information about the functions of each button used on the learning media

Figure 6. Display of User Role Slides

On the slide selection of the user's role there is a left and right arrow board that contains a link to deliver the user according to his role: teacher or student.

Figure 7. Display Slide Menu of Student Learning Media

In the slide menu of student learning media, students are asked to choose one of the available menus, which are motivational, apperception, and material menu.

Figure 8. Display Slide Menu Teacher Learning Media

In the slide menu of teacher learning media, the teacher is asked to choose one of the available menus, which is a motivation menu, apperception, material and basic competencies.

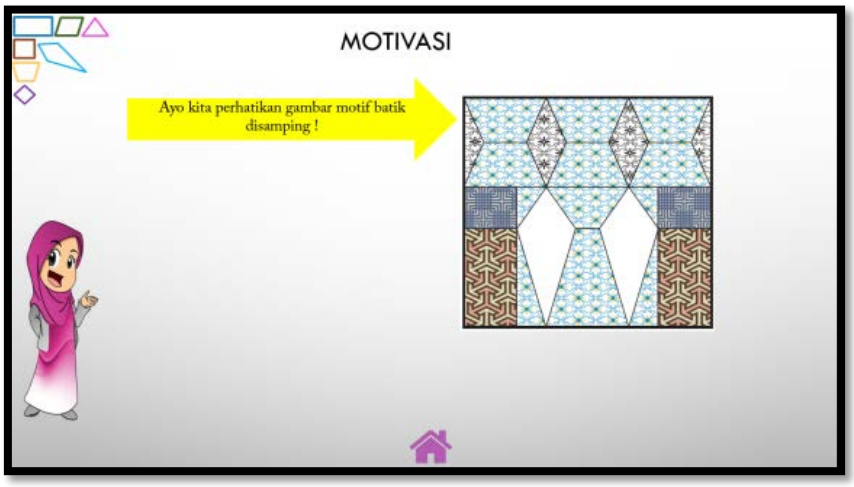


Figure 9. Display of Motivation Slides

The motivational menu on the “introductory” power point contains encouragement for students to learn to construct rectangles and triangles in general.

Figure 10. Display of Apperception Slide

Apperception slide serves to remind students of the material lines and angles that will relate to the material rectangles and triangles to be studied.

At the validation stage, in terms of aspects of the learning media curriculum that the researcher developed obtained a value of 3.33 which means that it falls into the very valid category because it contains basic competencies in accordance with Permendikbud number 24 of 2016, contains indicators of competency achievement in accordance with basic competencies and already contains learning objectives that are in accordance with indicators of achievement of competence.

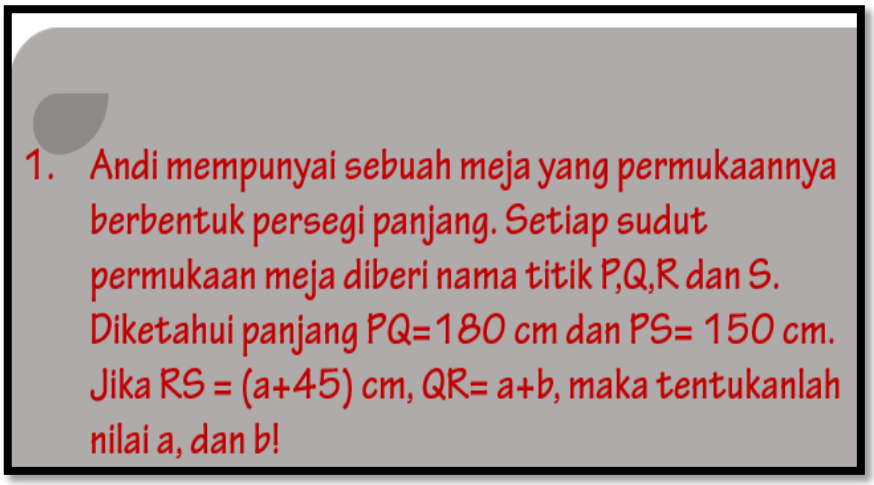
The results of the validation for the learning aspect obtained a value of 3.47, which means that it falls into a very valid category. All validators strongly agree that the media includes clearly stated usage instructions and all validators also strongly agree that the use of media controls is with the user. The third Validator gives a suggestion to correct the evaluation problem number one on the fifth slide that mixes between variables that have units of centimeters and the size of angles.

The results of the learning media validation on the display aspect scored 3.48 which means that it was included in a very valid category. The three validators found some typing errors. The first validator provides input to replace the center mind map image, because the image that the researcher uses is less like the flat shape that the researcher intended. The third validator gives a suggestion to give a sound effect when students answer questions given by the media and replace images that do not fit the context of the question. The second validator provides advice, which is better at the end of each power point file, there are instructions that direct students to return to the mind map.

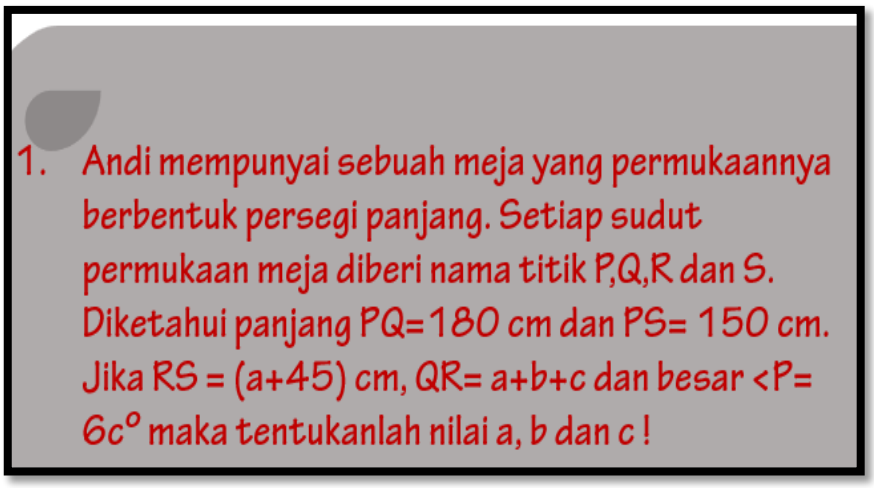
Learning media validation results in the aspects of the program get a value of 3.55, which means it is in a very valid category because the media can be operated on all types of computers and the installation process of XMind Pro software is easy, but the three validators still find link errors.

Following are the results of product design validation:

Before revision



After revision



Revision of the mind map center view

Before revision

After revision

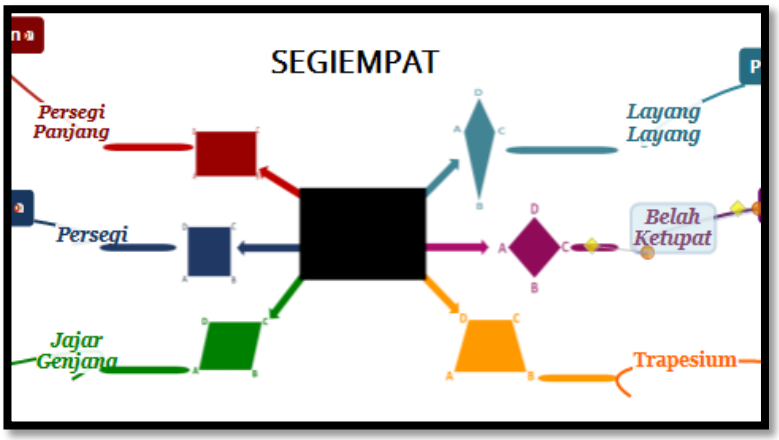


Figure 12. Revised the center of the mind map

Revision of additional user action directions at the end of each slide

Before revision

After revision

Figure 13. Revision results add user direction at the end of each slide

The practicality value of learning media in a small group trial is 3,698 which is considered very practical. But there are still link errors on computer-based learning media developed. In the product revision stage, researchers made improvements to the learning media based on the results of small-scale trials by making improvements to some inactive links and some typos.

The results of practicality in the large trial group test, which is 3.47 which is categorized as very practical. During a large group trial, a medium computer lab could not be used, so students brought their personal laptops. The limited number of students carrying personal laptops makes learning must be done in groups. This group learning makes students not free to use the learning media provided, so students do not feel learning independently. On the questionnaire sheet, students said that by using computer-based learning media, he was motivated to learn about rectangle and triangular flat material. Students' understanding regarding material and concepts is also good, marked by the fluency of students working on variations of the questions given by the teacher. However, there are still link errors on computer-based learning media developed. Finally, revisions to errors in the learning media are made.

Conclusion

Based on the results of the study it can be concluded that this study has produced a computer-based learning media using mind map on the subject matter of a flat-form earthquake and class VII triangle of SMP / equivalent which is valid and practical. Students assess that learning media can make learning more fun and interesting because learning material is delivered in the form of illustrations accompanied by pictures and animation. With the animations in the learning media make students easily understand the learning material because students are easier to understand the material by looking at the illustrations contained in the learning media accompanied by an explanation of the verbal explanation that is often done by the teacher. The results of this study are in accordance with the results of Desi Liana and Leonard's research (2016) which states that computer-based learning media can help teachers explain rectangle and triangle concepts and calculations and can increase student motivation in the learning process of mathematics.

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Analysis of Representation Forms on Linear Equations System Two Variables (LESTV) Materials for Class VIII Junior High School

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Abstract: This qualitative research aims to find out the representation forms of material Linear Equations System Two Variables. Data collection methods are interviews and written tests. The subjects of this study were two class VIIIA students as representatives chosen based on two large groups of the same answer. The results showed that from the two groups had different forms of representation, the subjects of one group used visual representation, while the other group used symbolic representation.

Keywords: representation, linear equations system two variables, visual, symbolic

Introduction

Representation is very important for planning, monitoring, and controlling the process of solving mathematical problems. The forms of representation of each person are different, in solving a mathematical problem related to daily life, students use several methods that have been previously known. One way that students can solve a contextual problem is to make a mathematical model or mathematical representation of the problem. The type of mathematical representation that can be chosen depends on the ability of each individual to interpret the problem. Kilpatrick (in Minarni, Napitupulu, & Husein, 2016), states that representation can be used to understand mathematics. Mathematics requires representation because of the abstract nature of mathematics so that people have access to Mathematical ideas only through the representation of ideas. Representation is a configuration of one's thinking as a whole or divided which connects one another simultaneously (Goldin, & Kaput, 2013). For example, a graph of the function $f(x) = x^2$ is a representation of functions in the form of formulas, but the function can also be represented in several forms, such as graphs of functions and in the form of a cartesius diagram. Images, graphics, mathematical statements and written texts or combinations are all a variety of representations that are often used in communicating mathematics (Cai, Lane, & Jakabcsin, 1996). Furthermore, National Council of Teachers of Mathematics (NCTM) said that the purpose of students learning mathematics is to develop and deepen understanding of concepts and relationships of mathematics when they make, compare and use various representations (NCTM, 2000). People develop representations to interpret and remember their experiences in an effort to understand the world (Minarni, Napitupulu, & Husein, 2016).

The use of representation develops and deepens students' understanding of mathematical concepts. Representation allows students to make connections between concepts and communicate their thoughts through representation (Helingo, Mamin, & Masriyah, 2018). In recent years the mathematics education community has increasingly shown that representation is a useful tool for communicating information and understanding (NCTM, 2000). Some studies related to mathematical representation are (Nie & Cao, 2019; Sedig & Sumner, 2006; Rahmah, Subanji, & Irawati, 2019).

One solution to find out the forms of mathematical representation of students is through Realistic Mathematics Education (RME). The learning process begins by proposing contextual problems that are appropriate to everyday life or the experience and level of knowledge of students is one of the characteristics of RME. Through RME, students are expected to be able to develop mathematical representation skills because through the material given and accompanied by the provision of mathematical examples derived from the conditions of everyday life of students, can represent the questions better and simpler. RME based devices containing visual representation, verbal representation and symbol representation were developed to facilitate various student learning styles (Muhtarom, Nizaruddin, Nursyahidah, & Happy, 2019). This representation begins with realistic situations that are

close to students so that they can develop other representations. RME-based devices are expected to contribute positively to students in gaining mathematical understanding, increasing learning interactions, and developing multi-representation capabilities.

The purpose of this study is to find out the forms of representation that students use in solving problems related to LESTV.

Research Method

The Directorate General of Primary and Secondary Education of the Ministry of National Education The type of research conducted in this study is design research. This study aims to determine the ability of students' mathematical representation after applying the Realistic Mathematics Education approach. The subjects in this study were VIIIA grade students of SMP St. Aloysius Turi Yogyakarta 2018/2019 academic year consisting of 20 students then work or written test results from 20 students consisting of two large groups, namely seven students solve problems using image representation and 13 students solve problems using symbol representation, from each group one student was selected for analysis. At the reduction stage, the researcher summarizes the results of the test results of mathematical representation abilities which are then coded from the name of the student to facilitate writing on the data presentation namely student one (s1) with the code “RPH” and student two (s2) with the code “ARC”. This grouping is done to find out the achievement of students' mathematical representation ability based on indicators. The data analysis technique carried out in this study consisted of three stages, namely data reduction, presenting data, and drawing conclusions.

Indicators of students’ mathematical representation through RME are assessed based on criteria (Sulastri, Marwan, & Duskri, 2017).

- Presenting data or information from a problem to representation of images, diagrams, table graphs or symbols.
- Resolve problems that involve mathematically.
- Write down the steps to solve a mathematical problem.

Discussion

Before conducting the test, researchers conducted learning in class VIIIA based on the learning trajectory or HLT which had been designed using the PMR approach consisting of 4 problems, namely the first and second problems in the first meeting learning while the third and fourth problems in the second meeting learning.

In the learning process the researcher accompanies students in group discussions. When there are students having difficulty in solving a given problem, the researcher gives a support in the form of questions that provoke students to find answers to the questions given. Students pay attention and try to find answers to the support given by the researcher.

At the third meeting the researchers gave written tests. The question given was “Aldi bought 4 books and 4 pencils at a price of Rp. 20,000. Ida bought 3 books and 2 pencils for Rp. 13,000. If Mira wants to buy 2 books and 1 pencil, how much does Mira have to pay?”

1. Mathematical representation of RPH (S1)
Analysis of student answers according to indicators:

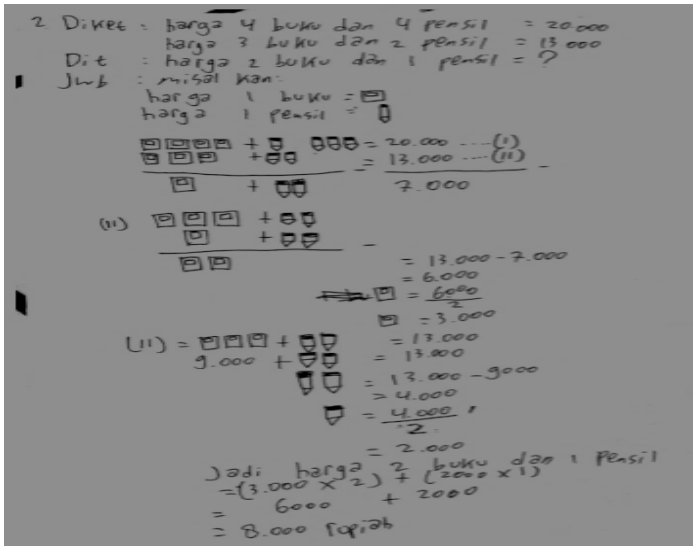


Figure 1. RPH answers (students 1 or S1) or mathematical representations of RPH

Excerpt of interview:

P (teacher) : "What is known about the problem?"
S1 (student 1) : "The price of 4 books and 4 pencils is equal to 20,000; and the price of 3 books and 2 pencils is 13,000"
P : "What was asked about the question?"
S1 : "Price of 2 books and 1 pencil"
P : "Why do you say a picture of a book and a pencil drawing, then write 4 picture books plus 4 pencil drawings equal to 20,000 and a picture of a book plus 2 pencil drawings equal to 13,000?"
S1 : "So it's easy to finish Mother."
P : "Why do you subtract pressure 1 with equation 2 then subtract equations 2 and 3?"
S1 : "To remove a pencil image and get a price of 1 book"
P : "Why is Equation (ii) three pictures of books replaced with 9,000?"
S1 : "There is a price of one book 50,000 mothers, so three books are 9,000 (while showing"
P : "Can you use equation 1 or 3 to replace the price of the book?"
S1 : "yes, it can be done ..."
P : "What is the purpose of replacing 3 books with 9,000?"
S1 : "To get the value of one pencil"
P : "Why is 3,000 times 2 plus 2,000 times 1?"
S1 : "Because the one asked for is one book and one pencil."
P : "Is the price of one book and pencil correct?"
S1 : "It's already Mother ..."
P : "How do you know?"
S1 : "The prices of books and pencils are included in this equation and the results are the same (while showing equations 1 and 2)"
P : "What are your conclusions from the answers you have received?"
S1 : "so the price of 2 books and 1 pencil is 8,000 rupiah"
P : "Try to re-read the question, is it asked for the price of 2 books and 1 pencil?"
S1 : "Hummm ... who was asked how much money Mira had to pay?"
P : "What do you mean by your conclusion?"
S1 : "So Mira has to pay eight thousand rupiah"

Based on the results of interviews and seeing the results of written tests it can be concluded that RPH meets all indicators where:

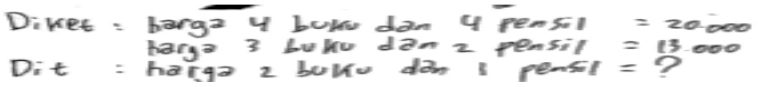
a) RPH presents data or information from a problem to image representation,
RPH presents problems using images that are book images ( ) and pencil drawings ( ) then RPH meets indicator one.

b) Resolve problems that involve mathematically.
RPH solve problems involving mathematical experiments such as equations or

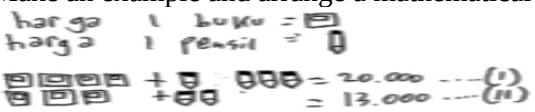
And mathematical symbols such as addition operations (+), subtraction (-), multiplication (x) and equals (=).

c) Writing down steps to solve mathematical problems.
RPH resolves problems using steps namely

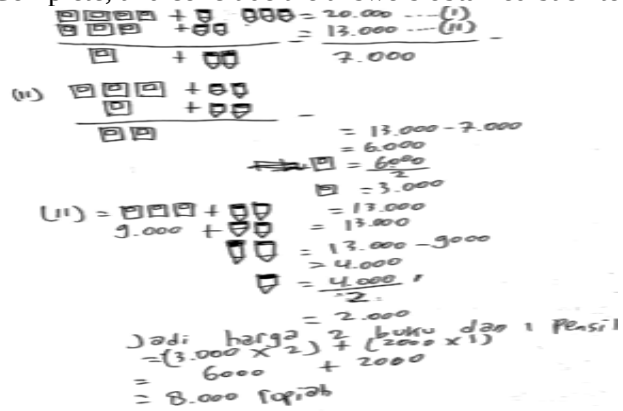
- Write down what is known and asked from the question.



- Make an example and arrange a mathematical model.



- Complete, and conclude the answers obtained back to the context of the question



1. Mathematical representation of ARC (S2)

Analysis of student answers according to indicators:

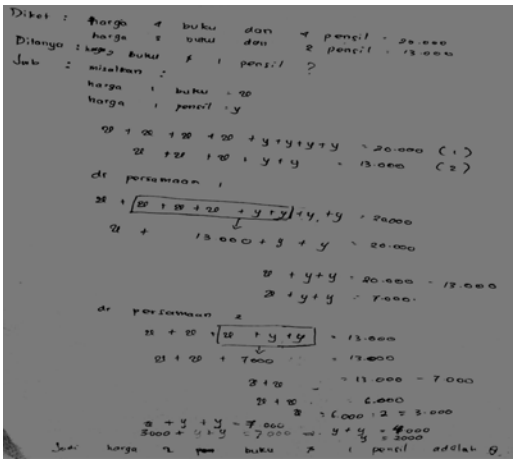


Figure 2. ARC answers (students 2 or S2) or mathematical representations of ARC

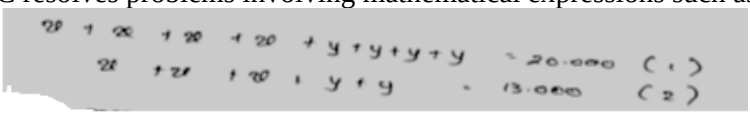
Excerpt of interview:

P (teacher) : "What is known about the question?"
S1 (student 1): "The price of 4 books and 4 pencils is 20,000; and the price of 3 books and 2 pencils is 13,000."
P : "What was asked about the question?"
S2 : "Price of 2 books and 1 pencil"
P : "Why do you suppose *x* and *y*, then write *x* plus 4 times plus *y* 3 times equal to 20,000; *x* added 3 times plus *y* twice as much as 13,000?"
S2 : "So it's easy to finish Mother."
P : "Why is this (i) in this box and writing 13,000 below it? (while showing equation 1)"
S2 : "Because in equation 2 the price of this (while showing) is equal to 13,000, so I change my mother"
P : "Why does *x* plus *x* plus *y* equal to 8,000, immediately stop working and conclude?"
S2 : "Because the one asking for the price was 2 books and one pencil, and this has answered the question about Mother."
P : "Are you sure the value of $x + x + y$ is 8,000?"
S2 : "Already Ma'am ..."
P : "How do you know?"
S2 : "I see one by one from the steps I use, nothing I miscalculated ... (while pointing out)"
P : "Why do you suppose *x* and *y*, then write *x* plus 4 times plus *y* 3 times equal to 20,000; *x* added 3 times plus *y* twice as much as 13,000?"
S2 : "So it's easy to finish Mother."
P : "Why is Equation (i) in this box and writing 13,000 below it? (while showing equation 1)"
S2 : "Because in equation 2 the price of this (while showing) is equal to 13,000, so I change my mother"
P : "Why does *x* plus *x* plus *y* equal to 8,000, immediately stop working and conclude?"
S2 : "Because the one asking for the price was 2 books and one pencil, and this has answered the question about Mother."
P : "Are you sure the value of $x + x + y$ is 8,000?"
S2 : "Already Ma'am ..."
P : "How do you know?"
S2 : "I see one by one from the steps I use, nothing I miscalculated ... (while pointing out)"
P : "What are your conclusions from the answers you have received?"
S2 : "So the price of 2 books and 1 pencil is 8,000 rupiah"
P : "Try to re-read the question, is it asked for the price of 2 books and 1 pencil?"
S2 : "Who was asked how much money Mira had to pay?"
P : "What do you mean by your conclusion?"
S2 : "So Mira has to pay eight thousand rupiahs for"

Based on the results of interviews and seeing the results of written tests it can be concluded that ARC meets all indicators where:

a. ARC presents data or information from a problem to symbol representation.
   The ARC answer above resolves the problem using symbol representation, where the RPH presents a problem using symbols namely the symbol *x* and symbol *y*.
b. ARC resolves problems that involve mathematically.

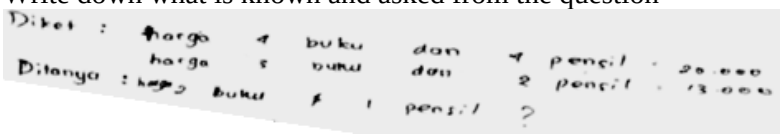
ARC resolves problems involving mathematical expressions such as equations or



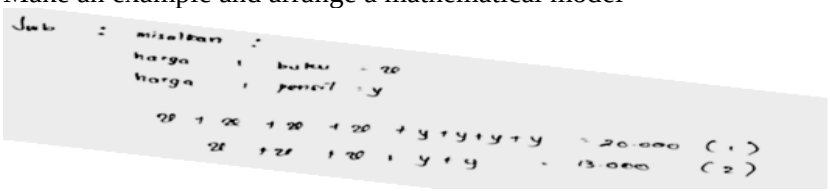
And mathematical symbols such as addition operations (+), subtraction (-), division (:) and equals (=).

c. ARC writes steps to solve mathematical problems.
ARC resolves problems using steps namely:

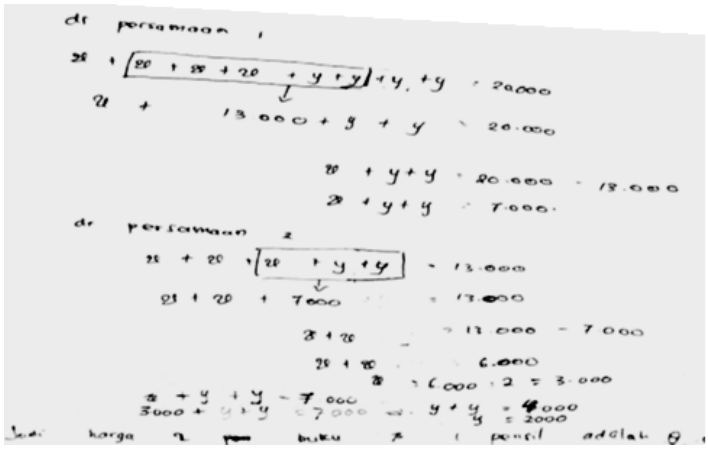
- Write down what is known and asked from the question



- Make an example and arrange a mathematical model



- Complete, and conclude the answers obtained back to the context of SOA



Conclusion

Based on the results of research and discussion of the forms of representation used by students in solving LESTV problems, the conclusion is that students who use image representation and symbol representations in solving everyday problems related to LESTV fulfill the three mathematical representation indicators, namely presenting data or information from problems to image representation, solving problems involves mathematics, and writing steps to solve mathematical problems.

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The Effects of Flipped Learning Implementation on The Students' Achievements in Language Teaching Media Course

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Abstract: This study aims to find out the effects of implementing Flipped Learning approach to the students' achievements in Language Teaching Media course. Flipped learning is a newly emerged teaching methodology that inverts the sequence of a traditional teaching and learning process. Flipped learning enables students to use their time in the class to engage more in group activities such as interactive discussion on the concepts that they have learned. This study employed survey method which was conducted in the English Language Education Study Program of Sanata Dharma University, Yogyakarta, Indonesia from April 2018 to December 2018. The participants of this study were 35 students who were enrolled in the Language Teaching Media course. Two research instruments were used in this study, namely questionnaires and scoring rubric. Data were gathered by distributing questionnaires and conducting assessment before and after the flipped learning approach was implemented. The results show a significant improvement in the students' achievements from the first test to the second test. A total of 31.43% increase was recorded for obtaining the A score. Students who managed to get a B also increase in numbers from 28.57% into 48.57%. Finally, the numbers of the students with C score declined significantly by 51.43%. The results of the questionnaire also found that flipped learning has improved not only the students' academic achievement, but also their ability for autonomous learning.

Keywords: flipped learning, language teaching media, students' achievements

Introduction

Flipped learning, a recently emerged teaching methodology, applies an inverted learning process which provides more time for students to use English both inside and outside the classroom (Bergmann & Sams, 2012). Flipped learning omits lectures and delivers the content of the lectures through other media such as videos, audio files, textbooks from which the students have to learn on their own and understand them before the class begins. Inside the class, the students will ask any questions they might have regarding the materials that they study outside the class. The questions that the students ask serve as the indicators of their knowledge construction and also a way to initiate participation and interaction among the students. After that, they will engage in group activities which are facilitated by the instructor (Milman, 2012). This study aims to find out the effects of the flipped learning implementation in the Language Teaching Media course, a compulsory course offered in semester four in the English Language Education Study Program, Sanata Dharma University. Since the students in this study program are trained to become future teachers, it is essential for them to experience the newly emerged teaching methodology themselves. Engaging the students through the courses that they are enrolled in is one of the most effective ways to teach them how to engage their future students (Vaughan, 2014). The formulated research question is "What are the effects of flipped learning implementation on the students' achievements in the Language Teaching Media course?".

Flipped Learning

Flipped learning is a newly emerged teaching methodology that inverts the sequence of a traditional teaching and learning process. In the classes that apply flipped learning, the learning materials which are normally studied in the class are studied outside the class. In addition, the assignments or projects that are traditionally conducted outside the class are then completed in the class (Bergmann & Sams, 2012).

Flipped learning omits lectures and delivers the content of the lectures through other media such as videos, audio files, textbooks from which the students have to learn on their own and understand them

before the class begins. Inside the class, the students will ask any questions they might have regarding the materials that they study outside the class. The questions that the students ask serve as the indicators of their knowledge construction and also a way to initiate participation and interaction among the students. After that, they will engage in group activities which are facilitated by the instructor (Milman, 2012).

Flipped learning enables students to use their time in the class to engage more in group activities such as interactive discussion on the concepts that they have learned. Students also have more time to clarify things that they find difficult to understand. The instructors' role changes into a facilitator and an observer. Therefore, the classroom will be a place in which active learning takes place, which then promotes meaningful learning (Rajesh, 2015).

Flipped learning offers various learning choices for the students so that they can learn the materials on their own pace comfortably. Students will no longer be passive participants in learning who spend most of their time in class to sit quietly and only listen to the lectures. With the newest development of technology and also the iniquitousness of the Internet, there are more digital content sources available which can be used to enrich the students' learning experience.

Previous studies conducted on flipped learning have shown that students prefer to have a flipped classroom compared to a traditional lecture (Lage et al., 2000). Another study conducted by Millard (2012) has found that flipped learning has promoted students' engagement, classroom discussion as well as team-based skills. Enfield (2013) also found that flipped learning is very effective to help the students to learn the content of the materials and also to increase the students' self-efficacy in terms of their ability for independent learning. This is also in line with the findings in a study conducted by Lockwood (2014) that flipped learning has improved the students' autonomy to be responsible of their own learning process.

Language Teaching Media Course

Language Teaching Media is a compulsory course offered in semester four in English Language Education Study Program, Sanata Dharma University. It is designed to provide the students with theories on language teaching media and opportunity to create innovative teaching media. On completing the course, the students will be able to understand the concept, characteristics, and purposes of media for teaching, utilize conventional media for teaching, produce pictures to produce printed media, produce audio file to create media for teaching, utilize word processors software for teaching, utilize presentation software for teaching and utilize some internet facilities for teaching.

Since the students are trained to become future teachers, it is essential for them to know the theories of language teaching media. Most importantly, they should possess the skill and ability to create language teaching media which are effective and engaging for their future students. Therefore, Language Teaching Media course plays an important role in preparing the students to become innovative and creative teachers.

English Language Education Study Program

English Language Education Study Program is one of the study programs in the Faculty of Teachers' Training in Sanata Dharma University, Yogyakarta. English Language Education Study Program offers an S1 program, which is equivalent to a four-year undergraduate university degree program in many other countries. English Language Education Study Program was established in 1955 and has been a well-known and a favorite study program for its outstanding graduates who are trained to be professional English teachers across Indonesia and abroad. The mission of the English Language Education Study Program is to provide an education which integrates academic excellence with humanistic values in order to produce English teachers who are competent, knowledgeable, and dedicated in designing, managing, and developing English language programs to participate in advancing Indonesia through their work in education.

Research Method

Survey method was conducted to find out whether there was an improvement on the students' achievements after the flipped learning approach was implemented. This study was conducted in the

English Language Education Study Program of Sanata Dharma University, Yogyakarta, Indonesia from April 2018 to December 2018. The participants of this study were 35 students who were enrolled in the Language Teaching Media course. Two research instruments were used in this study. The first instrument used was questionnaire consisting of two sections: close-ended statements with Likert Scales and open-ended questions. The second instrument used was the scoring rubric to assess the students' achievements on the first and the second test. Data were gathered by distributing questionnaire and conducting assessment before and after flipped learning approach was implemented.

Findings and Discussion

Flipped Learning Implementation in Language Teaching Media

The researcher divided the total meetings into two categories. The first half of the semester (six meetings) were taught using the traditional lecture style. After the mid-term test at the seventh meeting was conducted, the researcher continued teaching the course using flipped learning approach for the second half of the semester (six meetings). The final test was conducted at the fourteenth meeting. The questionnaire was distributed to the students at the last meeting of the semester.

In the traditional lecture style, the researcher delivered the materials in the class using a presentation software for about 15 to 30 minutes and played selected videos that are related to the topic taught on the particular meeting. After that, the researcher continued by providing some activities such as small group or whole-class discussion and in-pairs or group-work projects that the students had to do and complete by the end of the class.

When the researcher started teaching using the flipped learning approach, videos were posted online to the Moodle as the LMS platform used by Sanata Dharma University. The course participants were asked to watch the videos before attending the class, and then to participate in the discussion and project activities during the class time. The course progress is provided in the Table 1.

Table 1. Language Teaching Media Course Progress

Activities/Meetings	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Traditional lecture															
Mid-term test															
Flipped learning															
Final test															
Questionnaire															

Flipped Learning Effect on Students' Achievements

Two tests with the same types of questions were conducted as the course progressed. The first section of the test provides 20 open-ended questions in which the students have to give short answers to the questions. The second part is a project on the topics learned. The students were given 120 minutes to complete the test. The scores from the open-ended questions and the project were then accumulated to obtain the final score of the test.

In the first test, most of the students had difficulties in completing the test on time. Based on the recorded answers on the LMS, majority of the students only answered the questions that they are certain of, and the questions that they did not know the answers remained blank. The students also tend to spend a very long time in completing the project because they often re-watch the tutorial video. Most of the students (23 people) only managed to obtain 60 to 69 points (C). There are ten students who got 70 to 79 points (B); while only two students could get an A. The first student's score is 83 and the second student's score is 85. Therefore, none of the students managed to obtain 90 points and higher in the first test.

In the second test, there were no questions that were left unanswered whether or not they know the correct answers. When completing the project, only few students played the tutorial video. Nevertheless, when these students played the video, they went straight to a certain part of the video that showed them

what to do to solve their problem that they encountered in completing the project. Thus, they did not spend too much time watching the video and they could go back to do the project shortly after. Majority of the students did not play the video at all. They already knew the steps that they needed to do and thus they focused more in maximizing what they could do to make their individual project stood out. There were thirteen students who succeeded to get an A; and three of them even got above 90 points. Most of the students (17 people) got a B with scores ranging from 75 to 78 points. In the second test, there were only five students who got a C, with the lowest score being 65 points.

In conclusion, there was a significant improvement in the students' achievements from the first test to the second test. A total of 31.43% increase was recorded for obtaining the A score. Students who managed to get a B also increase in numbers from 28.57% into 48.57%. Finally, the numbers of the students with C score declined significantly by 51.43%. The comparison of the students' scores from the first and second test can be seen in the Table 2 below.

Table 2. Students' Achievements in Language Teaching Media

Scores / Test	Test 1	Test 2
A (80 – 100)	2 (5.71%)	13 (37.14%)
B (70 – 79)	10 (28.57%)	17 (48.57%)
C (60 – 69)	23 (65.71%)	5 (14.28%)
D (50 -59)	0 (0%)	0
E (<50)	0 (0%)	0

Questionnaire on Flipped Learning Effects

In the last meeting of Language Teaching Media course, the researcher distributed a questionnaire to find out the effects of the flipped learning approach implementation experienced by the students. All participants (35 people) were present to complete and submit the questionnaire. There are two sections provided in the questionnaire. The first section provides 12 statements followed by Likert Scale ranging from 1 (strongly disagree), 2 (disagree), 3 (undecided), 4 (agree) and 5 (strongly agree) on the right side of each statement. Table 3 below presents the summary of the results from the first section of the questionnaire.

Table 3. Summarized Results on the Close-ended Section of the Questionnaire

No.	Statements	SD	D	U	A	SA
1	Flipped learning enables me to prepare better for the test.	0%	0%	8.6%	62.9%	28.6%
2	Flipped learning helps me to enrich my knowledge.	0%	0%	5.7%	57.1%	37.1%
3	Flipped learning improves my high order thinking skills (analyzing, evaluating, creating).	0%	0%	14.3%	71.4%	14.3%
4	Flipped learning allows me to clarify things that I find difficult to understand.	0%	0%	8.6%	77.1%	14.3%
5	Flipped learning provides me a better mastery on the materials.	0%	0%	8.6%	71.4%	20%
6	Flipped learning enables me to do the tasks better.	0%	0%	5.7%	42.9%	51.4%
7	Flipped learning increases my interest on the subject.	0%	0%	8.6%	48.6%	71.4%
8	Flipped learning helps me to improve my score.	0%	0%	14.3%	65.7%	14.3%

9	Flipped learning encourages me to participate more actively in the class activities.	0%	0%	5.7%	74.3%	14.3%
10	Flipped learning improves my team-based skills.	0%	0%	8.6%	68.6%	22.9%
11	I like flipped learning more than traditional lecture style.	0%	0%	5.7%	80%	14.3%
12	I would like to have another flipped learning class in the future.	0%	0%	5.7%	65.7%	28.6%

The results suggest that flipped learning has positive effects on the students' achievements in Language Teaching Media course. None of the participants choose the "Strongly Disagree" or "Disagree" options on the statements provided in the questionnaire. Furthermore, the majority of the students (94.3%) like flipped learning better than the traditional lecture style and agree to have another course which using flipped learning.

The second section provides two open-ended questions for elaborative answers. The first question is "What do you like from the flipped learning approach implementation?". The majority of the students (57.1%) stated that flipped learning enabled them to become independent learners. The online materials can be read and played as often as they want; which helps them to understand the materials on their own speed. Most of the students (48.6%) expressed that they had more opportunities to interact with the lecturer and their classmates. By using flipped learning, they had more time for discussion and doing the projects in class. Another response stating that they feel more comfortable in asking questions to the lecturer and their friends, as stated by 34.3% of the participants. In addition, the students expressed that flipped learning has increased their motivation to learn the subject (28.6%) and encouraged them to be more responsible of their own learning (14.3%).

The second question is "What do you dislike from the flipped learning approach implementation?". Most of the students (71.4%) pointed out that they often had difficulties in finding the time to watch the videos and study the online resources provided by the lecturer due to their demanding assignments from other courses. In addition, some of the students (28.9%) also mentioned that they had difficulties in using the features in the LMS as well as in operating some online software that they need to do in order to access the provided materials. The summary of the students' responses can be seen in Table 4.

Table 4. Summarized Results on the Open-ended Section of the Questionnaire

Questions	Responses	Percentage
What do you like from the flipped learning approach implementation?	Flipped learning enables me to learn at my own pace comfortably (watching the videos as often as needed)	57.1%
	Flipped learning increases my motivation in learning (learning from videos is more interesting compared to textbooks)	28.6%
	Flipped learning provides more time for discussion and practices.	48.6%
	Flipped learning encourages me to take responsibility of my own learning.	14.3%
	Flipped learning allows me to ask questions more easily to my lecturer and my friends.	34.3%
What do you dislike from the flipped learning approach implementation?	Flipped learning is time consuming (we have to watch the videos and do other preparation outside the class time).	71.4%
	Flipped learning requires good knowledge on the use of technology (use of computers, software and LMS).	28.9%

The results of the questionnaire suggest that flipped learning has good effects in improving not the students' academic achievement, but also their ability for autonomous learning. Most of the students are mostly satisfied with the implementation of flipped learning in Language Teaching Media course.

Conclusion

Based on the results of the tests and the questionnaire, it can be concluded that flipped learning has positively affect the students' achievement. Students' scores have significantly increased after the implementation of flipped learning. In addition, flipped learning also promotes the students' autonomous learning. However, the students also expressed that flipped learning also has disadvantages in terms of the time consumed to complete the assigned online materials and the lack of ability in operating computers, software and LMS.

In connection with the disadvantages mentioned by the participants, it is highly recommended that the lecturer ensures that the materials provided online are effective and interesting. The videos that are selected should not have too long duration that might cause students to be bored and decide not to continue watching the video. Lecturers should consider making several short videos instead of one long video. The materials have to be selected carefully so that the time that the students use to access the materials will not be wasted. Furthermore, the lecturer should allocate special time to demonstrate the way to use of computers, necessary software and features in the LMS to the students so that every student knows what exactly they have to do. Further research with long-term implementation of flipped learning with larger sample are encouraged to provide more reliable results.

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Improving the Communication Skills of Grade VII Students for Animals Classification and Set by Using STEM Approach

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Abstract: Communication ability is one of the most important abilities in the 21st century, but at this time students' ability to communicate is very limited. The STEM (Science Technology Engineering and Mathematics) approach helps teachers integrate between science, technology, engineering and mathematics in learning. Learning using the STEM approach makes the knowledge possessed by students intact and able to create effective communication in various forms and contents verbally, written, and using multimedia. This study aims to describe the communication skills of 34 students of Grade VII D on Science and Mathematics subjects with the STEM approach. The research method used is design research (data collection instrument method) The results of the study are in the form of presentations in the form of science and mathematics subjects. This research was conducted at Yogyakarta State Middle School 1 for grade VII students. The results of the study indicate that students' communication skills can be trained structurally indicated by the results of the videos made. The average score of 28 shows good value. The results of this study indicate that science and mathematics learning with the STEM approach has the potential to develop students' communication skills.

Keywords: communication skills, STEM

Introduction

Naturally, humans need to communicate since they were babies until the end of their lives. As social beings, humans will always want to talk, exchange ideas, send and receive information, share experiences, work together with others to fulfill their needs and so on (Aw, 2011). Ruben and Stewart (2006) defined that communication is the process by which someone or several people, groups, organizations, and communities use information to connect with the environment and the others. In teaching and learning, communication skills are very necessary. It will be easier to convey ideas or ideas related to teaching and learning.

If viewed from the form of information messages delivered, communication is divided into two types, namely verbal communication and nonverbal communication. Verbal communication is communication using language which written and spoken. While nonverbal communication is communication that uses cues, motion, images, symbols, facial expressions, and so forth (Devito, 1997). In the learning process, students are required to be active. One of the activities of students is shown by expressing opinions and asking questions. These communication skills need to be developed so that the delivery of information from students can be understood and accepted well. Supratiknya (1995) stated that, communication skills are not abilities that are born from birth and also will not appear suddenly - when people need it. These skills must be learned or trained.

Education is very important in creating civilization in a country. The advance of state education is determined by the quality of education. This is due to the increasing age, which is marked by the rapid advancement and information. Competition in various fields of life in the 21st century is very competitive. Life is currently faced with the demand for the importance of competent human resources so that they can compete in living life. Quality human resources can be the main force to overcome the problems faced in education. Therefore, various countries in the world try to define the 21st century human characteristics in question.

ATCS (Assessment and Teaching for 21st Century Skill) in Greenstein (2012) stated that there are four main things related to the 21st century, namely ways of thinking, ways of working, work tools, and life skills. The way of thinking includes creativity, critical thinking, problem solving, decision making, and learning. How to work includes communication and collaboration. Tools for work include

information and communication technology. Life skills include citizenship, life and career, and personal and social responsibilities.

In the 21st century, students who are able to survive are those who are able to communicate in various ways, both written and verbal. Students are required to understand, manage, and create effective communication in various forms and contents in writing, oral, and multimedia. Students are given the opportunity to use their abilities to express their ideas, both during discussions with friends and when solving problems from the teacher.

Karso et al. (2011) stated that indicators of scientific communication capabilities include: compiling and submitting reports systematically and clearly, explaining the results of experiments, discussing the results of experiments, classifying data and compiling data and describing data in graphs, tables or diagrams.

Learning at SMPN 1 Yogyakarta is dominated by lecture systems and tends to be teacher-centered, interactions between students and teachers are lacking. In learning there are only a few students who actively ask questions and express opinions. When presenting, many students feel nervous and dare not express their opinions in public and are afraid of being criticized. If problems are found in learning, students will find it difficult to work together and discuss with friends. Another problem that is also found is that students are afraid of being wrong in conveying their ideas.

In science and mathematics learning, especially the material set and classification of living things there are several obstacles. Students find it difficult to determine the various types of sets on real objects, so that some objects should not enter into the set that students specify. In the material of classification of living things, students have difficulty if this material is explained without using objects, whether images or real objects.

Some problems that can be identified based on communication skills, researchers obtain the following problems: (1) students' communication skills do not come on their own, but students must be given many opportunities in communicating their ideas, (2) students are afraid of conveying ideas or ideas, (3) difficult students in working together to convey group ideas, and (4) not all students are active in the process of communication and discussion. Hodiyanto (2017) said that the learning model or approach can be used to develop mathematical communication skills, including: PMR approach, problem posing learning model with PMR approach, problem solving learning model with PMR approach, and reciprocal teaching.

The 21st century was marked by the rapid development of technology. Various types of information spread rapidly which led to the emergence of an era of technology-based economy. Individuals who can answer various global challenges are individuals who are able to obtain, process, and interpret various information and knowledge. This requires learning that can improve skills in the 21st century so that students can compete in the era of globalization. Learning using the STEM approach is one solution to answer this educational challenge (Fan & Ritz, 2014).

STEM is an approach in education where Science, Technology, Engineering, Mathematics is integrated with the educational process focusing on solving problems in real life as well as in professional life. STEM is an acronym for science, technology, engineering and mathematics. This term was first launched by the National Science Foundation (NSF) of the United States (US) in the 1990s.

STEM education is a learning that relies on the cross disciplinary approach and Project Based Learning. The purpose of STEM itself is to prepare students to be able to apply their knowledge to solve complex problems and develop STEM expectations (Sukardjo, 2009). Every aspect of STEM has special characteristics that distinguish between these four aspects. The four characteristics are based on the definition outlined by Torlakson (2014), namely: (1) science that represents knowledge of applicable laws and concepts in nature; (2) technology is a skill or a system used in regulating society, organization, knowledge or designing and using an artificial tool that can facilitate work; (3) engineering or engineering is the knowledge to operate or design a procedure to solve a problem; and (4) mathematics is a science that connects between quantities, numbers and spaces that only require logical arguments without or accompanied by empirical evidence.

Bybee (2013) revealed that there are four outlines of improvements that make STEM different from others in the world of education as follows: (1) talk about the global challenges that must be understood by the community; (2) changing perceptions of environmental problems and problems between people; (3) recognize abilities that must be possessed in the 21st century; (4) continuing issues of national defense.

The problems in this study is formulated as follows how communication skills after students experience the learning process using the STEM approach in learning about animal classification and set. This study aims to describe the communication skills of students after experiencing the learning process using the STEM approach in learning about animal classification and sets.

Research Method

This study is design research. Design research is a development model for designing and developing interventions in learning such as; teaching programs, strategies and learning materials (Ploomp & Nieveen, 2013). Basically, design research is relevant to the practice of education (and hence also to educational policy) because it aims to develop research-based solutions to complex problems in educational practice or to develop or validate theories about the learning and teaching process. Whatever the purpose of design research, the research process is always combined with a systematic educational design process.

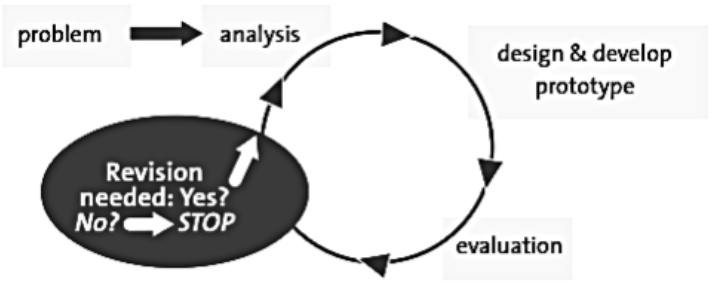

Figure 1. The systematic of design research

This research was conducted in four stages including: (1) initial investigation; (2) theoretical learning; (3) empirical testing; (4) documentation, analysis, and reflection on the process and results. In this initial stage, the researcher determines the place, the subject of the research, and makes other preparations such as arranging the research schedule and cooperation procedures with other teachers to develop teaching materials developed on the students' communication skills. The instruments used in this study were observation sheets, videos, photos, field notes, and assessment guidelines. All instruments are used to collect data in these results. Finally, all data were analyzed using descriptive analysis and triangulation data.

This research was conducted at SMP N 1 Yogyakarta on August 25, 2018 to September 7 2018. The subjects of this study were 34 students of class VII D. In the learning process, to help students understand how the process of classifying animals in science learning, how to distinguish sets and not set, determine the requirements for membership of a set, and write down members of a set.

Observations carried out by students in groups by documenting pictures or photos of various kinds of animals at the Gembira Loka Zoo in Yogyakarta. Photographs of the animals are printed and cut out, and pasted and grouped based on certain characteristics, for example based on the type of food, mobile devices and others. The instrument used in this study is the communication skills assessment sheet on video. The communication skills assessment instrument sheet can be seen in the Table 1.

Table 1. Communication Skills Assessment Instrument

No	Aspects	Score				
		1	2	3	4	5

1	Students are able to express ideas of design that will be made
2	Clarity of concept in the design made
3	Communicate the concept of the design systematically
4	Division of roles in communicating the design concepts proportionally
5	Suitability of design with presentation
6	The logical aspect of design
7	The logical idea of design

The data about communication is descriptive and obtain from video assessments. Assessment in this study using a Likert scale, said to be feasible if the mean (average) of the respondents at least get good criteria. Data in the form of scores are converted into qualitative data (data intervals) with a scale of 5. Changing this score refers has the following conditions:

Table 2. Scores for the Average Score of Each Component

No	Score renge (i)	Score	Category
1	$X \geq Mi + 1.8\ SBi$	A	Very good
2	$Mi + 0.60\ SBi < X \leq Mi + 1.80\ SBi$	B	Good
3	$Mi - 0.60\ SBi < X \leq Mi + 0.60\ SBi$	C	Fair
4	$Mi - 1.80\ SBi < X \leq Mi - 0.60\ SBi$	D	Poor
5	$X < Mi - 1.8\ SBi$	E	Very poor

Symbols:

$M_i = \frac{1}{2}$ (ideal maximum score + ideal minimum score)

SB_i = The ideal standard deviation that can be searched using

$SB_i = (\frac{1}{2}x\frac{1}{3})$ x (ideal maximum score − ideal minimum score)

$= \frac{1}{6}$(ideal maximum score − ideal minimum score)

$\bar{X}$ = empirical score

Ideal maximum score = $\sum$ highest score criteria

Ideal minimum score = $\sum$ lowest score criteria

Determine the overall value by calculating the average score of all assessment criteria, then changing it into qualitative values according to the criteria of the ideal assessment category in table 2 above.

Before the communication skills assessment instrument sheet is used, the validity test is first performed. The validity test is carried out with regard to the accuracy of the measuring instrument against the concept being measured so that it actually measures what should be measured. The validity test of the communication instrument was carried out through the consideration of experts consisting of 2 physics lecturers, 1 mathematics lecturer, and 2 teachers. The results of the considerations are presented in Table 3.

Table 3. The validity of communication instrument

No.	Validator				
Soal	1	2	3	4	5
1	0	1	0	1	1
2	1	1	1	1	1
3	1	0	1	1	1

4	1	1	1	1	1
5	1	1	1	1	1
6	1	1	1	1	1
7	1	0	0	1	1

Information: 1 = Valid, 0= Tidak Valid

The results of the expert scales presented in the Table 3 are then analyzed using the Q-Cochran statistical test.

Table 4. Q-Cochran test on instrument **validity**

N	7
Cochran's Q	2400(a)
Df	2
Asump. Sig.	.666667

Based on Table 4 above it can be seen that the Cochran Q statistical price for validity is 2400 with an asymptotic significance rate of 0.666667. Because the asymptotic significance price is greater than 0.05, it can be concluded that at the 5% significance level the validators give uniform consideration to the validity of the communication instrument.

Discussion

This research begins to determine the material between Science and Mathematics that can be integrated in the learning process. Before the learning process in class, students do an outdoor learning class that is visiting the Gembira Loka zoo on Saturday, August 25, 2018. The purpose of students visited the zoo to observe the layout of the cage, while also looking for data in the form of photographs of animals there. The photos are collected which will later be used in the learning process.

The first lesson was conducted on Monday, September 3, 2018 in the Association material for mathematics and animal classification in science lessons using the STEM approach. Learning is focused on the process of communication skills.

The last meeting was held on September 7, 2018. Students presented the results of their discussions regarding animal classification and set concepts. After the presentation is complete, students are directed to draw conclusions about the classification of living things, define the meaning of sets, distinguish sets and not sets, and determine how to write or present the set.

The technique that students apply is to design zoos based on the concept of animal classification and the set they have learned. Furthermore, zoo designs that have been made are then presented in the form of videos. The video is uploaded to YouTube and the assessment is based on many likes obtained and also from the assessment questionnaire to find out how students communicate.

Here are the results of assessment of students the ability to communicate via video sketch zoo:

Table 5. Data of student communication assessment score

No.	Group's name	No. of question						
		1	2	3	4	5	6	7
1	Group 1	3	4	4	4	3	3	4
2	Group 2	4	3	4	3	4	4	3
3	Group 3	4	4	4	5	4	4	5
4	Group 4	5	4	5	5	5	5	4

5	Group 5	4	5	4	4	4	5	3
6	Group 6	4	3	4	3	4	4	4
	Averages	4	3,83	4,17	4	4	4,17	3,83

Based on the data presented, the number of scores obtained from the assessment of communication skills is then analyzed based on the conversion of a five-scale scoring score. The range of quantitative scores and their categories are as follows:

Tabel 6. Score conversion table for assessment of communication skills

Interval Score		Score	Category
$X > Mi + 1{,}80\ SBi$	$X > 29{,}41$	A	Very good
$Mi + 0{,}6\ SBi < X \leq Mi + 1{,}80\ SBi$	$21{,}60 < X \leq 29{,}41$	B	Good
$Mi - 0{,}6\ SBi < X \leq Mi + 0{,}6\ SBi$	$26{,}00 < X \leq 34{,}00$	C	Fair
$Mi - 1{,}80\ SBi < X \leq Mi - 0{,}6\ SBi$	$17{,}99 < X \leq 26.00$	D	Poor
$X \leq Mi - 0{,}6\ SBi$	$X \leq 17{,}99$	E	Very poor

The results of students 'communication skills attainment in tables 5 and 6 are known that the total score for communication skills assessment is 28. This score is in the range of scores $21.60 < X \leq 29.41$, so that students' communication skills are included in the B score with good categories. The level of students' ability to communicate well based on the research is due to the learning approach used which is STEM approach. These results are in line with research [8] which shows that the communication skills of junior high school students using STEM-based science learning is good enough.

From table 5 it can be seen that students' communication in developing design concepts is still lacking. That is because students' lack of understanding determines the type of zoo they want to make. In addition, the students is still lacking of logical idea for example: playing rides, canteens, and, sellers of souvenirs that are less appropriate.

Students' abilities in various aspects of communication can be seen from students' ability to discuss problems and make drawings or models. To improve students' communication skills by encouraging students to conduct learning activities in discussion, solve problems, and convey the results of the discussion to other students. When discussing, students will communicate a lot with their members. Students will exchange information and be directly involved in learning and explore their knowledge. These results can be concluded that the STEM approach in the learning process can help students practice structured communication skills.

Conclusion

Based on the results of research and discussion, it can be concluded that the communication skills of students can be trained structurally indicated by the results of the videos made. The average score of 28 shows good value. The results of this study indicate that science and mathematics learning with the STEM approach has the potential to develop students' communication skills.

Referring to the results of the above research, things can be suggested as follows: (1) When learning using STEM, it is better to be integrated between science, technology, engineering, and mathematics. So that learning will be intact and make it easier for students to find concepts in learning. (2) The STEM approach can develop students' communication skills, so that it can be an alternative for teachers in the natural teaching and learning process. (3) The STEM approach can also help students prepare themselves to face the industrial revolution. (4) For schools, it is best to apply the STEM approach to learning and enter the curriculum system.

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Student Worksheets Using the PISA Context for Statistics Topic in Class VIII SMP

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Abstract: This study was inspired by the achievements of Indonesian students who were still low on the PISA test. The low of these results suggests that students must be trained to use mathematics in their daily lives. One way that can be done is to provide contextual problems to students in mathematics learning. In this study the contextual problems are poured into worksheets that can be used by students and become a reference for teachers to develop other contextual problems. The context used in the problem refers to the PISA contexts, namely, personal, occupational, societal and scientific. This development aims to produce worksheets that are valid and practical to be used on statistical topics of class VIII SMP. The development model used is 4-D consisting of define, design, development, and disseminate. The results showed that the statistical worksheet was valid in terms of content, constructs, and languages based on the validator's assessment with an average of 3.52 and was practically based on a large group trial of 88.57%.

Keywords: students' worksheet, the PISA context, statistics, class VIII SMP

Introduction

One of the characteristics of the 21st century is the swift flow of information in daily life, it needs skill to choose and sort data or information to be used as conclusions accurately (Kusumah, 2018). Nowadays, the information presented is not only in the form of text, but also in the form of numbers, pictures/charts, tables, and patterns, so that it requires literacy skills for the reader. This condition force everyone to have critical thinking skills, literacy skills, and master information and communication technology to deal with the 21st century issues (Frydenberg & And one, 2011). In other words, literacy is one of the important competencies or skills that must be owned by students in accordance with the demands of the 21st century.

Literacy is initially interpreted as "literacy" and then is interpreted as "understanding". But understanding literacy in the end does not only reach the problem of reading and writing. A person's ability in sixth basic literacy is used as an indicator of someone able to survive in the 21st century [3]. The sixth basic literacy are reading, mathematics, science, information technology and communication, finance, and culture and citizenship.

Mathematical literacy is one of the focuses of the assessment of The Program International Student Assistance (PISA). Puspendik Balitbang Kemendikbud (2012) explains that PISA is a study developed by several developed countries in the world which are members of the Organization for Economic Cooperation and Development (OECD) which serves as an administrative evaluation where the results will show the extent of education in a country compared to the state other participants. The following are Indonesia's achievements in the field of mathematics based on the results of the PISA study.

Table 1. Indonesia's Achievements in Mathematics on PISA Study

Year	Rank	Score	International Average
2000	39 of 41	367	500
2003	38 of 40	361	500
2006	50 of 57	391	498
2009	61 of 65	371	496
2012	64 of 65	375	494

Year	Rank	Score	International Average
2015	63 of 69	386	493

Source: OECD in Abidin, Mulyati, & Yunansah (2017)

From Table 1 it can be seen that Indonesia is always in the bottom rank among all PISA participating countries. The low achievement of Indonesia was also seen from the achievement of scores that never reached the international average score. The results of the PISA study are in line with the research which shows that the literacy skills of junior high school students in Pekanbaru are still low (Siregar, Solfitri, & Roza, 2018). One of the factors of students' low mathematical literacy abilities is because students are less accustomed to working on problems with PISA characteristics (Wardhani, 2011).

The problems with PISA characteristics should not only be given during the exam. If students are not trained in learning, it is certainly difficult for students to answer questions with PISA characteristics. Therefore, we need a strategy in learning that can introduce and train students to be able to solve problems with PISA characteristics. One way that can be done is to develop student worksheets that use the PISA context. Student worksheets is a type of learning aid that can be used by students as a guide in conducting investigative or problem-solving activities (Hamdani, 2011; Trianto, 2012).

Context describes the situation of problems in everyday life. Problems in the PISA study involved four contexts: personal, occupational, social, and scientific. The problem of personal context is a problem related to the lives of learners in everyday life, problems in the context of occupational in relation to one's work, problems in the social context are issues related to life in society, and problems in scientific contexts related to mathematics, use technology tools, and others (Abidin, Mulyati, & Yunansah, 2017).

One of the material or content contained in the PISA study is uncertainty and data. This content requires students to be able to analyze data based on data distribution, average value, median, mode, and size of data distribution. Content uncertainty and data in the PISA study are in line with 2013 Curriculum which contains Basic Competencies 3.12 Analyze data based on data distribution, average values, median, mode, and data distribution to draw conclusions, make decisions, and make predictions; and 4.12 Presenting and resolving problems related to data distribution, average value, median, mode, and distribution of data to draw conclusions, make decisions, and make predictions (Permendikbud No. 24 Tahun 2016). These two basic competency pairs are intended for students of class VIII SMP which are contained in Statistics topic.

Research Method

The type of research conducted is Research and Development (R&D). This study uses a research development design with a 4-D model developed by Thiagarajan and Semmel (1974). The development model consists of four stages, are Define, Design, Develop, and Disseminate. The disseminate stage cannot be implemented because of the limitations of the researcher.

The activities carried out at the define stage are preliminary analysis, student analysis, concept analysis, task analysis and specification of learning objectives. At the design stage, the researcher designed the student worksheets and the selection of contexts that were in accordance with the Statistics topic in class VIII SMP. At the develop stage, several activities are carried out, are developing the student worksheets prototype, validating the product to fulfill the validity aspects, and conducting small group and large group trials to fulfill practical aspects.

The data obtained in this study are qualitative and quantitative data. Qualitative data comes from criticism, suggestions, and comments from the validator on the student worksheets while the quantitative data is obtained from the validation sheet and responses questionnaire of the students. To collect both types of data, researcher was used data collection instruments, namely validation sheets and questionnaires for students' responses. The validation sheet of a form containing statements using a Likert Scale with four scales, namely 1, 2, 3, and 4 which states are very inappropriate, inappropriate, appropriate and very appropriate. The questionnaires for students' responses of a structured form

containing several statements (positive and negative). Questionnaire responses of students using the Guttman Scale which consists of two alternative answers, namely Yes and No.

Discussion

The development of the student worksheets using the PISA context is carried out using the 4D development model, which includes the Define, Design, Development and Disseminate stages. But in this study, the stages carried out only to develop only because of the limitations of the researcher.

1.1. Define stage

At the define stage, the development activities carried out are to determine the initial problems encountered so that a solution is needed for these problems. Define stage consists of five stages, namely the initial analysis, analysis of students, material analysis, task analysis, and specifications of learning objectives.

1.1.1. Initial analysis. The results of the PISA study illustrate the extent to which mathematics education for students in a country is run. The results of the PISA study show that Indonesian students' literacy skills are still low. One of the causes of students' low mathematical literacy abilities is because students are not used to working on problems with PISA characteristics (Wardhani, 2011). This is due to the lack of available learning resources that can support the development of students' mathematical literacy abilities. One source of learning for students is the student worksheets. Therefore, as an effort to improve students' literacy skills, mathematics learning innovations can be carried out by developing student worksheets that use the PISA context.

1.1.2. Student analysis. Analysis of students is a study of the characteristics of students of class VIII SMP which includes the background of students' cognitive knowledge and development. The background of the knowledge possessed by students relating to Statistics is the material for presenting data in tables, bar charts, line diagrams, and pie charts that have been studied in class VII. The cognitive development of junior high school students is at the end of the concrete operational stage entering the formal operational phase. At this stage, students go beyond concrete experience and are able to think abstractly and logically. However, because all students have different abilities, the consideration in developing student worksheets that can be used by students with high, medium, and low ability.

1.1.3. Material analysis. Referring to Curriculum 2013, the mind map for Statistics topic in class VIII SMP is presented in Figure 1 below.

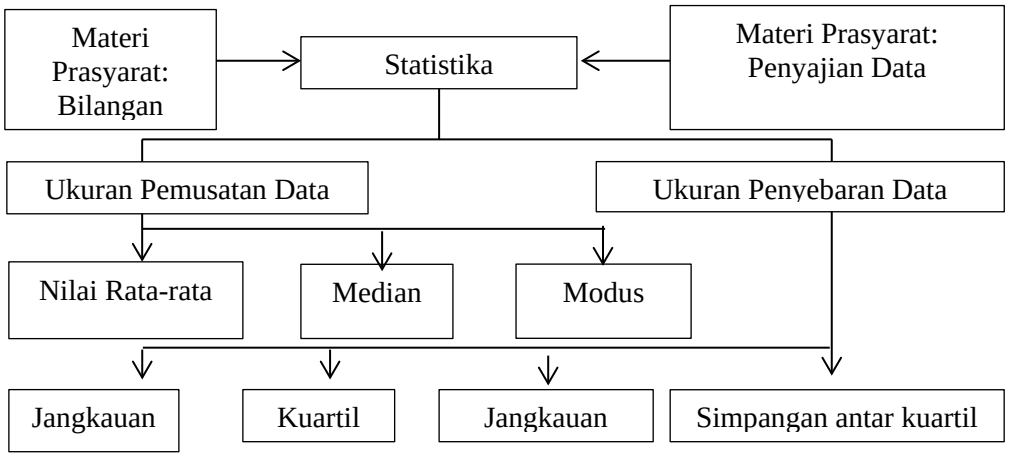


Figure 1. The mind map for Statistics topic in class VIII SMP

By considering the breadth of Statistics topic, the learning material is arranged into four parts, namely (1) analysing data based on data distribution, (2) single data average, (3) single median and data mode, and (4) single data deployment size. Thus, this study developed four student worksheets according to the four learning materials.

1.1.4. Task analysis. Student worksheets used the context of PISA as a learning resource used by students during Statistics learning. The tasks given can be individually and in groups according to the learning material. Individual tasks include practice questions aimed at knowing individual knowledge of students after learning. While group assignments aim to see students in solving more difficult problems through group discussions. The group assignments compiled at student worksheets include PISA questions on uncertainty and data content.

1.1.5. Specifications of learning objectives. In this step what is done is to describe the learning objectives that are in accordance with the results of the analysis of tasks and material. The purpose of learning Statistics topic is so that students can (1) interpret data presented in the form of tables or diagrams; (2) determine the average value, median, mode and size of data distribution; and (3) solve problems related to daily life using the data provided.

1.2. Design stage

The purpose of the design stage is to design 2013 curriculum-based student worksheets on Statistics topics using the PISA context. The developed student worksheets contain steps to find concepts and solve statistical problems so that students can be active in learning activities and fulfill deductive, constructive, and technical requirements. The preparation of the student worksheets design includes cover design and activities that will be carried out by students. The design cover of the student worksheets consists of the title of the learning material, the identity of the students, supporting pictures, learning objectives, and instructions for the work of the student worksheets. The learning objectives of each student worksheets are designed based on learning material.

Student worksheets begin with Statistics problems that use the PISA context. With the problem, students are directed to read and understand problems, write down information that is known, and formulate problems to find solutions. The next activity in student worksheets is to solve problems. Students are directed to discuss and gather information that can help them find the concepts learned so they can find solutions to the problems given.

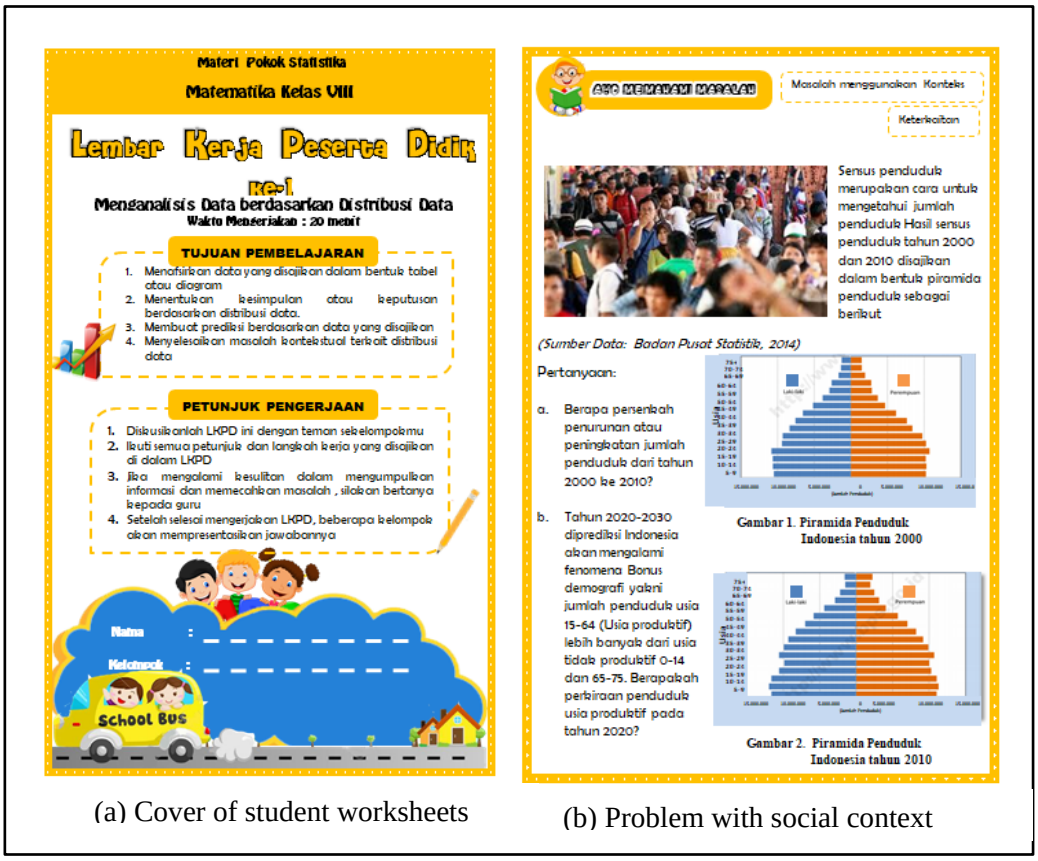
The PISA contexts are used in all four student worksheets, namely:

1) Social context (population census, fuel price, traffic accident, and number of baby births) used in 1st Student Worksheet.
2) The occupational context (bread entrepreneurs, grades of students, and clothes traders) is used in 2nd Student Worksheet.
3) Personal context (poetry competition, weight, height) used in 3rd Student Worksheet.
4) Personal context (drying clothes), occupational (flower traders), and social (Paskibraka), used in 4th Student Worksheet.

1.3. Development stage

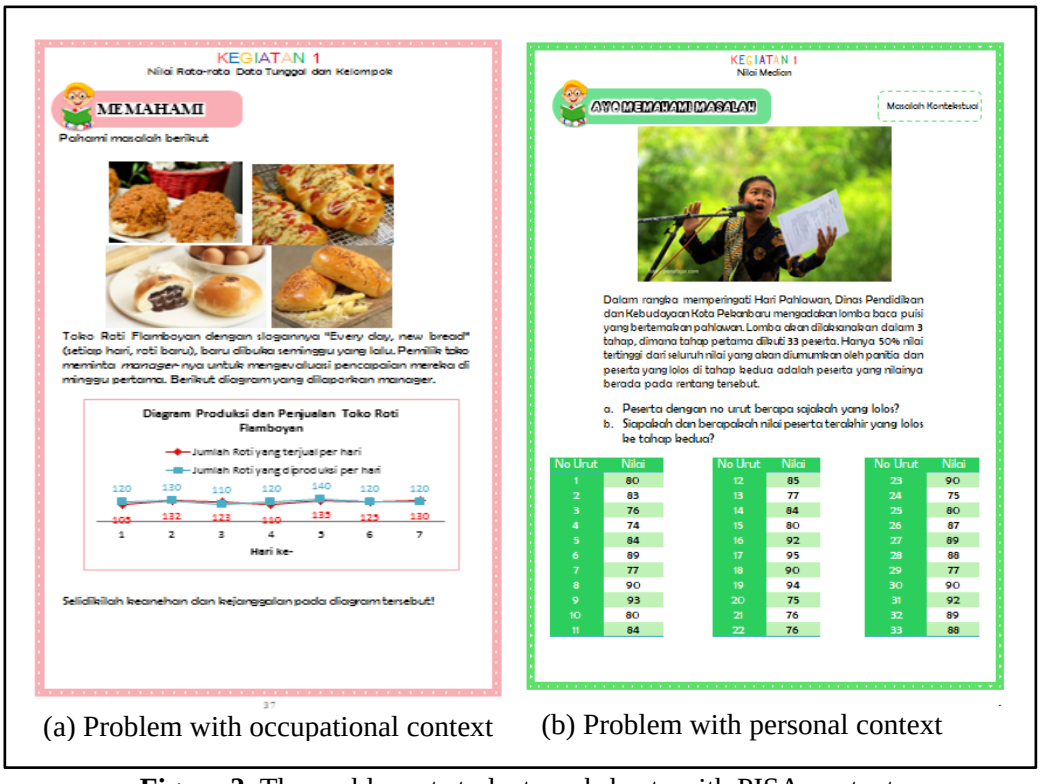
The development phase includes three activities, namely product development, product validation and revision, and small group and large group trials.

1.3.1. Product development. The activity that the researcher did at this stage was to make the student worksheets in accordance with the initial design. The resulting student worksheets is in the form of print out. The cover section and problems in the student worksheets are presented in Figure 2 and Figure 3.



(a) Cover of student worksheets (b) Problem with social context

Figure 2. Cover of student worksheets and problem with PISA context



(a) Problem with occupational context (b) Problem with personal context

Figure 3. The problem at student worksheets with PISA contexts

1.3.2. Validation and revision of product. Validation in this study was conducted by three validators consisting of two lecturers of Mathematics Education at the Riau University who were qualified doctors and a mathematics teacher at SMPIT Pekanbaru who already had educator certificates as mathematics teachers. The evaluation of the three validators is presented in Table 2.

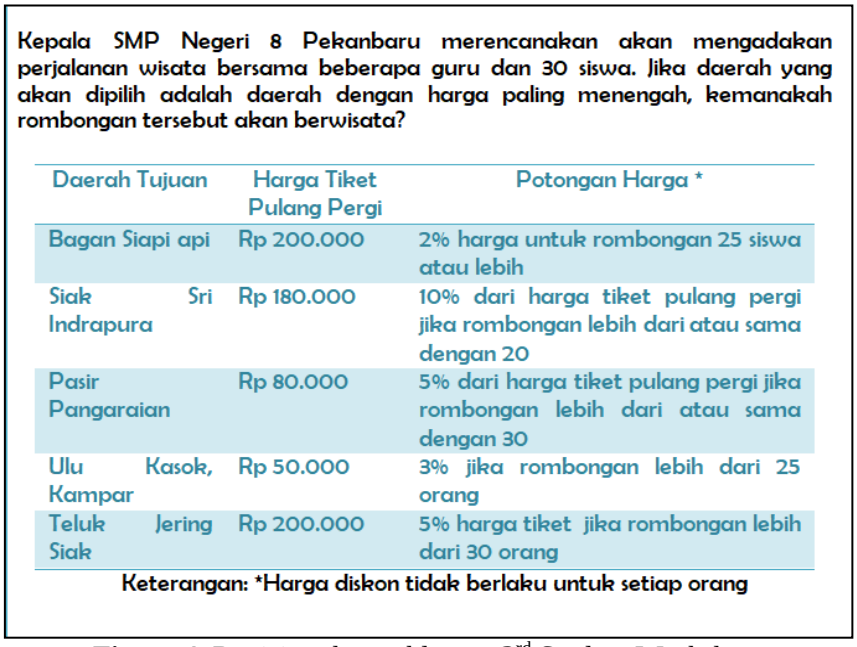
Table 2. Results of Student Worksheets Validation Using the PISA Context

Aspects assessed on Student Worksheets	Student Worksheets				Average	Validation Category
	1	2	3	4		
Cover of student worksheets	4.00	4.00	4.00	4.00	4,00	Very Valid
The suitability of the material with the basic competences that must be mastered by students	3.44	3.44	3.67	3.78	3.58	Very Valid
The suitability the problem with PISA context	3.56	3.67	3.89	3.67	3.69	Very Valid
The suitability student worksheets with didactical conditions	3.56	3.44	3.22	3.44	3.42	Very Valid
The suitability student worksheets with construction conditions	3.50	3.42	3.25	3.25	3.35	Very Valid
The suitability student worksheets with technical conditions	3.58	3.67	3.17	3.75	3.54	Very Valid
Average	3.62	3.60	3.51	364	3.59	Very Valid

From Table 2, it can be seen that the perfect value (4.00) is given validator for cover of student worksheets. It means that the cover of student worksheets is complete, containing the identity of the students, the title of the material to be studied, the learning objectives, and the instructions for using student worksheets. The developed student worksheets are also very valid (3.58) in terms of the conformity aspects of learning material with basic competencies that must be mastered by students. In the suitability the problem with the PISA context, the average value given by the validator is 3.69 which is a very valid criterion. It means that the problems in the student worksheets are in accordance with the PISA context (personal, occupational, and social). The student worksheets also fulfilled didactical requirements, construction requirements, and technical requirements as indicated by the average value given by the validator is 3.42; 3.35, and 3.54 (very valid). Very valid criteria on aspects of didactical requirements indicate that the problems presented in the student worksheets can encourage students to learn independently and be confident in conveying their ideas. Very valid criteria in the aspects of construction requirements and technical requirements indicate that the use of the student worksheets and the learning objectives presented are clear, the sentence structure does not cause double meaning, and the images used in the student worksheets are in accordance with the learning material.

Three validators stated that the student worksheets could be tested by making several revisions, namely:

1) The context of the problem is in accordance with PISA, but still the closest to the student in general. In 3rd Student Worksheets, the problem uses a personal context, namely poetry competition that is followed by students. The validator recommends using a social context that shows tourist attractions in Riau Province. This adds insight to students and is related to social science. Revisions made by researchers can be seen in Figure 4.



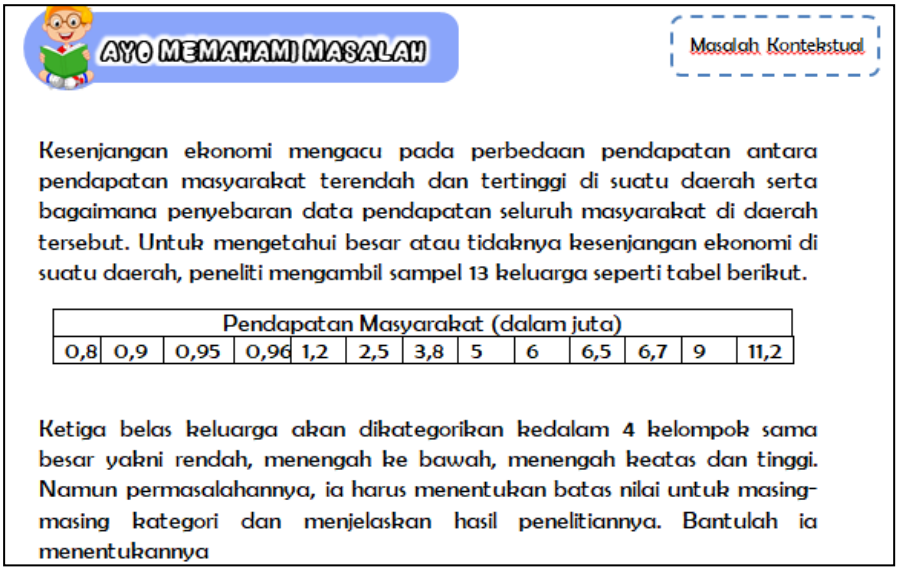
Kepala SMP Negeri 8 Pekanbaru merencanakan akan mengadakan perjalanan wisata bersama beberapa guru dan 30 siswa. Jika daerah yang akan dipilih adalah daerah dengan harga paling menengah, kemanakah rombongan tersebut akan berwisata?

Daerah Tujuan	Harga Tiket Pulang Pergi	Potongan Harga *
Bagan Siapi api	Rp 200.000	2% harga untuk rombongan 25 siswa atau lebih
Siak Sri Indrapura	Rp 180.000	10% dari harga tiket pulang pergi jika rombongan lebih dari atau sama dengan 20
Pasir Pangaraian	Rp 80.000	5% dari harga tiket pulang pergi jika rombongan lebih dari atau sama dengan 30
Ulu Kasok, Kampar	Rp 50.000	3% jika rombongan lebih dari 25 orang
Teluk Jering Siak	Rp 200.000	5% harga tiket jika rombongan lebih dari 30 orang

Keterangan: *Harga diskon tidak berlaku untuk setiap orang

Figure 4. Revision the problem at 3rd Student Worksheet

2) There are many words unknown to the learners in 4th Student Worksheet.



AYO MEMAHAMI MASALAH

Masalah Kontekstual

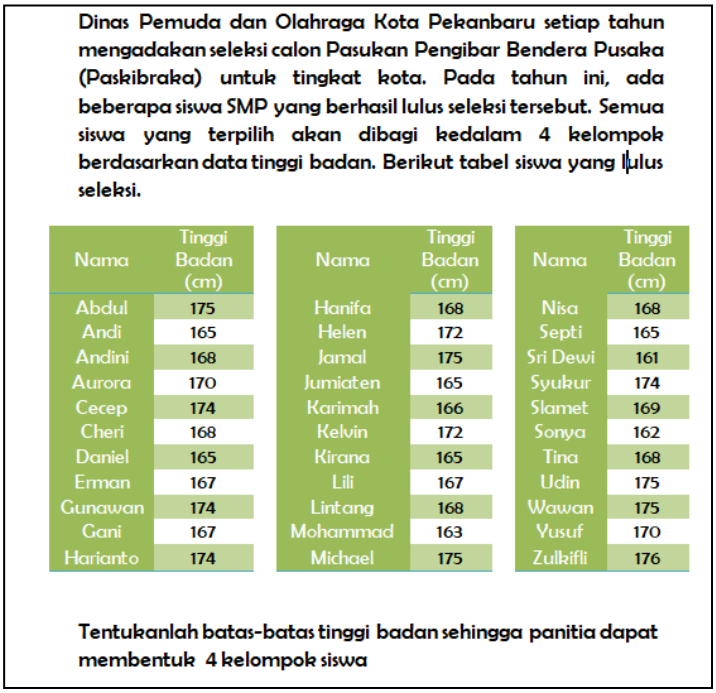
Kesenjangan ekonomi mengacu pada perbedaan pendapatan antara pendapatan masyarakat terendah dan tertinggi di suatu daerah serta bagaimana penyebaran data pendapatan seluruh masyarakat di daerah tersebut. Untuk mengetahui besar atau tidaknya kesenjangan ekonomi di suatu daerah, peneliti mengambil sampel 13 keluarga seperti tabel berikut.

Pendapatan Masyarakat (dalam juta)												
0,8	0,9	0,95	0,96	1,2	2,5	3,8	5	6	6,5	6,7	9	11,2

Ketiga belas keluarga akan dikategorikan kedalam 4 kelompok sama besar yakni rendah, menengah ke bawah, menengah keatas dan tinggi. Namun permasalahannya, ia harus menentukan batas nilai untuk masing-masing kategori dan menjelaskan hasil penelitiannya. Bantulah ia menentukannya

Figure 5. The problems at 4th Student Worksheet before revision

Based on suggestions from the validator, the researcher revised the section and the results are presented in Figure 6.



Dinas Pemuda dan Olahraga Kota Pekanbaru setiap tahun mengadakan seleksi calon Pasukan Pengibar Bendera Pusaka (Paskibraka) untuk tingkat kota. Pada tahun ini, ada beberapa siswa SMP yang berhasil lulus seleksi tersebut. Semua siswa yang terpilih akan dibagi kedalam 4 kelompok berdasarkan data tinggi badan. Berikut tabel siswa yang lulus seleksi.

Nama	Tinggi Badan (cm)
Abdul	175
Andi	165
Andini	168
Aurora	170
Cecep	174
Cheri	168
Daniel	165
Erman	167
Gunawan	174
Gani	167
Harianto	174

Nama	Tinggi Badan (cm)
Hanifa	168
Helen	172
Jamal	175
Jumiaten	165
Karimah	166
Kelvin	172
Kirana	165
Lili	167
Lintang	168
Mohammad	163
Michael	175

Nama	Tinggi Badan (cm)
Nisa	168
Septi	165
Sri Dewi	161
Syukur	174
Slamet	169
Sonya	162
Tina	168
Udin	175
Wawan	175
Yusuf	170
Zulkifli	176

Tentukanlah batas-batas tinggi badan sehingga panitia dapat membentuk 4 kelompok siswa

Figure 6. The problems at 4th Student Worksheet after revision

1.3.3. Group Trial. The trial was conducted to see the practicality of using student worksheets by students. The trial was conducted in small and large groups. The small group trial was conducted on five students of class VII of SMPN 8 Pekanbaru randomly selected with heterogeneous academic abilities. The selected students are students who have not studied Statistics topic but already have the prerequisite knowledge, namely Data Presentation topic. When students learned by using student worksheets, the researcher acts as a companion and mentor who provides direction if students experience difficulties in completing student worksheets. The researcher also observed the activities and responses of students while using student worksheets. Based on the observations of researchers, students seemed enthusiastic in carrying out the activities contained in the student worksheets and asked researchers if they were confused. After the students have finished learn by using student worksheets, the researcher asks the students to fill out the questionnaire according to their opinions. The results of the questionnaire responses of students in small group trials showed that student worksheets were very practical for students to use, which can be seen in Table 3.

Table 3. Percentage of Questionnaires for the Response of Students in the Small Group Trial

Percentage of Questionnaire for Students' Response to Students Worksheets				Average	Category
1	2	3	4		
87.14%	94.29%	92.86%	85.71%	90.00%	Very Practice

Next, the researchers conducted a large group trial of 20 people of class VII-3 SMPN 8 Pekanbaru who did not take a small group trial. In a large group trial, the researcher became a companion and mentor who gave direction if students experienced difficulties in completing student worksheets. Learning activities are carried out with group discussions. The researcher grouped students into four groups and each group consisted of five students. Students look more enthusiastic because learning activities are carried out in groups. On the first day of the trial, students had difficulty working on the problem because students usually were used to working on routine questions. After the end of the

learning, the researcher provides a questionnaire for students' responses to assess student worksheets that has been studied. The percentage of participants' questionnaire responses to student worksheets in the large group trials can be seen at Table 4.

Table 4. Percentage of Questionnaires for the Response of Students in the Large Group Trial

Percentage of Questionnaire for Students' Response to Students Worksheets				Average	Category
1	2	3	4		
88.21%	93.93%	87.50%	84.64%	88.57%	Very Practice

Based on students' responses to questionnaires in large group trials, student worksheets using the PISA context for Statistics topic in class VIII SMP are categorized as very practical. As many as 88% of students stated that the problems found in student worksheets are often found in everyday life, so they have a curiosity about how to solve the problem. Students also stated that they could carry out activities at student worksheets because the activity instructions were clear, and the sentences contained in student worksheets were easy to understand so they could solve the problem. If reviewed from the aspect of the display, as many as 95% of students stated that the composition colour of student worksheets that interesting and the images presented could help them understand Statistical topic.

Conclusion

This development research produced four student worksheets that used the PISA context, namely personal, occupational, and social. Student worksheets have gone through the stages of validation and two trials which show that student worksheets are very valid and gets a very practical response from students. Thus, it can be concluded that student worksheets that uses the PISA context in the developed Statistics material is valid and meets the practical requirements to be used by the eighth-grade students of SMP.

Author express special thanks to all students and teachers who participated in the process of development of this worksheet.

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Hypothetical Learning Trajectory for Classification of Animals and Sets by Using the STEM Approach

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Abstract: STEM approach is an approach to teaching science, technology, engineering, and mathematics in an integrated manner. The aim of this study was to describe the design of teaching and learning process to teach animal classification in science and set in mathematics using the STEM approach. The type of research used in this study was the Gravemeijer and Cobb models which consist of three phases. The research subjects in this study were 34 students of class VII D of SMPN 1 Yogyakarta. The instrument used in this study is the hypothetical learning trajectory. In the design made by the researcher, there were observations by students about animal characteristics and animal placement in the Gembiraloka zoo. From this observation process, the researcher facilitated students to understand how the process of classifying animals in science, and how to make a set, determine the terms of membership of a set, and write down the membership of a set.

Keywords: STEM approach, integrative, and collaboration.

Introduction

The character of modern society that lives in the 21st century is rational, open, forward-thinking, creative, independent, appreciating time and innovating. Their lives are also influenced by the rapid development of technology and communication. To be able to play a role in shaping the character of society in the 21st century, schools, especially teachers are required to be able to present learning that is able to foster these skills. In the 1990s the United States National Science Foundation held a renewal movement in the education sector and the theme raised was Science Technology Energetic Mathematics (STEM) and from this movement the term STEM first emerged. This movement is a movement that seeks to make updates in the learning process related to the four fields, so that the growth of the workforce of the STEM fields can be increased (Firman, 2015). In addition, this movement also intends to open the horizons of Americans so that they are literate with STEM. If this goal is successfully achieved, then the result is US global competitiveness in science and technology innovation can increase. According to the National STEM Education Center, STEM education does not only mean strengthening the praxis of education in STEM fields separately but developing an educational approach that integrates these four fields by focusing on the educational processes that occur in the classroom in solving real problems found in everyday life and professional life (Firman, 2015). In other words, they began to be invited to learn to integrate their knowledge in the four fields to solve problems they encountered in everyday life. According to Bybee (2010), within the framework of primary and secondary education, STEM education aims to develop STEM literate students with the following characteristics: (1) using scientific steps in identifying and solving problems, (2) understanding the characteristics of each STEM disciplinary component so that it can use all four components in an integrated manner, (3) realizing how the roles of each discipline in STEM form a material environment. intellectual and cultural, and (4) willing to study STEM related issues.

According to Reeve STEM education is an interdisciplinary approach to learning where in the learning process occurs students use science, technology, engineering, and mathematics to solve problems, so that they can be well connected with the world of work, and the world global (Firman, 2015). Therefore, STEM-based learning can be used as a solution that can provide opportunities for students to foster an attitude of cooperation and integrate abilities and knowledge in these four fields. Moore et al. explains that STEM is an approach and effort in combining several or all four STEM subjects into one lesson that is based on relationships between subjects and real-world problems

(Firman, 2015). Sanders explained that STEM is an approach that explores two or more STEM subjects and one or more subjects in school (Sanders, 2009).

One of the problems faced by students in our school is that students have not been able to integrate the material obtained separately when solving a problem, for example when students are asked to design the location of animal cages in a zoo if animals will be placed at the zoo it is known. Students have not been able to integrate the knowledge they have acquired about animal classification in Science subjects, and the set in Mathematics. Therefore, in this study, we try to design learning activities that can integrate set material on Mathematics subjects and Classifications of Living Beings on science subjects, so that the knowledge formed by students can be integrative with each other.

Hypothetical learning trajectory (HLT) is a hypothesis or prediction of how students' thinking and understanding develop in learning activities (Wijaya, 2009). According to Gravenmeijer (2004), there are three main components in HLT, namely (1) learning objectives, (2) learning activities and devices / media used in the learning process, and (3) the conjecture of the learning process, which contains the initial understanding students and student strategies that emerge and develop when learning activities are carried out in class (Gravemeijer, 2004). In this study, researchers will design a hypothetical learning trajectory (HLT) that uses the STEM approach to teach animal classification in science and the set of mathematics lessons in class VII D at SMPN 1 Yogyakarta in an integrated manner. The researcher chose the two materials because according to the researchers both materials were interconnected and could be taught in an integrated manner.

Research Method

The type of research used in this study is the Cobb and Gravemeijer model design research which consists of three stages, namely (1) making a design plan; consists of (a) determining learning objectives, (b) determining the starting point of learning, and (c) determining the learning model to be used; (2) testing the design design, and (3) conducting a retrospective analysis (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). The results presented by researchers in this paper are only limited to stage one of three stages. The things presented by new researchers are limited to how the HLT design is to teach animal classification and assemblies using the STEM approach.

The subjects in this study were students of class VII D of SMP 1 Yogyakarta. The data collection method that will be used in this study is making field notes, observing, giving written tests, and conducting interviews. The research instruments used in this study were HLT, test sheets, and interview guideline sheets. The stages of data analysis used in this study are the stages of data analysis in qualitative research, namely (1) reducing data, (2) presenting data, and (3) making conclusions and verifying conclusions (Miles & Huberman, 1994).

Discussion

The learning objectives of HLT made by researchers are: (1) students can classify animals found based on the characteristics of the animal, (2) students can explain the characteristics of animals in a classification, (3) students can identify whether an animal enters a particular class or not, (4) students can define the meaning of a set, and (5) students can represent membership of a set.

HLT designed by researchers was conducted into two major stages detailed follows:

In the first stage, students were told to photograph five animals that live around their houses and were asked to write down the characteristics of the five animals based on observations made. Then, the students were made to work in groups of three. Each group later was asked to share their observation results and showed pictures of the animals observed. In the next the task, each group was to identify animals that have similar characteristics. Then students were asked to look for some learning resources available about (1) how the animals they observed breed, (2) how the animal respiration systems are like, and (3) what the animals' digestive systems look like. When the information had been obtained, students were asked to make classifications of animals based on their breeding methods, respiratory and digestive systems. Following their discussion on the classifications, each group was asked to make a poster containing their findings based on the leading questions. Each group were also given the opportunity to add their explanations to the pictures. After that, each group was asked to present the

results of their work during Natural Science class and teacher. Each group was reminded to present different classifications.

Using the results of the group presentations, the Math teacher asked to answer questions, such as: why can animal A, for example a cat, be grouped into groups of animals that breed by giving birth? Give examples of other animals that belong to the group of animals that breed. The Math teacher, then, invited students to draw conclusions about the meaning of the set. To help students draw conclusions about the meaning of the set, the teacher associated the question with the process that happened before, for example about cats that are included in the group of animals that give birth. The teacher asked why cats are included in the set of animals that give birth. From this process, students were expected to make conclusions that the set refers to a collection of objects that have the same characteristics or features. Then, students worked together to add more animals which bear the same characteristics presented during Natural Science class. Then, the students were made to convert all the data they used into graphs. Some were expected to use images or tables. The teacher asked the groups to present the results of their discussion. The teacher ensured that the Math/set poster displayed presented a different representation of the membership of the sets. The procedure was followed with students making conclusions on how to present a set.

Still working in the group, students were given a piece of paper containing the names of sets of numbers, for example a set of integers ranging from - 5 to 4, the set of natural numbers between 12 to 21, or the set of even numbers located between 3 to 15. The groups were tasked to express the statements in different ways. Then, the groups were asked to present the results of their discussion on a poster. The teacher ensured that the poster displayed presented a different representation of the membership of the set. The first stage ended with students concluded about how to present a set.

The second stage began by making students work in groups 3 – 4 students and were told to visit Gembiraloka zoo on a particular day accompanied both Natural Science and Math teachers. During their visit to the zoo, each group was tasked to do the followings: (1) take photos of 15 different animals, (2) record the classifications of the animals while touring in the built-in gardens ranging from the types of food to the living habitats of the animal, and (3) make a video containing reportage two different types of animals in 15 minutes duration. Following their visit to the zoo, students were asked to upload the reportage videos to You Tube channel. Then, other students were asked to watch reportage videos made by other groups. After watching the videos, students were asked to make important notes about the animals described from each video for students to make important notes about things that they felt not right from the reportage their friends made. In the same group, each student was asked to present the notes he had made after watching the video. At the end, each group was asked to summarize the notes from their member and wrote them on the poster. After that, students were invited to discuss the notes that appeared the most especially about things that are not right.

Following that, the teaming-teachers selected thirty photos which were sent by students. These selected photos were returned to the groups, thus each group had thirty photo compilation which they must cut out. The teacher asked the groups to make different classifications to present the results of their discussion. Using a new working sheet from their teachers, the group pasted the photos on the new sheet under a certain classification. In the posters, students were also asked to explain how the classification was made along with the membership requirements for each classification.

Then, the groups continued working by designing a mini zoo containing animals within the collections. After finishing the mini zoo, students were asked to make a video presentation explaining how they built the mini zoo, why they built it, and what difficulties they experienced when making the zoo. After the video was finished, each group was asked to upload it on you tube. Students must watch the videos and rated the content of the video. The most liked videos will be entitled for some presents from the two teachers. A written test, finally, was given to measure their achievement of their learning objective(s).

Conclusion

The context of the exploration of animals that live around the home environment of students can be raised as a context for learning animal classification, understanding sets, and how to represent the set. Another context that can be used to achieve this goal is the context of visiting zoos and discussion activities related to visits to zoos. To see the achievement of the objectives and the implementation of this HLT, researchers need to conduct a trial to the field.

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Hypothetical Learning Trajectory for Uniform Motion and Gradient Using the STEM Approach

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Abstract: Learning in the fields of science, technology, engineering, and mathematics (STEM) has developed into a meta-discipline. Learning in all four fields is focused on the emergence of innovative solutions to a complex contextual problem facing the world today. The purpose of this study was to describe the design of teaching and learning about uniform motion in science and gradient of a line on Mathematics using the STEM approach. The type of research used in this study was the design of the Gravemeijer and Cobb models which consist of three phases. The exposure presented in this paper was only limited to the first phase of design research. The research subjects in this study were class VIII of SMPN 2 Yogyakarta. The instrument used in this study is the hypothetical learning trajectory. In the design made by researchers, researchers will experiment with dropping mahogany trees from a certain height. From this experiment, researchers will build understanding and meaning of the concepts of regular straight motion and straight-line gradients.

Keywords: STEM approach, uniform motion, gradient

Introduction

Students in SMP Negeri 2 Yogyakarta have an average score above the average of students in general in the city of Yogyakarta, but their communication skills are not in accordance with the academic abilities they have. This can be seen from the way they answer the questions in science and mathematics, students tend to only write the final answer, not writing the steps to solve the problem. This is because students' ability to describe what they think in writing is not good. Likewise, with their verbal communication skills. When students present the results of the experiment, students only read what they wrote in the notes, they have not explained how process took place and how their process obtained the experimental results.

When students learn the material of linear equations, students have difficulty in interpreting gradients from a straight line, and represent mathematically two parallel lines, perpendicular or coincident in the equation of straight lines. For example, students cannot explain what means a line has a gradient of 1/3 and which of the two lines is more upright if the gradients of the two lines are 1/2 and 1/4. Students are also still difficult to understand why if two parallel lines are known, then the gradients of the two lines are the same or if the two lines are perpendicular to each other, then the product of the multiplication of the two lines is -1. When students solve questions in the material of linear equations, students use more formulas that have been derived by the teacher than the meaning of straight-line gradients and the relationship between gradients of 2 straight lines.

In science learning at Yogyakarta State Junior High School 2 especially in linear motion material students experience difficulties in making and reading charts. So that at the time of presentation students cannot explain in detail about the results of the experiments they did. For example, students find it difficult to explain the results of the experiments they did in relation to regular straight motion. They experimented using a ticker timer and dropped mahogany flowers.

The problem that explained above encourages researchers to try to make hypothetical learning trajectory design that can teach material linear equations in Mathematics and regular linear motion in science subjects in integration. The results in this paper is still limited by researchers in the explanation of how the hypothetical learning trajectory is to teach material linear equations in Mathematics and regular linear motion in science subjects using the STEM approach and paying attention to the communication process of students verbally and in writing.

STEM is an integrated learning between science, technology, engineering, and mathematics to develop students' creativity through the process of solving problems in daily life (Winarni, Zubaidah, & Koes, 2016). The aim of STEM learning for students is to deliver students to meet 21st century capabilities, among others, learning and innovating skills which include: thinking critically and being able to solve problems, creative and innovative, and able to communicate and collaborate, skilled in using media, technology, information and communication (ICT) (Winarni et al., 2016).

William F. Glueck (in Winarni et al., 2016) said that communication can be divided into two forms, namely as follows: (a) interpersonal communications, and (b) organization communications. According to William F. Glueck (in Winarni et al., 2016) interpersonal communications is a process of information exchange and transfer of understanding between two or more people in a small group of people, while an organization communication is a process where the speaker systematically provides information and move understanding to many people in the organization and to individuals and institutions outside of the relationship. Widjaya said that the notion of communication is a contact relationship between and between humans both individuals and groups (As'ari, Tohir, Valentino, Imron, & Taufiq, 2017a).

According to Gravemeijer and Cobb (in Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006) there are three phases in design research, namely:

1. The first phase, namely preparation of design trials According to Gravemeijer and Cobb (in Van den Akker et al., 2006), preparation for design trials begins with setting goals to be achieved by students after they learn mathematics which are referred to as design endpoints. After completing setting goals to be achieved by students, the researcher must then determine the starting points of learning, which are referred to as the starting points of the design. After the objectives to be achieved by students and the starting points of learning are formulated, then the next task of the researcher is to formulate the guesswork of local learning theory (a conjecturer local instruction theory) of the design to be tested.
2. The second phase, namely the design trial. According to Gravemeijer and Cobb (in Van den Akker et al., 2006), the purpose of the design trial is to test and increase the suspicion of local learning theory (a conjecture local instruction theory) that has been developed in the first phase and develop understanding of how the design works. According to Gravemeijer and Cobb (in Akker et al., 2006), the key to the process of testing, improvement, and understanding is an integrated cyclic process of the design and analysis process.
3. The third phase, namely retrospective analysis According to Gravemeijer and Cobb (in Van den Akker et al., 2006), the purpose of the retrospective analysis depends on the objectives of the theoretical research development carried out. Furthermore, it was stated that one of the main objectives of a retrospective analysis was to develop a local learning theory. Despite the differences in objectives in theory the development of research is reflected in differences in retrospective analysis, but the form of analysis needs to include an iterative process that analyzes the incoming data set.

Research Method

In this study we use design research whose model of Gravemeijer and Cobb (in Van den Akker et al., 2006) which has the following characteristics: (1) Interventionist, which mean design research has the purpose of designing an intervention in the real world; (2) Iterative, which mean that in the design research process there is a cycle (a) design, (b) evaluation, and (3) revision; (3) Process oriented, which mean that research is focused on understanding the process and the impacts that occur in the intervention carried out by researchers and the development of interventions; (4) Utility oriented, which mean the usefulness of this research is measured by practicality for users; and (5) Theory oriented, which mean that the design is built based on theoretical prepositions then field testing is done to contribute to the theory.

The subjects of this study were class VIII students. The research instrument used in this study is a field note that is used to record all the processes of implementing learning in the classroom and communication skills both oral and written that are shown by students during the learning process, and

the tests used to see how the ability impacts students in regular straight-line material and straight-line equations and written communication skills of students. The research method used in this study is to make field notes and carry out tests. Field notes are made during the learning process and after the learning process is complete. The test is done at the end of the learning process. Data analysis was carried out following data analysis in qualitative research, namely (1) reducing data, (2) presenting data, (3) and making conclusions (Miles & Huberman, 1994).

Discussion

The results presented in this new paper are limited to the results achieved by researchers in phase one of design research. The aim of the learning process designed by researchers is (1) for mathematics subjects so that students (a) interpret the meaning of gradients in linear equations (mathematics), (b) identify whether a graph is a graph of a linear equation or not, and (c) determine the equation of a linear graph; for science subjects is that (a) students can explain the phenomenon of regular linear motion, (b) make and read graphs about linear motion, (3) conduct experiments with mahogany flowers and ticker timers, and (4) report in writing the results obtained from experiments with mahogany flowers and ticker timers; (3) for the communication aspect so that students can (a) make exposure, which is coherent and systematic, in writing about the results obtained from the experiment with mahogany flowers and ticker timers, and (2) present, coherently and systematically the results obtained from the results of experiments with mahogany flowers and ticker timers.

Before learning about straight line equations and regular straight motion, students have learned about (1) equations, (2) variables, constants, coefficients, and terms, (3) Cartesian coordinates, (4) distance and displacement, and (5) speed (As'ari et al., 2017a; As'ari, Tohir, Valentino, & Imron, 2017b; As'ari et al., 2017c; Widodo, Rachmadiarti, & Hidayati, 2017; Zubaidah, Mahanal, & Yuliati, 2017a; Zubaidah, Mahanal, & Yuliati, 2017b).

The activities carried out by teachers and students designed by researchers for the first meeting planned to last for 5 × 40 minutes are as follows:

1. The teacher greets students.
2. Students and teachers pray to begin the lesson.
3. The teacher checks the attendance of students.
4. The teacher conveys the learning objectives to students.
5. Students observe the marbles phenomenon which is rolled on a board that is not tilted and tilted.
6. Teachers and students discuss the observed phenomenon. To start discussion, the teacher can give the following question, what is the difference in the condition between the marbles rolled on the board that are not tilted and tilted? What is the speed of the marbles that are rolled on the board that is not tilted with the tilted one? Can you explain why the marbles that are rolled on the tilted board have increased speed, while the marbles that are rolled on the board that are not tilted do not experience an increase in speed.
7. The teacher organizes students in several groups (each group consists of 8 students).
8. Teachers share student worksheets that need to be done by students. The following is a student worksheet that is shared with students:

STUDENTS' WORKSHEET

1) OBJECTIVE: students analyze the phenomenon of mahogany fall with the tracker program.

2) TOOLS AND MATERIALS: cellphones for recording videos, laptops equipped with tracker programs, and mahogany flowers

3) EXPERIMENT STEPS:

a) Drop a mahogany flower from a certain height.
b) Video the process of falling mahogany flowers.
c) Perform the first and second steps three times from different heights.
d) Analysis of videos with the tracker program, for that to do the following steps:

(1) install the tracker program on the laptop that will be used.
(2) open the tracker program.
(3) open file choose the video that will be analyzed.
(4) right click on mouse – filter – new – rotate (pilih yang tepat) – close.
(5) see the video and specify the start and end times of the moving object by clicking clip settings – start frame.....- end frame..... ok.
(6) create a calibration line with the following steps: click show- new – calibration stick. On the keyboard press shift and click at the beginning of the moving object - press shift and click on the end of the moving object.
(7) change the length.
(8) make coordinate line .. pull it put in the middle of the object is hidden.
(9) analyze the video by clicking create – point mass.
(10) press shift and control together and click on the ball - dialog box appears - shift and control is released - click search - close.
(11) click 2x on the digraphic table section, then a new table will appear - click measure - coordinates checked..lope checked.area checked.
(12) click analyze- statistics checked – curve fits checked.
(13) observed the results,
(14) make conclusions about the phenomenon of mahogany. Explain the phenomenon from a scientific perspective.

9. Each group made a poster explaining the trial process carried out and the results obtained from the experiments conducted by them.
10. Give the opportunity to two to three groups to explain the trial process they did and the results obtained from the experiments conducted by them.
11. Students are invited to conduct class discussions about the phenomenon of falling mahogany flowers. The teacher directs the discussion so that students can (1) explain that the phenomenon of falling mahogany is a phenomenon of regular linear motion, (2) explaining why the phenomenon is a phenomenon of linear straight motion, and (3) defining regular linear motion.
12. Take one of the charts produced by one of the groups obtained from the experiment of dropping the mahogany flower and display the graphic so that each student can see the graph clearly.
13. Ask students to make discussion groups consisting of 2-3 students.
14. Ask students to discuss the following questions: (1) whether the graph is a straight line, (2) what the slope of the line from the graph is, (3) the slope of the line expresses what phenomenon in trying to drop the mahogany flower, and (4) determine the equation the straight line.
15. Each group was asked to write the results of their discussion on poster paper.
16. Ask one to three groups to explain the results of their discussion.
17. Invite students to have class discussions. Direct the discussion so that students can (1) explain that the graph of a straight line equation is a straight line, (2) interpret the meaning of the slope of the line using the phenomenon of mahogany flower fallout, (3) identify whether a graph is a graph of straight line equations or not, (4) explain the steps to find the equation of a straight line, and (5) find the equation of a straight line.

The activities carried out by teachers and students designed by researchers for the second meeting planned to last for 5 × 40 minutes are as follows:

1. The teacher greets students.
2. Students and teachers pray to begin the lesson.
3. The teacher checks the attendance of students.
4. The teacher reviews the previous meeting learning again.
5. The teacher tells the students about the learning objectives.

6. The teacher provides an overview of the activities and assessments that will be carried out at this meeting.
7. Students in groups (each group consists of 8 students) and groups is the same with the first meeting
8. Students look for objects that move straightly irregularly outside the class and record them.
9. Students analyze the results of the video with the tracker program.
10. Each group made a poster explaining the trial process carried out and the results obtained from the experiments conducted by them.
11. Give the opportunity to two to three groups to explain the trial process they did and the results obtained from the experiments conducted by them.
12. Students are invited to conduct class discussions about the phenomena observed by students. The teacher directs the discussion so that students can (1) explain that the phenomenon is a phenomenon of regular linear motion, (2) explain why the phenomenon is a phenomenon of regular linear motion, and (3) define regular linear motion.
13. Take one of the charts produced by one group obtained from observing the phenomenon of regular straight motion and display the graph so that each student can see the graph clearly.
14. Ask students to make discussion groups consisting of 2-3 students.
15. Ask students to discuss the following questions: (1) whether the graph is a straight line, (2) what the slope of the line from the graph is, (3) the slope of the line expresses what phenomenon in trying to drop the mahogany flower, and (4) determine the equation the straight line.
16. Each group was asked to write the results of their discussion on poster paper.
17. Ask one to three groups to explain the results of their discussion.
18. Invite students to have class discussions. Direct the discussion so that students can (1) explain that the graph of a straight line equation is a straight line, (2) interpret the meaning of the slope of the line using the phenomenon of mahogany flower fallout, (3) identify whether a graph is a graph of straight line equations or not, (4) explain the steps to find the equation of a straight line, and (5) find the equation of a straight line.

Conclusion

There are several conclusions that can be concluded from the discussion above, that are:

1. The phenomenon of the fall of mahogany can be one of the phenomena that can be observed by students to learn regular straight motion.
2. The experimental results obtained from observing the fall of mahogany can also be used to be a phenomenon for students learning about (1) explaining that the graph of a straight line equation is a straight line, (2) interpreting the meaning of the slope of the line using the phenomenon of mahogany fall flowers, (3) identify whether a graph is a graph of a straight line equation or not, (4) explain the steps to find the equation of a straight line, and (5) look for the equation of a straight line.
3. The results presented in this paper are only limited to the hypothetical learning trajectory, so researchers still need to conduct field tests on this hypothetical learning trajectory.

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Learning Design on Set Materials Using the Model Problem Based Learning

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Abstract: This study aims to: produce learning trajectories to teach set material using PBL models in class VII junior high school of Kanisius Kalasan. This research was conducted in Kanisius Kalasan Middle School Yogyakarta. This type of research is design research. The subjects in this study were VIIC class students (trial class) and VIIA class students (research class). Data collection methods used are documentation of research, written tests, interviews and field notes. The data analysis technique used is data reduction, data presentation and conclusions or verification. Researchers designed learning using PBL models on set operating material (intersection and union) and final test analysis of mathematical problem-solving abilities. The results showed that: the feasibility of learning trajectory that has been designed using the PBL model on set material according to the revised HLT results.

Keywords: PBL, learning trajectories, HLT results

Introduction

Based on interviews with mathematics teachers in 2018, in the learning process the teacher still uses conventional methods in teaching and learning activities where the teacher explains and provides material and students sit quietly, listen to material, accept formulas, work on practice questions. The teacher also said that, students had difficulty in solving non-routine questions. Most students have difficulty in modeling real situations mathematical problems and do not understand the meaning of the symbols used in solving problems related to set operations (intersection and union). Students tend to pass questions that require problem analysis. During learning, students often wait for the teacher to explain or wait for friends to work in front of the class. Students are less independent and tend to need a long time to learn. Activities like this that cause passive students, are less motivated in understanding and applying mathematical concepts. As a result, students seem passive and have difficulty understanding and learning the material.

On the standard content of mathematics subjects in 2006 stated that one of the important aspects learned by students is problem solving ability (Wardhani, 2010). Therefore, teaching is needed which can spur students' ability to solve mathematical problems. Through problem solving skills, students are enabled to gain experience using the knowledge and skills they already have to apply to solving a problem.

Based on the background above, the formulation of the problem in this study is how is the learning trajectory to teach set operating material (intersection and union) using a problem-based learning model for VII grade students of Kanisius Kalasan Middle School Yogyakarta? So, the purpose of this study is to produce a learning trajectory to teach set material using a problem-based learning model.

Problem Based Learning

Problem based learning is a learning model that is designed so students exercise the ability to solve problems (Setyorini, Sukiswo, & Subali, 2011). With the problem-based learning model, learning will result in students being more able to solve the problems they face. Thus, the ability to solve problems will increase automatically. The stage in problem-based learning is as follows (Trianto, 2007).

Table 1. Stages of Problem Based Learning

Phase	Indicator	Teacher Activity
1	Student orientation to problems	The teacher explains the learning objectives, explains the logistics needed, motivates students to be involved in the problem-solving activities they choose.
2	Organizing students to study	The teacher helps students define and organize learning tasks related to the problem.
3	Guiding individual and group investigations	The teacher encourages students to gather appropriate information, carry out experiments to get explanations and problem solving.
4	Developing presents	The teacher assists students in planning and preparing suitable works such as reports, videos, and models that help them to share tasks with their friends.
5	Analyze and evaluate the problem-solving process	The teacher helps students to reflect or evaluate their investigations and the processes they use.

Then it can be concluded by the researcher, that Problem Based Learning is a learning model that makes the problem the basis of a learning process. Problems taken in Problem Based Learning are problems in real life.

Design Research

Design research is a systematic study of designing, developing and evaluating educational interventions (such as programs, strategies and learning materials, products and systems) as solutions to solving complex problems in educational practice, which also aim to advance our knowledge of characteristics and interventions. the intervention and the design and development process (Plomp, 2007).

Design Research Function

The function of design research is to design / develop an educational intervention (such as programs, strategies and learning materials, products and systems) with the aim to solve complex educational problems and to develop knowledge (theory) about the characteristics of interventions and the design process of interventions and processes design and development (Plomp, 2007).

Results from Design Research

There are three results obtained from design research (Plomp, 2007), namely:

1. Principles of design theory and intervention theory

Design research aims to generate knowledge about whether and why an intervention works in a particular context. In design research, research results cannot be generalized from sample to population.

2. Intervention model

Design research will produce program designs, learning strategies, teaching materials, products and systems that can be used to solve problems in empirical learning or education.

3. Professional Development

Design research is carried out collaboratively and collaboratively by researchers and educational practitioners in the field. Practical collaboration can be useful to overcome various problems of learning and education quickly and precisely.

Research Method

The learning model used is developing student learning materials (HLT) is PBL. The type of research used in this study (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006) is design research. Data analysis in this study uses the model of Miles and Huberman, including 3 data analysis activities, namely: data reduction, data presentation and conclusion drawing.

Findings and Discussion

The First Meeting

1. Phase 1: Student Orientation to Problems

The teacher begins learning by checking student readiness, class readiness, and conveying learning objectives.

a. If there are students, they cannot mention the last material they have learned, and no student can mention the meaning of the set.
b. If the teacher asks students about their answers, that does not mean the answer is incorrect, but the teacher wants to know the thinking process of the students.
c. The teacher distributes students in several groups.
d. The teacher illustrates the problem to students. Problems that can be made can be presented in the following table form:

Name	Preferred Subjects
Andi	
Bunga	

2. Phase 2: Organizing Students for Learning

a. The teacher appoints two students to mention the 5 subjects they like. The following are the results of the two students who mentioned the subjects they liked

Nama	Preferred Subjects
Andi	Mathematics, Religion, Bahasa Indonesia, IPS, Sports
Bunga	Bro. Indonesia, Mathematics, English, Sports, Science

b. The teacher asks students what category is right for Andi, and interest? Then what categories are right for Mathematics, Religion, Bahasa Indonesia, Social Sciences, Sports, Science, English.

Possible 1:

Students cannot state the set of names and set of subjects.

Possible 2:

Students can declare a set of names that is

• Andi and the set of subjects namely {Mathematics, Religion, Bahasa Indonesia, IPS, Sports}.

• Interest and set of subjects, namely {Indonesian, Mathematics, English, English, Sports, Science}

Possible 3:

Students cannot express Andi's relationship with Mathematics, Religion, Bahasa Indonesia, IPS, Sports.

Possible 4:

Students can express Andi's relationship with Mathematics, Religion, Bahasa Indonesia, Social Sciences, Sports are "preferred subjects"

Possible 5:

Students can declare a set of names that is

• Andi and the set of subjects namely {Mathematics, Religion, Indonesian, Social Sciences, Sports}.

• Interest and set of subjects namely {Bahasa Indonesia, Mathematics, English, Sports}

• Andi and Bunga have a set of preferred subjects, namely {Bahasa Indonesia, Mathematics, Sports}

Possible 6:

A = {Mathematics, Religion, Indonesian, Social Sciences, Sports}

B = {In Indonesian, Mathematics, English, Sports}

C = {Indonesian. Sports Mathematics}

3. Phase 3: Guiding individual and group investigations

a. The teacher goes around to monitor the process of solving the problems carried out by each group by going around in the classroom and having dialogue with students.

b. The teacher asks questions that can stimulate students to solve student answers, for example:

1) The teacher asks students what category is right for Andi, and interest? Then what categories are right for Mathematics, Religion, Bahasa Indonesia, Social Sciences, Sports, Science, English. If students have answered "name" and "preferred subject", then further guide the students to write the names and subjects with a comma (,) separator. After that, guide students to add curly brackets at the beginning and end of the category. When students finish writing, the teacher asks students how to read it. The answers expected by the teacher (according to possibility 2) are: "the set of names is Andi and the interest while the set of subjects that are preferred are Indonesian, Mathematics, English, Sports, Science"

2) The teacher asks students what is Andi's relationship with Mathematics, Religion, Indonesian, Social Sciences, Sports? What is the relationship between Flowers and Bahasa Indonesia, Mathematics, English, English, Sports, Science? The teacher's expected answer is "preferred subject" according to the Possibility 4.

3) The teacher gives a question like this: can you write a new set of members whose members are Andi and Bunga's favorite subjects? The answer expected by the teacher is according to the possibility 5. The teacher continues the question again so that students can write with the symbols of the set by specifying the name of the set? The answer that the teacher expects is in accordance with Possibility 6. In addition, the teacher can also direct students to mention the symbol or symbol of "slices". Because the symbol or symbol of the slice has not been studied before ... Then the teacher gives stimuli to students to be able to define slices according to students' language that is easy to understand.

4. Phase 4: Developing and Presenting Works

a. The teacher checks students' understanding by asking.

b. The teacher gives appreciation to students because they have understood the problem correctly, that is, can mention what is known and asked about the problem given.

c. The teacher gives appreciation to students for writing down the problem-solving plan according to what they understand from the purpose of the problem. Then the teacher gives motivation to students to continue the next step according to the plan that has been made by the students

5. Phase 5: Analyzing and Evaluating the Problem-Solving Process

a. The teacher helps students to reflect or evaluate their investigations and the processes they are working on.
b. The teacher directs students to conclude the material they have learned.
c. Students can conclude the material that has been studied along with teacher interaction, namely Slices A and B are a set whose members are members of set A and are also members of set B and are denoted by $A \cap B$.

Second Meeting

1. Phase 1: Student Orientation to Problems

The teacher begins learning by checking student readiness, class readiness, and conveying learning objectives.

a. If there are students, they cannot mention the last material they have learned, and no student can mention the meaning of the set.
b. If the teacher asks students about their answers, that does not mean the answer is incorrect, but the teacher wants to know the thinking process of the students.
c. The teacher illustrates the problem to students. Problems that can be made can be presented in the following table form:

Name	Preferred Subjects
Andi	
Bunga	

2. Phase 2: Organizing Students for Learning

a. The teacher appoints two students to mention the 5 subjects they like. The following are the results of the two students who mentioned the subjects they liked
b. The teacher appoints two students to mention the 5 subjects they like. The following are the results of the two students who mentioned the subjects they liked

Name	Preferred Subjects
Andi	Mathematics, Religion, Bahasa Indonesia, IPS, Sports
Bunga	Bro. Indonesia, Mathematics, English, Sports, Science

c. The teacher asks students what category is right for Andi, and interest? Then what categories are right for Mathematics, Religion, Bahasa Indonesia, Social Sciences, Sports, Science, English?

Possible 1:

Students cannot state the set of names and set of subjects.

Possible 2:

Students can declare a set of names that is

• Andi and the set of subjects namely {Mathematics, Religion, Bahasa Indonesia, IPS, Sports}.

• Interest and set of subjects, namely {Indonesian, Mathematics, English, English, Sports, Science}

Possible 3:

Students cannot express Andi's relationship with Mathematics, Religion, Bahasa Indonesia, IPS, Sports.

Possible 4:

Students can express Andi's relationship with Mathematics, Religion, Bahasa Indonesia, Social Sciences, Sports are subjects that are liked.

Possible 5:

Students can declare a set of names that is

• Andi and the subject set are {Mathematics, Religion, Indonesian, Social Sciences, Sports}.

• Interest and set of subjects namely Indonesian, Mathematics, English, English, Sports}

• Andi and Bunga have a set of preferred subjects namely {mathematics, religion, Indo, social studies, sports, Bhs English}

Possible 6:

A = {Mathematics, Religion, Indonesian, Social Sciences, Sports}

B = {Indonesian, Mathematics, English, Sports}

Possible 7:

A = {Mathematics, Religion, Indonesian, Social Sciences, Sports}

B = {Indonesian, Mathematics, English, Sports}

C = {Mathematics, Religion, Bahasa Indonesia, Social Studies, Sports, English}

3. Phase 3: Guiding individual and group investigations

a. The teacher goes around to monitor the process of solving the problems carried out by each group by going around in the classroom and having dialogue with students.

b. The teacher asks questions that can stimulate students to solve student answers, for example:

1) The teacher asks students what category is right for Andi, and interest? Then what categories are right for Mathematics, Religion, Bahasa Indonesia, Social Sciences, Sports, Science, English. If students have answered "name" and "preferred subject", then further guide the students to write the names and subjects with a comma (,) separator. After that, guide students to add curly brackets at the beginning and end of the category. When students finish writing, the teacher asks students how to read it? The answers expected by the teacher (according to possibility 2) are: "the set of names is Andi and Flowers while the set of subjects that are preferred are Indonesian, Mathematics, English, Sports, Science"

2) The teacher asks students what is Andi's relationship with Mathematics, Religion, Indonesian, Social Sciences, Sports? What is the relationship between Flowers and Bahasa Indonesia, Mathematics, English, English, Sports, Science? The teacher's expected answer is "preferred subject" according to the Possibility 4.

3) The teacher gives questions like the following: can you write a new set of members whose members are Andi and Bunga's favorite subjects? The answer given by the teacher is according to possibility 5.

4) The teacher continues the question again so that students can write with the symbols of the set by specifying the name of the set? The answer that the teacher expects is according to Possibility 6.

5) The teacher gives support to students like the following: try to check the members of set A and set B, take the first element of A then match the members of set B. If there is the same, delete the element from set A. If there is no equal go to the next element. Repeat the process for the second element, third until all elements C have been matched. All elements of set A are added with the remainder of set elements B is a combination of set A with set C. The

answer given by the teacher is according to possibility 7. In addition, the teacher can also show students what is a symbol of “combination”. Then the teacher gives stimuli to students so that they can define the combination according to students' language which is easy to understand.

4. Phase 4: Developing and Presenting Works

a. The teacher checks students’ understanding by asking.
b. The teacher gives appreciation to students because they have understood the problem correctly, that is, can mention what is known and asked about the problem given.
c. The teacher gives appreciation to students for writing down the problem-solving plan according to what they understand from the purpose of the problem. Then the teacher gives motivation to students to continue the next step according to the plan that has been made by the students.

5. Phase 5: Analyzing and Evaluating the Problem-Solving Process

a. The teacher helps students to reflect or evaluate their investigations and the processes they are working on.
b. The teacher directs students to conclude the material they have learned.
c. Students can conclude the material that has been studied along with teacher interaction, namely: Combined set A and B is a set whose members consist of members of set A or members of set B. It is denoted by A ∪ B

Description of Students' Problem Solving Abilities

The researcher gives a problem to find out students’ problem solving abilities related to slices and combinations that have been studied before. The results of solving student problems are as follows:

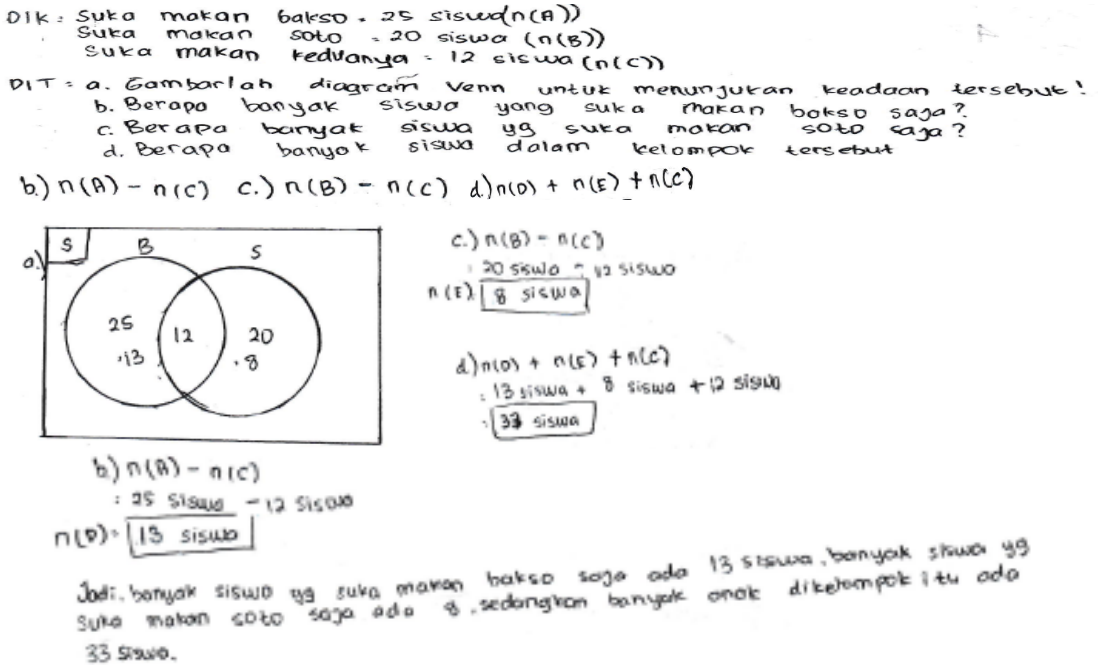

Figure 1. Picture of Student Work Results 1 (S1)

It appears that S1 has understood the problem, writing down what is known and asked about the Puestion. In writing what is known, S1 symbolizes many students who like to eat meatballs, namely n(A), many students who like to eat soup are n(B) and many students like to eat both namely n(C). S1

also writes down what was asked of the problem. The following is an excerpt from an interview with S1:

P: From question number 1, what is known?

S1: There are those who like to eat meatballs, namely 25 students who are given n (A), those who like to eat soto are 20 which are represented by n (B) and like both 12 are raised with n (C).

P: What are the questions about number 1?

S1: Students read what has been written on the answer sheet.

P: Try to retell the meaning of question number 1!

S1: Find out how many students like to eat meatballs only, students who like to eat soup and how many students are in the class.

In planning problems, S1 uses mathematical symbols to solve the problem. S1 can plan completion by using the concept of operating slices of two sets. The following is an excerpt from an interview with S1:

P: What concept is used to solve the problem?

S1: Use the concept of slice operation.

Based on the results of the S1 answer, for point (a) it can be seen that S1 describes the Venn diagram correctly. S1 describes the Venn diagram with two sets which are given information from meatballs (B) and soto (S). In diagram (B), S1 writes in Venn diagrams (B) 25 and 13, in the S diagram, S1 writes 20 and 8 and in the middle circle, S1 writes 12.

After describing the Venn diagram, S1 determines how many students only like meatballs which are assumed to be n (D) in point (b) according to the plan that has been done before, namely reducing the number of students who like meatball n(A) with the number of students who like both n(C) as follows 25-12 = 13 students. Next to answer point (c), namely the number of students who only like soto n(E) is the number of students who like soto n(B) is reduced by the number of students who like both n(C) as follows 20-12 = 8 students. Then to calculate how many students in the group, S1 sums up the number of students who only like meatball n(D), the number of students only likes soto n(E) and the number of students who like both n(C) that is 13 + 8 + 12 = 33 students.

S1 can also conclude the results of his work, by writing the number of students who like meatballs alone are 13 students, who like Soto only are 8 students and many students in the group are 33 students. This is reinforced by interviews with S1 as follows:

P: Try to explain how you solve problem number 1?

S1: For a, draw a Venn diagram, so there are two sets of fruit circles, namely 25 students like Soto, 20 students who like meatballs and 12 students in the middle.

P: In circle B there are 25 and 13 what does it show?

S1: So 25 are students who like to eat meatballs, 13 are students who only like to eat meatballs.

P: What is 12, what is 8?

S1: 12 is a student who likes to eat both. 8 it is students who only like to eat soup.

P: What is 12 from B and S?

S1: Is a slice.

P: For point b?

S1: n (A) likes to eat meatballs, which n (C) likes both. So n (A) -n (C) = 25 students-12 students = 13 students that I compared n (D) as students who only like meatballs.

P: For point c?

S1: n (B) likes to eat meatballs, which n (C) likes both. So n (B) -n (C) = 20 students-12 students = 8 students that I compared n (E) as students who only like meatballs.

P: Which one?

S1: That is right, asking how many students in the group. many students in the group mean n (D) as many students who only like soto are summed with n (E) as many students only like soto and n (C) as many students like both. So 13 students + 8 students + 12 students = 33 students.
P: From number 1, are you sure the answer is correct?
S1: Yes sir.
P: Where are you sure the answer is correct?
S1: I tested it by summing students who only like to eat meatballs with 13 with 12 being 25 students who like meatballs. Students who only like to eat soto are 8 and add up to 13 so there are 20 students who like to eat soup. When counting all students in the group, the number of students who only like meatballs is summed, students who only like soto and students who like both are seen from the venn diagram that has been described.
P: What are the conclusions
S1: So there are 13 students who only like to eat meatballs, there are 8 students who only like to eat soto, there are 8 students, while there are 33 students in that group.

Based on the results of student answers and S1 interviews, it is concluded that, S1 already has problem solving skills in solving problems in daily life related to set operations (intersection and union) of two sets, **namely understanding the problem**, things This is indicated by the ability of the S1 to identify the adequacy of the data to solve the problem by mentioning the information provided from the questions asked, namely the elements known from the questions and what was asked from the questions. **Devising a plan**, this is indicated by the ability of the subject to make a mathematical model of the problem given. S1 has a plan for solving the method by showing that to solve the problem one method of resolution will be chosen. **Carrying out the plan**, S1 is able to plan problem solving by showing the steps to solve the problem using the chosen strategy that is the operation of two sets of pieces so that the resolution of the problem is 13 students, who just like Soto is 8 students and many students in the group are 33 students. **Looking back**, S1 is able to re-examine the truth of the conclusions obtained by showing how to check the correctness of the answer, namely reexamining the value obtained at the conclusion.

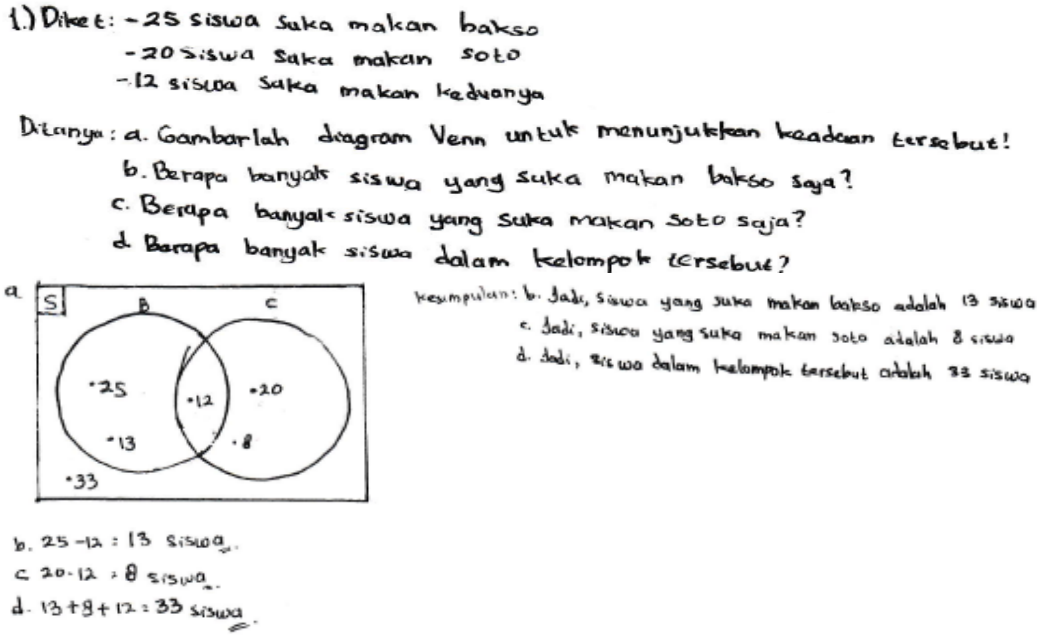

Figure 2. Pictures of Student Work Results 2 (S2)

It appears that S2 has understood the problem, writing down what is known and asked about the Puestion. But in writing what is asked, S2 does not write sentences into the formal form of mathematics, which is a symbol of the number of sets of problems. The following is an excerpt from the interview with S2:

P: From question number 1, what is known?
S2: While reading the questions, students 25 students like to eat meatballs, 20 students like to eat soup and 12 students like to eat meatballs and soup.
P: What are the questions about number 1?
S2: Students read questions
P: Try to retell the meaning of question number 1!
S2: How to draw a Venn diagram, determine the sets of students who like to eat meatballs only, like to eat soup and how many students in the group.
P: What concept is used to solve the problem?
S2: Using the slice concept.

Based on the results of the S2 answer, for point (a) it appears that S2 describes the Venn diagram correctly. S2 describes the Venn diagram with two sets which are given information from meatballs (B) and soto (C) and write 25 and 13. In the set diagram B and in the set diagram C, S2 writes 20 and 8, while 12 is the slice of the two sets that is the number of students who like both.

After describing the Venn diagram, S2 determines how many students only like meatballs in point (b), which is to reduce the number of students who like meatballs with the number of students who like both as follows: 25-12 = 13 students. Next to answer point (c), namely the number of students who only like Soto is that the number of students who like Soto is reduced by the number of students who like both as follows: 20-12 = 8 students. Then to calculate how many students in the group, S2 sums up the number of students who only like meatballs, the number of students who only like Soto and the number of students who like both are 13 + 8 + 12 = 33 students.
S2 can also conclude the results of his work, by writing the number of students who only like meatballs are 13 students, who only like Soto are 8 students and many students in the group are 33 students. This was confirmed by interviews with S2 as follows:

P: Can you explain how you solve problem number 1?
S2: For a, draw the Venn diagram first, there are two sets, 25 students like meatballs, 20 students like meatballs and 12 students in the middle.
P: There you have written 25 and 13, what do you mean?
S2: 25 students who like to eat meatballs and 13 I reduce by those who like both. It's the same with 20 and 8, sir (while showing Venn diagram).
P: What does 13 show?
S2: 13 shows that there are many students who only like meatballs and there are many students who only like soup.
P: How do you complete point b?
S2: Students who only like meatballs are reduced by students who like both 25-12 = 13 students (while pointing to the answer).
P: For point c? How to?
S2: It's the same as the one, sir.
P: How do you do it?

S2: Students who like soto are reduced by students who like both, namely 20-12 = 8 students. And for c, students in that group, I add from students who only like meatballs, students who only like soto and students who like both are 13 + 8 + 12 = 33 students.
P: From answer number 1, is that correct?
S2: Yes sir.
P: Where are you sure the answer is correct?
S2: I have seen what was known and what was asked, the process of counting and then I wrote the conclusion, sir (while pointing to the results of the work).
P: Is there another way to prove this number 1 answer?
S2: So students who only like to eat meatballs are summed with 12 to 25 students who like meatballs. Students who only like to eat soto are 8 and add up to 13 so there are 20 students who like to eat soup. It was summed up, which only likes to eat meatballs, soto and like both the results, 33 students were all in the group.

Based on the results of student answers and S2 interviews, it was concluded that, S2 already has problem solving skills in solving problems in daily life related to set operations (intersection and union) of two sets, namely understanding the problem, things This is indicated by the ability of the S2 to identify the adequacy of the data to solve the problem by mentioning the information provided from the questions asked, namely the elements known from the questions and what was asked from the questions. Planning deviing a plan, this is indicated by the ability of S2 to use the concept of operating slices of two sets to solve the problem. Carrying out the plan, S2 was able to do a problem solving plan by showing the steps to solve the problem using the chosen strategy, namely the operation of two sets so that the completion of the problem was 13 students, who just like Soto is 8 students and many students in the group are 33 students. Looking back, the S2 is able to re-examine the truth of the conclusions obtained by showing how to check the truth of the answer, namely reexamining the value obtained at the conclusion.

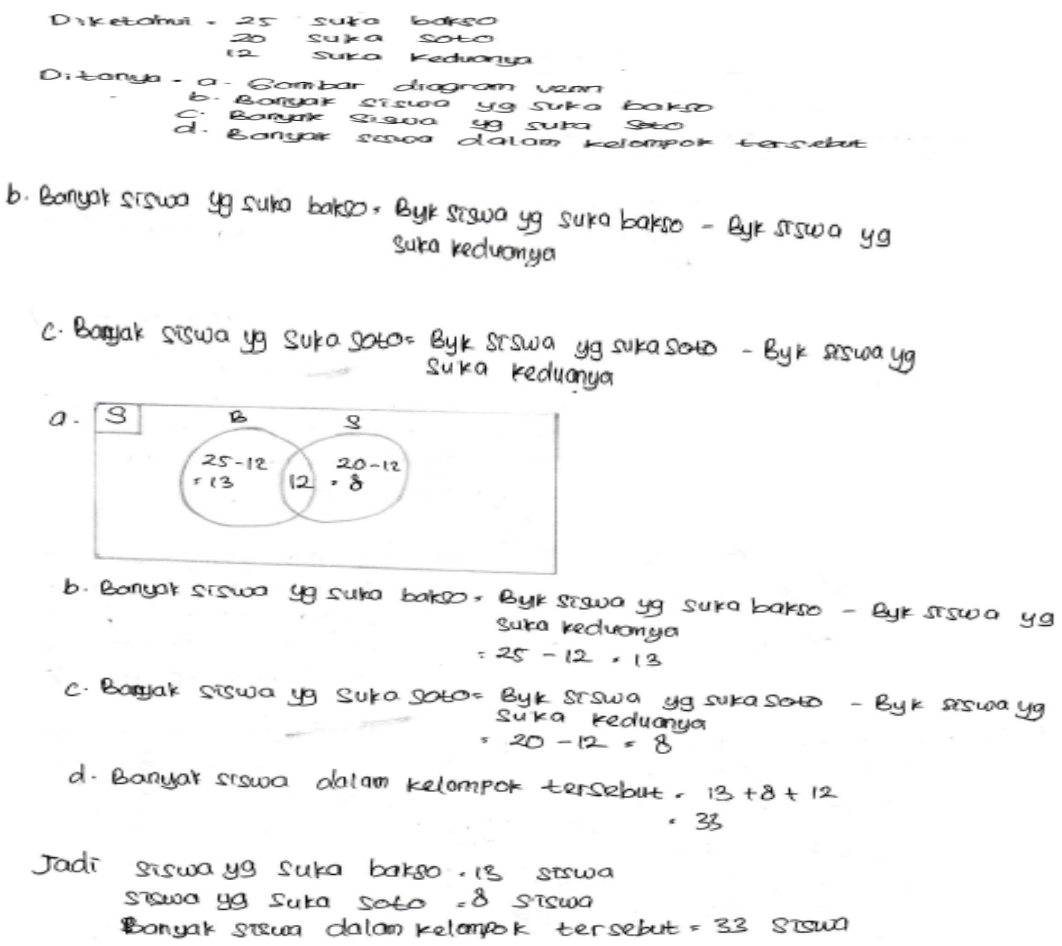

Figure 3. Pictures of Job Results for Students 3 (S3)

It appears that S3 has understood the problem, by writing down what is known and asked about the question. But in writing what is asked, the S3 does not write sentences into the formal form of mathematics, which is a symbol of the number of sets of problems. The following is an excerpt from an interview with S3:

P: From question number 1, what is known?

S3: While reading the questions, students 25 students like to eat meatballs, 20 students like to eat soup and 12 students like to eat meatballs and soup.

P: What are the questions about number 1?

S3: students read questions

P: Try to retell the meaning of question number 1!

S3: How to draw a Venn diagram, determine the sets of students who like to eat meatballs only, like to eat soup and how many students in the group.

In planning problems, S3 does not use mathematical symbols but uses words to solve problems. But based on interviews with S3, S3 can use the solution to use the concept of operating slices of two sets.

P: What concept is used to solve the problem?

S3: Using the slice concept.

Based on the results of the S3 answer, for point (a) it appears that S3 describes the Venn diagram correctly. S3 describes the Venn diagram with two sets which are given information from meatballs (B) and soto (S). In the set diagram B, S3 writes 25-12 = 13 which is the number of students who only like meatballs, in the S diagram, S3 writes 20-13 = 8 which is the number of students who only like soto, while 12 is the slice of the two sets which is the number of students who like both.

After describing the Venn diagram, S3 determines how many students only like meatballs in point (b), which is to reduce the number of students who like meatballs with the number of students who like both as follows: 25-12 = 13 students. Next to answer point (c), namely the number of students who only like Soto is that the number of students who like Soto is reduced by the number of students who like both as follows: 20-12 = 8 students. Then to calculate how many students in the group, S3 sums up the number of students who only like meatballs, the number of students who only like Soto and the number of students who like both are 13 + 8 + 12 = 33 students.
S3 can also conclude the results of his work, by writing down the number of students who only like meatballs are 13 students, who only like Soto are 8 students and many students in the group are 33 students. This is reinforced by interviews with S3 as follows:

P: Can you explain how you solve problem number 1?
S3: For a, draw the Venn diagram first, there are two sets, 25 students like meatballs, 20 students like meatballs and 12 students in the middle.
P: There you have written 25 and 13, what do you mean?
S3: 25 students who like to eat meatballs and 13 that I reduce by those who like both. It's the same with 20 and 8, sir (while showing Venn diagram).
P: What does 13 show?
S3: 13 shows that there are many students who only like meatballs and there are many students who only like soup.
P: How do you complete point b?
S3: Students who only like meatballs are reduced by students who like both 25-12 = 13 students (while pointing to the answer).
P: For point c? How to?
S3: It's the same as the one, sir.
P: How do you do it?
S3: Students who like soto are reduced by students who like both, namely 20-12 = 8 students. And for c, students in that group, I add from students who only like meatballs, students who only like soto and students who like both are 13 + 8 + 12 = 33 students.
P: From answer number 1, is that correct?
S3: Yes sir.
P: Where are you sure the answer is correct?
S3: I tested it by summing students who only like to eat meatballs with 13 with 12 being 25 students who like meatballs. Students who only like to eat soto are 8 and add up to 13 so there are 20 students who like to eat soup. When counting all students in the group, the number of students who only like meatballs is summed, students who only like soto and students who like both are seen from the venn diagram that has been described.

Based on the results of student answers and S3 interviews, it is concluded that, S3 already has the ability to solve problems in solving problems in daily life related to the set operation (intersection and union) of two sets, namely understanding the problem, things This is indicated by the ability of the S3 to identify the adequacy of the data to solve the problem by mentioning the information provided from

the questions asked, namely the elements known from the questions and what was asked from the questions. Planning devising a plan, this is indicated by the ability of S3 to use the concept of operating slices of two sets to solve problems. Carrying out the plan), S3 was able to do problem solving plan by showing the steps to solve the problem using the chosen strategy, namely the operation of two sets of pieces so that the resolution of the problem was 13 students, who just like Soto is 8 students and many students in the group are 33 students. Looking back, S3 is able to re-examine the truth of the conclusions obtained by showing how to check the truth of the answer that is reexamining the value obtained at the conclusion.

Conclusion

The results showed that: 1) learning trajectory with the PBL model as follows: (a) The researcher conveys the learning objectives so that students can set strategies to solve problems according to the learning objectives and the researcher gives real problems verbally with context in the class about set operations joint); (b) Researchers form students in groups and provide problems related to set operating material (intersection and union); (c) Next the researcher accompanies students; (d) After students have finished solving the problem, then presented (e) Then the researcher and students evaluate the problem solving process by students. (f) Next the researcher gives a problem related to the real problem related to the material of the set operation (intersection and union) based on the results of the description and interview with students, students are able to construct their knowledge in solving problems.

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Validating the Indonesian Version of Reflective Thinking Questionnaire and Investigation of the Relationship Between Pre-Service Teachers' Reflective Thinking and Academic Achievement

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Abstract: Teacher training process must stimulate reflective thinking skill because this skill is crucial to improve teaching and learning capability. Indonesian version of standardized instrument to assess the development of reflective thinking skill in teacher training program is still limited. This research aimed to adapt Reflective Thinking Questionnaire (RTQ) to Indonesian version, investigate its quality, probe pre-service chemistry teachers' level of reflective thinking, investigate relationship between reflective thinking and GPA, and compare between 1st year and 4th year pre-service chemistry teachers' reflective thinking skill. RTQ is a 16 items 5 point Likert scale questionnaire purposed to measure reflective thinking in 4 subscale levels: Habitual Actions (HA), Understanding (U), Reflection (R), and Critical Reflection (CR). Each subscale was assessed by 4 questionnaire items. With the help of four science education experts who are fluent in both languages, RTQ was first translated into Indonesian and then its empirical result was substantiated. The translated RTQ was given to 147 pre-service chemistry teachers from Department of Chemistry Education, Raja Ali Haji Maritime University, Indonesia. Data were analyzed using Rasch model method. Result indicated that the instrument and all 16 items nicely fit the Rasch model. The data also showed good reliability (Cronbach alpha .84). Result of this research also indicated that Understanding received the highest mean (17.70), followed by Critical Reflection (16.50), Reflection (16.48), and the lowest mean was Habitual Action (14.60). Non-parametric analysis was used because normal data distribution is not observed. Based on Wilcoxon Test result, significant difference between all subscales levels were detected, except for CR-R. Spearman Correlation result indicated that correlation between reflective thinking and GPA was not significant. Based on Mann-Whitney Test result, significant difference between 1st year and 4th year college students' reflective thinking was only detected in CR. The implications relate to reflective thinking skill were discussed to improve the quality of learning process and its' evaluation.

Keywords: reflective thinking questionnaire, pre-service teacher, academic achievement, Rasch model

Introduction

Teacher must be a reflective thinker because they need to make continuous improvement in their competencies. Because of that, teacher training process must stimulate reflective thinking skill. Developing reflective thinking encouraged pre-service teachers to be responsible for their own learning (Rinchen, 2019). Reflective thinking also has important role in leadership preparation (Carver & Klein, 2016). Positive significant relationship between pre-service teachers' perceived self-efficacy and reflective thinking also discovered (Arma, 2016). Social problem solving abilities is important for teacher and there was a significant positive relationship between reflective thinking and that abilities (Sivaci, 2017). In higher education, reflective thinking also had positive significant relationship with critical thinking and self-monitoring (Ghanizadeh, 2017). Reflective thinking lead to self-efficacy, self-assessment and teaching awareness, all of which are traits of competent teachers (Choy, Yim & Tan, 2017). The ability to think reflectively is crucial to develop confidence and competence among teachers.

There are various instrument and method to assess reflective thinking. Reflective Thinking of Teachers Questionnaire (RTTQ) can be used to assess five constructs: lifelong learning skills (LLS), self-assessment ability (SA), self-belief (SB), teaching awareness (TA) and reflective thinking (RT) (Choy, Yim & Tan, 2017). SISRT questions can measure self-induced, self-reflective thinking (Van Velzen, 2017). Another instrument is Reflective Thinking Tendency Scale or YANDE (Semerci, 2007).

There are seven sub-dimensions of YANDE: continuous and intentional thinking; open-mindedness; inquiry and effective teaching; teaching and scientific responsibility; researcher; foresighted and friendly; and view of profession. Questions in reflective diaries have been used to guide participant to write reflectively (Töman, 2017). Reflective journal can be used to measure levels of reflective writing (Cengiz & Karataş, 2015). Instrument for determining the levels of reflective thinking among elementary school students was also developed (Bilge & Cennet, 2014). Rubric in reflective writing that analysis of seven key activities which are factual knowledge, conceptual knowledge, procedural knowledge, metacognitive knowledge, problem solving, critical thinking and applications can be used to assess refection in laboratory activities (Xu & Talanquer, 2013). Chemistry Learning and Thinking Instrument (CLTI) also have been developed, that can place each student in the "high" group (more "inclined-to-reflect" compared to the sample's mean performance) or the "low" group (less "inclined-to-reflect") (Tan & Goh, 2008). For assess reflective narrative, Narrative Reflection Assessment Rubric (NARRA) can be used (Alsina, Ayllón, & Colomer, 2019).

Another standardized instrument to assess reflective thinking is Reflective Thinking Questionnaire (RTQ) (Kember et al, 2000). Consisting of 16 items and 5-point Likert scale, it includes four sub scale which are "habitual action", "understanding", "reflection" and "critical reflection". This classification can be used to evaluate the appropriateness of students' writings, compositions, dairies, and their answers to open ended questions to reflective thinking. Likert scale ranging from 5 Definitely Agree, 4 Agree with reservation, 3 only to be used if a Definite answer is not possible, 2 Disagree with reservation, to 1 Definitely disagree, so the lowest possible score from each sub scale is 4 and the highest is 20. Because of usefulness and easiness, RTQ have been used widely in research about reflective thinking, such as by Gencel and Saracaloğlu (2018), Asakereh and Yousofi (2018), Ghanizadeh (2017), Abdullah (2015). RTQ also have been adapted to Turkish (Basol & Evin Gencel, 2013) and Persian (Ghanizadeh & Jahedizadeh, 2017). Literature review indicated that RTQ haven't adapted into Indonesian. Indonesian version of RTQ will provide researchers an instrument to measure reflective thinking, an important feature of constructivist approach, especially for Indonesian people. This study seeks to adapt and validate RTQ among Indonesian university students. It then aims at probe pre-service chemistry teachers' level of reflective thinking, investigate relationship between reflective thinking and GPA, and compare between 1st year and 4th year college students' reflective thinking skill.

Research Method

Participants

One hundred forty seven (147) Indonesian pre-service chemistry teachers from Department of Chemistry Education, Raja Ali Haji Maritime University participated in this study (120 females and 27 males). They were varied from 1st to 4th year student (1st year = 29, 2nd year = 43, 3rd year = 36, 4th year = 39) and participated this study in April 2019.

Procedure

Descriptive survey method was used in this study. RTQ first translated to Indonesian and checked for language equity and clarity by four science education experts who are fluent in both languages (Indonesian and English). Translated RTQ then improved according to feedback from experts and rechecked until suitable for used. A pilot study about translated RTQ is given to a group of undergraduate students (N=8) in order to evaluate its appropriateness for their level. After adaptation process was completed, this Indonesian version of RTQ distributed to 149 undergraduate student which 147 were returned. The participation in this study was completely voluntary. They were also asked to indicate their grade point average (GPA) as an indication of academic achievement, their gender, and study year.

Analysis

Collected data from 147 participants was analyzed using Rasch model and Winstep Program to check the item fit, instrument fit, and reliability. Rating scale model was used because questionnaire items used more than two categories (Likert scale). Non-parametric analysis and SPSS Program was used because normal data distribution is not observed. Wilcoxon Test was used for analyzing the difference

between four subscales levels, Spearman Correlation to identify correlation between sub scale reflective thinking and GPA, and Mann-Whitney to analyze difference between 1st and 4th year students' reflective thinking.

Result and Discussion

Result

The rule of Rasch model is that items with good model-data-fit have OUTFIT MNSQ within the range of 0.5−1.5, OUTFIT ZSTD within the range of −2.0 to +2.0, or PT-MEASURE CORR within the range of 0.4 to 0.85. Item fit if minimally fulfill one of three fit criteria. Item fit order as the result from Rasch model analysis can be seen in Table 1.

Table 1. Item Fit Order of Indonesian Version of RTQ

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
9	556	147	.65	.11	1.57	3.7	1.68	4.4	A .48	.55	44.1	51.6	I9
2	628	147	-.37	.13	1.28	2.0	1.58	3.7	B .42	.47	58.6	58.3	I2
1	532	147	.92	.10	1.21	1.6	1.36	2.6	C .49	.57	52.4	48.7	I1
15	628	147	-.37	.13	.98	-.1	1.19	1.3	D .45	.47	58.6	58.3	I15
13	513	147	1.11	.10	1.17	1.4	1.19	1.5	E .60	.58	38.6	46.2	I13
3	582	147	.33	.12	1.04	.3	1.18	1.4	F .44	.53	54.5	54.2	I3
10	649	147	-.76	.14	1.07	.6	1.02	.2	G .48	.44	65.5	59.9	I10
14	646	147	-.70	.14	.97	-.2	1.00	.0	H .49	.44	57.9	59.1	I14
5	543	147	.80	.11	.92	-.6	.98	-.1	h .53	.56	54.5	50.1	I5
4	631	147	-.42	.13	.85	-1.2	.94	-.4	g .49	.47	55.9	58.4	I4
16	611	147	-.09	.13	.90	-.8	.92	-.6	f .52	.49	60.0	56.8	I16
6	679	147	-1.44	.16	.90	-.7	.81	-1.1	e .48	.37	73.1	67.2	I6
7	604	147	.01	.12	.85	-1.2	.87	-.9	d .57	.50	66.2	56.4	I7
12	590	147	.22	.12	.79	-1.7	.80	-1.6	c .55	.52	64.1	54.8	I12
11	611	147	-.09	.13	.76	-1.9	.73	-2.1	b .56	.49	62.8	56.8	I11
8	590	147	.22	.12	.72	-2.2	.74	-2.2	a .59	.52	59.3	54.8	I8
MEAN	599.6	147.0	.00	.12	1.00	-.1	1.06	.4			57.9	55.7	
S.D.	44.3	.0	.66	.02	.21	1.5	.27	1.9			8.1	4.9	

According to Table 1, it was seen that all 16 questionnaire items was fit with Rasch model. Almost all items fulfill all three criteria. Although Item 9 and 2 didn't meet OUTFIT MNSQ and OUTFIT ZSTD requirement, these items retained because fulfill PT-MEASURE CORR requirement. In Rasch model, an instrument has a high quality if it's INFIT and OUTFIT MNSQ close to 1.0, and it's INFIT and OUTFIT ZSTD close to 0.0. The result for instrument analysis with Rasch model can be seen in Table 2.

Table 2. Summary Statistics of Instrument

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Person RAW SCORE-TO-MEASURE CORRELATION = .93
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .84

     SUMMARY OF 16 MEASURED (NON-EXTREME) Item
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	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	599.6	147.0	.00	.12	1.00	-.1	1.06	.4
S.D.	44.3	.0	.66	.02	.21	1.5	.27	1.9
MAX.	679.0	147.0	1.11	.16	1.57	3.7	1.68	4.4
MIN.	513.0	147.0	-1.44	.10	.72	-2.2	.73	-2.2

REAL RMSE	.13	TRUE SD	.65	SEPARATION	5.02	Item	RELIABILITY	.96
MODEL RMSE	.12	TRUE SD	.65	SEPARATION	5.20	Item	RELIABILITY	.96
S.E. OF Item MEAN = .17								

According to Table 2, it was seen that Indonesian Version of RTQ meet the good instrument requirement (INFIT MNSQ = 1.00, OUTFIT MNSQ = 1.06, INFIT ZSTD = -0.1, and OUTFIT ZSTD = 0.4). Besides that, Indonesian Version of RTQ have a good reliability (Cronbach Alpha = 0.84).

Mean distribution was used to measure the level of reflective thinking skills of college students based on four subscales. The complete result can be seen in the Table 3.

Table 3. Mean Score Distribution

Year of Study	Mean			
	HA	U	R	CR
4th year	14.97	17.67	16.44	16.28
3rd year	14.67	17.64	16.61	16.75
2nd year	14.14	17.72	16.28	15.98
1st year	14.62	17.79	16.76	17.14
Overall	14.60	17.70	16.48	16.50

According to Table 3, obtained it sub scale mean score of reflective thinking skills test result indicated that Understanding (U) received the highest mean, followed by Critical Reflection (CR), Reflection (R), and the lowest mean was Habitual Action (HA).

As for measuring the differences between all subscale level in this study using the Wilcoxone Test, where if the asymp sig value < significance level (.05), then the conclusion is that there are significant differences. Wilcoxon Test resulted significant difference between all subscales level, except for CR-R, as can be seen in Table 4.

Table 4. Wilcoxon Test Result

Sub Scale	U - HA	R - HA	CR - HA	R - U	CR - U	CR - R
Z	-8.880[b]	-6.969[b]	-7.260[b]	-6.062[c]	-6.408[c]	-.262[b]
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.793

Next, to find out the relationship between reflective thinking skills and GPA, the Spearman Correlation Test was used. SPSS result of Spearman Correlation Test between subscale of reflective

thinking skills and GPA can be seen in Table 5. Spearman Correlation Test resulted no significant correlation between all subscale and GPA.

Table 5. Spearman Correlation Result

Sub Scale	HA	U	R	CR
Correlation Coefficient	.022	-.104	.093	-.049
Sig. (2-tailed)	.792	.210	.265	.558

Furthermore, to determine the difference in reflective thinking skills between 1st year and 4th year of college students, the Mann-Whitney Test was used. If the asymp sig value < .05, then there are significant differences. SPSS result of Mann-Whitney Test between 1st year and 4th year of college students in four sub scales can be seen in Table 6.

Table 6. Mann-Whitney Test Result

Sub Scale	HA	U	R	CR
Mann-Whitney U	528.000	453.000	494.000	399.500
Z	-.468	-1.426	-.902	-2.084
Asymp. Sig. (2-tailed)	.640	.154	.367	.037

Mann-Whitney Test resulted significant difference between 1st year and 4th year college students' reflective thinking in Critical Reflection subscale, while significant difference in sub scale Habitual Action, Understanding, and Reflection was not observed.

Discussion

Adaptation procedure of RTQ to Indonesian version was well implemented so that resulting a good instrument. Items and instrument empirically meet fit criteria requirement according to Rasch model and fulfill good reliability criteria. Indonesian Version of RTQ had 16 items and can be used to assess reflective thinking in four level (Habitual Action, Understanding, Reflective, and Critical Reflection. So that, each level had 4 items with the highest score is 20. Indonesian Version of RTQ suitable for Indonesian undergraduate students, but doesn't close the possibility for another grade level. Reflective thinking group comparison or reflective thinking improvement in a training process can be measured by this instrument.

From Table 3 and 4, can be seen that the mean scores for habitual action are lower than those for understanding. These should be indication that the students in the sample were less inclined to employ habitual action than understanding in the learning process. It is because there is insufficient time for curricula to require students to repeatedly perform particular actions in university. Mean scores for reflection and critical reflection are lower than those for understanding too. These should be indication that learning process need modification so that can improve reflection and critical reflection ability so that equal with understanding ability.

Significant difference of understanding, habitual action, and reflection was not observed between 1st year and 4th year student. It can be seen from Table 3 and 6. Significant difference of critical reflection was founded, but in negative pattern (mean score of 1st year student > 4th year student). Result indicated that there is no significant improvement of reflective thinking skill across learning process. This result strengthens the reason that improvement of the learning process needs to be carried out. Reflective thinking improvements can be made by utilizing Web 2.0 application (Abdullah, 2015), self-evaluation and reflective journal (Toman, Cimer & Cimer, 2014), layered curriculum (Gencel & Saracaloglu, 2018), and web based portfolio system .

From Table 5, can be seen that there is no significant correlation between reflective thinking in all subscale with academic achievement (GPA). This result is in accordance with the study carried out by Asakereh and Yousofi (2018). On the contrary, this was different from study result carried out by

Ghanizadeh and Jahedizadeh (2017) and (Ghanizadeh, 2017). This study results showed that indicators of reflective thinking have not been integrated in the evaluation of academic achievement. Reflective thinking indicator need to be integrated with the course material in academic achievement evaluation. Indicators that have been developed by Redmond (2014) can be used for this purpose.

Conclusion

Indonesian Version of Reflective Thinking Questionnaire meet the good instrument requirement so that can be used to assess Indonesian reflective thinking skill. Modification of the learning process needs to be done to improve reflective thinking skill. Reflective thinking indicator need to be integrated into academic achievement evaluation so that will be coherence with learning process improvement.

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Overcoming Anxiety in English Language Learning Through Drama Performance

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Abstract: Anxiety becomes one of the top emotional encounters a person could have (Suleimenova, 2013: 1860). Anxiety towards learning English is very common among Indonesian students, especially at Universitas Madura Pamekasan. The process of studying literature is the most beneficial than another thing, it is true that some people read literature for pleasure and enjoyment, but if we study literature more for that purpose, indeed we lose the life experience that we might never endure in the real life. The writer tries to decrease student anxiety through one of the literary works, Drama. The study is design to obtain information concerning the current status of the phenomena and it exists at the time of the study. The participants of the study were 21 students at 5th semester, English Department. After performing the Drama, most of the students become more confident and off course increase their motivation in learning English.

Keywords: EFL Learners, Anxiety, Drama, English Language Learning

Introduction

The importance of English language nowadays is can be used as a communication media for teaching learning process in the classroom, for international conferences and for communicate with native. There are still a lot of factors that cause most of the students to face their difficulties in English learning, especially in their speaking skill. Learning would be success if learners have interesting to learning new language and could accept that new language rightly (Nunan, 2003: 6). Getting opportunities to practicing students' speaking skill in English can motivate them in the classroom.

In Indonesia, English as a foreign language is seldom too used by the students' daily conversation. Of course, it has an impact of students speaking skill. There are lots of mistakes during English learning process. Some of them are intonation, grammatical, accuracy, vocabulary, and also fluency. It reveals that language anxiety is not connected with any language course grades, as found by Price (1991). Most of EFL students feel unconfident as one of their personal influences correlated with anxiety. Perspiration, sweaty palms, dry mouth, muscle contractions and tension, and increase heart rate are some physical signs of anxiety (Spielberger, 1983). Horwitz, Horwitz and Cope (1986: 125) state that "some learners may claim to have a mental block against anxiety when they come to learn to speak a second or foreign language. It makes students have less confidence, stress, and nervousness that impede learning process."

Anxiety could be faced by everyone and it becomes one of the top emotional problems (Suleimenova, 2013: 1860). It can be irritating the mind caused by fear of danger and misfortune. "Anxiety poses several potential problems for the student of a foreign language because it can interfere with the acquisition, retention, and production of the new language" (MacIntyre and Gardner, 1991: 86).

Foreign language anxiety can interfere learners' performance in their communication with another speaker, and also influence their comprehending in the new language (Tóth, 2006). Anxiety in learning English is very common for the students and there are some reasons that make their mind grow fast towards anxiety. Students also feel anxious when their performance in speaking skill evaluated by others. Cubukcu (2007, 133) establish the main sources of anxiety, those are: "(a) presenting before the class, (b) making mistakes, (c) losing face, (d) inability to express oneself, (e) fear of failure, (f) teachers, and (g) fear of living up to the standards."

During the observation session, Universitas Madura Pamekasan students has differences in their level of confident and knowledge. Some of them cannot handle their own speaking task, uninterested with the instruction and had no idea to start speaking. Based on informal interviewed, the biggest student weaknesses in speaking task is lack of vocabularies.

In the daily, literature becomes one of the sorts of art in which language is the medium to express it. The process of understanding literature is the most valuable than another. One of the functions of reading literature is entertaining, but more than that, reading literature can experienced and understanding the readers by themselves. As a teacher at Universitas Madura Pamekasan, the writer experience that most of the students could not resolve their anxiety towards learning English.

To overcome those problems, the writer tries to decrease their anxiety through one of literary works, Drama. Using drama in EFL classes is the core of teaching speaking, in which it brought a positive significant improvement in students' oral performance. Drama has become one of teaching strategies which motivate students to learn a new language (English).

Drama is unique, because it cans balancing our thought and feeling, also it makes teaching learning process in the classroom becomes challenging and enjoyable (Wagner, 1998: 9). It provides the learners to practice their English as an opportunity and they could feel free and safe. Through drama, the classroom's atmosphere become friendlier and stress-free (Miccoli, 2003). It considered that drama can be a powerful tool in teaching language.

Dundar (2013) state that "there are 9 (nine) types of drama activities (drama and language games, role play, improvisation, simulations, mime, skits, froze image building, script writing, and readers theatre)." After applying Drama performance, the writer assumes that effectively technique is can be one of some ways to overcoming the anxiety experienced by students at 5th semester of English Department, Universitas Madura Pamekasan.

Research Method

This study designed to explore student speaking anxiety and how to overcome their anxiousness which refers to qualitative research design. Burns and Grove (2003: 19) describe a qualitative approach as "a systematic subjective approach used to describe life experiences and situations to give them meaning". In line with Parahoo statement that qualitative research emphasized on people experiences and it is stressing on individual uniqueness (1997: 59). In collecting the data, the writer used some instruments; those are observation, interview guide, and documentation. Hand in hand with Creswell (1994: 145) said that "qualitative research is descriptive in what the researcher is interested in process, meaning and understanding gained through word or picture." The objective of the study is describing students' anxiety and the way to overcome it.

During observation stage, the writer interviews students with 4 (four) questions. The following questions are: (1) Please describe your feeling when you had to speak English in front of your classmates, (2) When the teacher ask you to study and prepare the next subject from home, are you really do the preparation?, (3) Do you have any thought (or question) towards the today's topic during the class?, (4) What's exactly on your mind when the teacher and your colleagues evaluate your speech (opinion)? From the interview, the writer decides that drama performance as a strategy in helping the students as English foreign learners decrease their anxiety in learning English.

The study was conducted at Universitas Madura Pamekasan with a different region and background in Indonesia. Some of them have a good experience in English; the others need to practise their English speaking skill. The participants of the study were 21 students at 5th semester, English Department, Universitas Madura Pamekasan, academic year 2015/2016.

Result and Discussion

There was only one class of students in English Department, Madura University. Most of the students were interested in studying English language through drama. There were 16 meetings for Drama course. First meeting was an overview (introduction) of the course. The writer did observation and interviewing within 6 (six) meeting. During next 7 weeks drama course, students develop their English language learning. The writer took notes on her reflections.

Drama script was used which are previously prepared. The script was prepared according to learners' interests, age and language level. In the study, the drama script chosen was Cinderella. Students had a chance to create their own props which was very motivating for them. Before start to practice, they do a small observation about Cinderella story then comparing with the script. There are 2 (two)

groups that has a different task and responsibilities. Group A consist of 11 (eleven) students and they were played 11 (eleven) roles of the drama, those are Cinderella, the prince, 2 (two) step sisters, step mother, a fairy, 2 (two) guests, 2 (two) royal guards, and a horse. Group B consist of 10 (ten) students called backstage crew (director and co-director, narrator, 2 (two) make-up artist and hairdo, 2 (two) fashion stylist, 2 (two) decor device, and cameraman).

The next stage was called drama rehearsal. It started from December 2015 until January 2016.

1. Week 8 (eight): December 1st, 2015

Students start reading as a first step of a drama performance. Most of them were shy to show the real expression of the drama. To motivate them, the writer shares a short course of how to get the exact tone of each role in the script. They had to practice each dialogue of each role played, twice. The writer makes a video recording during this step then show to the students, and let them to compare those 2 (two) recordings. From those comparisons, it can help to increase student motivation and evaluating their performance.

2. Week 9 (nine): December 8th, 2015

The second meeting was run with practical the dialogues with real act, tone and expression. Students were train to become more focus, understand and confident in this process. Another participant in group B was start to discussed of their responsibility and supports the process of the drama.

3. Week 10 (ten): December 15th, 2015

All participants both in group A and B show the better communication skill in English. It can create opportunities for students to set personal goals that are realistic and attainable. The chemistry among the actors was start built naturally.

4. Week 11 (eleven): December 22nd, 2015

The actors were wearing the costumes prepared by fashion stylist. Classroom becomes more communicative and comfortable. It helps the students' progress in learning English especially in their communication skill. Some actors already memorize the dialogue.

5. Week 12 (twelve): December 29th, 2015

The students become more fun and enjoy their learning. Most of them were well prepared for their rehearsal. Positive work environment and classroom dynamic was created.

6. Week 13 (thirteen): January 5th, 2016

Students who have decor responsibility were finished to fulfil their concept of the stage on next 2 weeks drama performance. The chemistry becomes stronger in this week.

7. Week 14 (fourteen): January 12th, 2016

It's 1 (one) week-to-go before drama performance. The actors and all crew were ready to give their best performance through Drama.

8. Show time: January 19th, 2016

On the d-day, the students perform the drama successfully. The actors and the backstage crew were work hard to give their best for the best results. Both group A and B were not only give the entertaining but also educating and valuably performance.

From those activities, EFL students were experienced how to build a good team work. Each of them has their own motivation and opportunity to speaking English. They can re-build their confident to make conversation with their classmates. They also had space time to prepare their drama performance for the audiences. Their good team work can made English learning process become more fun and dynamic.

It is important for a teacher knowing their EFL students thought and fear during teaching learning process to decrease their anxiety in English speaking skill. Drama performance can be the one of strategies to overcome student anxiety. It gives more positive feedback from EFL students. Some of them (with lack and poor motivation) become proactive and can learn directly from their friends who have highly motivation in learning English.

It is deals with Wagner statement that "Drama is powerful because of its unique balance of thought and feeling makes learning exciting, challenging, relevant to real life concerns, and enjoyable." It has the potential to provide learners to practice their English as an opportunity and they could feel free and safe. Also, fixed to Miccoli said that "Drama also creates a friendly, stress-free atmosphere where optimal learning occurs."

Teacher should try to create positive attitudes (activities) to make their EFL students learn with more fun, free and enjoyable. Drama performance can be an alternative method to overcoming students' anxiety in learning English as a foreign language. Motivation and personality of each learner also important for their English speaking progress in a great manner. Their motivation needed in English communication was quietly different each other. In this case, a teacher must be focused on motivate their EFL students to speaking in English as a foreign language, well and correctly.

Conclusion

The study discussed about the way to decrease students' anxiety in English learning through drama performance. The writer concludes some benefits using the method for EFL students (from the first week until show time). Those activities can ensure students fully understand the expectations of an assignment; can create opportunities for students participate equally; increases student responsibility; and strengthens students' active participation as a member of the classroom.

There are some strategies to 'repair' English speaking learning in the classroom; individual activity (memorizing some words or phrases), peer activity (practising dialogue), outdoor activity (drama rehearsal), and free activity (watching a film related to the story for drama performing).

The writer hope for further researcher to explore another strategy to overcoming EFL students' anxiety in learning English and also to evaluate the short-term successful strategy for a long-term successful strategy.

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Student Perception of Online Quizzes and Interview Pretest Implementation in Pre-Practicum Activity

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Abstract: A practicum is activities that can improve student's scientific skill. However, students sometimes do not prepare themselves before practicum activities, so pre-practicum activities are needed to help students prepare themselves. This study wanted to find out students' perceptions about pre-practicum activities in the form of online quizzes and interview tests. The samples in this study were students who took the Modern Physics Experiment. At the first meeting, students directly conducted practicum without any pre-practicum activities. The second meeting, they must answer questions that have been prepared in the google form (online quizzes) one day before conducting the practicum. The third meeting, the students conducted a direct interview pretest before the practicum. Afterward, they filled out a questionnaire to be able to compare which pre-practicum methods were most helpful in preparing the practicum activities. The results obtained more than half of total students preferred the online quizzes pretest method, more than quarter of total students chose the interview pretest, and the rest wanted no pre-practicum activities. Then to support the results, interviews were conducted with several students. Students choose the online quizzes pretest as a pre-practicum activity because it can help them prepare themselves before conducting a practicum and it doesn't take much time because it can be done at home. While the interview pretest method takes a lot of time to practicum, other than that nervous factors make it difficult for them to answer well.

Keywords: perception, pre-practicum, online pretest, interview pretest

Introduction

Practicum is one of the important subjects in the Physics Education Study Program. Students study in the practicum class to support theoretical classroom learning. Practicum activities are important because practicum can improve student's scientific abilities (Hamidah, 2014). When students do practicums, they are invited to take scientific steps. Through practicum activities, students find solutions to problems and then make hypotheses. Then complete the activity to prove the hypothesis with the steps to retrieve data. After the data is obtained then begin to analyze the data and proceed with concluding. Although usually practicum steps have been provided, at least students learn the stages.

Many benefits can be taken from practical activities, but the students themselves sometimes look at the eyes of this practicum activity. The students did not respond to practical activities as important as activities in theory class. Even though, students who are well prepared for laboratory classes are more likely to successfully acquire laboratory skills and gain the maximum possible benefit from the laboratory learning environment (Sarah-Jane & Di Trapani, 2012; Amin, 2015). They consider the practicum class is the time to play so that they do not prepare well, so the practicum does not run smoothly. The time that should be used for discussion strengthens the understanding of the material through practical observations, but it is used up to discuss technical constraints due to lack of preparation. Besides, students tend to want to get data only without looking deeper so that when compiling the report, they cannot discuss more deeply. Usually, the discussion contains just the story of activities without realizing why this can happen and is associated with the theory that has been accepted. As a result, the benefits of practicum are not optimal.

Modern physics experiments are activities that observe electrons and atoms. Of course, these electrons and atoms cannot be directly seen by the eye. Many practicum equipment is an integrated tool so that events that occur in them cannot be seen and observed directly by students. Therefore, students must understand how to work first before conducting practicums. Because if you do not understand how

it works and the process, if there is an obstacle that cannot be overcome, especially if you have difficulty discussing why it can happen.

Previous research concludes that it's an unknown pre-practicum method that is ideal for students, it depends on students itself (Rollnick et al., 2001). However, other studies have found that online quizzing makes students prepare before class (Marcell, 2008; Whittle & Bickerdike, 2015; Dobson, 2008). Therefore, this study will use online quizzes as a pre-practicum activity. The online quizzes will use google form. These online quizzes will be compared to interviews as a pre-practicum activity. The purpose of this research is to look at students' perceptions of these two pre-practicum activities to find out which methods help students prepare themselves.

Research Method

This research was conducted with descriptive research methods. The sample used was sixth-semester Physics Education students who took courses in modern physics practicums. The total sample is 41 people. In this study, students were given a prior explanation of theories and also the procedure of conducting practicums in modern physics. All material is given at the beginning of the meeting. The giving of this material was carried out for three meetings because eight practicum eyes had to be done.

After the material explanation is complete, students are divided into groups. Each group consists of two to three people. Then at the next meeting, students are welcome to conduct practicums immediately according to a predetermined schedule. Students are only encouraged to study and prepare practicums privately at home. In other words, there is no pre-practicum activity before the first day of practicum.

At the second meeting, before conducting the practicum, students are asked to answer questions about the practicums that will be conducted tomorrow. Questions have been prepared with the help of Google Form. Students must answer every question on the google form one day before practicum, and every student answer personally. Then on the practicum day, before the practicum begins students are invited to a brief discussion to straighten out the incorrect answers or discuss things that are still not understood.

At the third meeting, pre-practicum activities were carried out at the practicum hours. Each group will be asked directly (interview) about the material from the practicum they will do. This question is open and can develop to adjust the answers of the practicum participants, but there are basic things that must be mastered and answered correctly. After the practicum participants can answer correctly then it can do the practicum.

After three treatments, students are asked to choose the most preferred method. Also, there are open questionnaires for them to answer. This questionnaire was used to find out the reasons for choosing their pre-practicum activities. Data from the questionnaire is then analyzed by percentage technique that appears from their answers.

Result and Discussion

Result

The results of the questionnaire showed that students preferred to fill the Google Form (online quizzes) compared to interviews and directly. Of the 41 students used as the sample, 58% chose online quizzes, 32% chose the interview method, and only 10% chose no pre-practicum activities as shown in Figure 1. Besides choosing more methods preferred, the students were also asked to convey the reasons why they chose the method and revealed the benefits and obstacles they had when using the method as a pre-practicum activity. The reasons students choose pre-practicum activities are shown in Figure 2 and Figure 3.

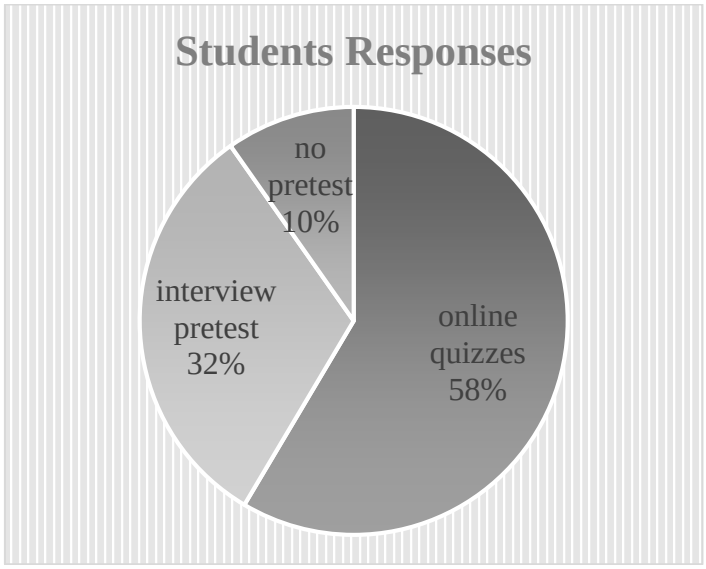

Figure 1. Student choice for pre-practicum method

Figure 2 shows the reasons students chose online quizzes as pre-practicum activities. More than thirty percent of students' responses are online quizzes that help them prepare before practicing. The other benefit of online quizzes is the practicum time more efficient and can help students to understand about the practicum so the practicum can be done smoothly. While, the interview test can help students to understand about the practicum, as shown in Figure 3. The interview also can help to force students to prepare before practicum.

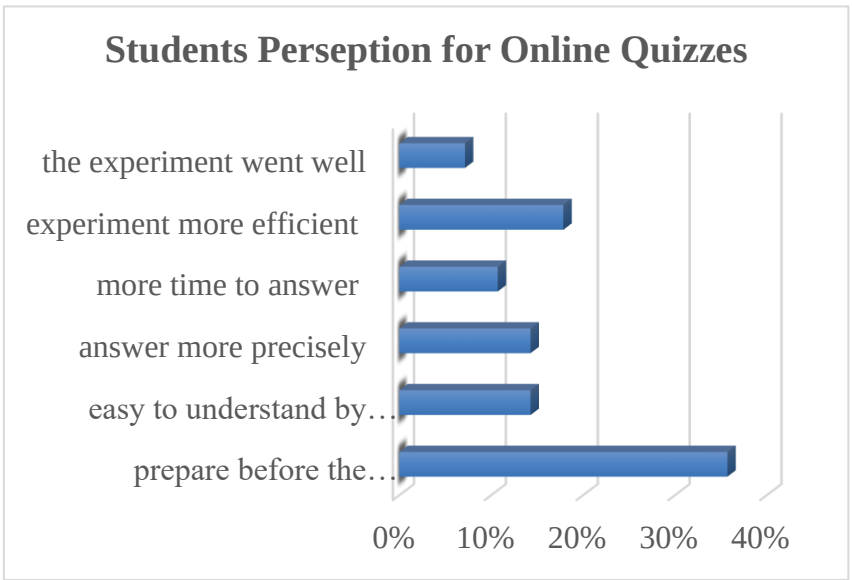

Figure 2. Students' perceptions of online quizzes as the pre-practicum method

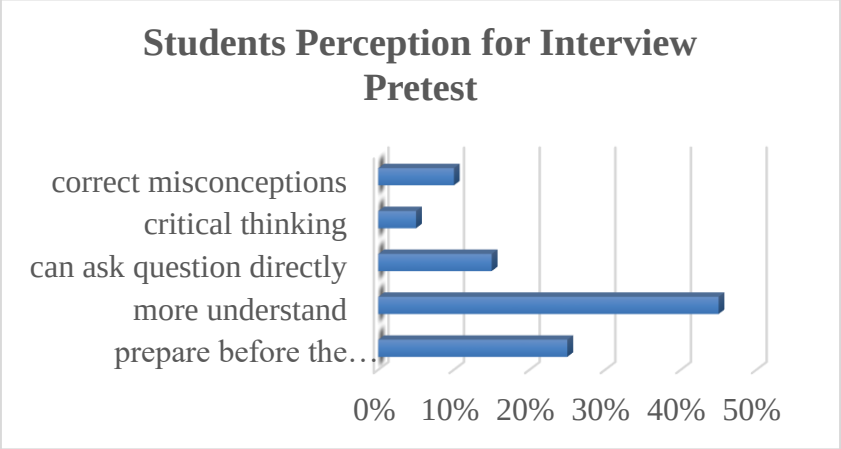

Figure 3. Students' perceptions of the pre-practicum interview method

Discussion

Figure 1 shows that more than half of students choose the method of answering questions on the google form. The students choose to answer questions on the google form because one reason is to force them to study before practicum. This is in line because students must answer questions on this google form one day before they do the lab. Based on this reason, the purpose of the pre-practicum activity is of course that the practicum participants prepare themselves for practicum as shown in Figure 2. By answering questions, students are forced to learn to be able to answer questions correctly, therefore one of the benefits obtained is they become aware of the practicum they will do. The students who are better prepared can certainly carry out the practicum more smoothly so that the practicum time felt more effective, this is also one of the benefits felt by this pre-practicum activity. The next benefit is still felt after the completing practicum, students are required to make reports and pre-practicum activities turned out to be help make reports, especially on discussion points. This student's perception is in line with previous research (Patterson, 2011; Miranda, Sanchez, & Forero, 2017).

The benefits of this pre-practicum activity can indeed help practicum participants to prepare themselves, but some things become obstacles. One of the most conveyed obstacles is forgetting. Pre-practicum activities have not yet become an ordinary thing to do, especially the sample is the final year student and this Modern Physics experiment is the last practicum course. Besides, another obstacle encountered was network. Good internet quality is very supportive of this activity. If an error occurs, the difficulty is they must refill from the beginning because the answers cannot be partially saved, while the questions that must be answered are quite a lot. In addition, for students who are lazy and want to be practical, answering questions can be done simply by copying paste directly from the source they are looking for on the internet. But this can usually be detected so that before the practicum it needs to be straightened out and re-checked the understanding. This slows down the time to start practicing.

The second choice for pre-practicum activities is the interview method. The students choose the interview method as a second choice because it makes them more understanding as shown in Figure 3. This happens because by interviewing, direct answers can be corrected if wrong, or if there are direct misconceptions that can be corrected. In addition, this pre-practicum method can also force students to learn before they start practicing because if they cannot answer smoothly the practicum time will decrease a lot to do pre-practicum activities. Pre-practicum activities with this interview method are indeed carried out before practicum so that practicum time is reduced. Through this interview method, the benefits obtained are training to be able to speak better and train mentally.

The pre-practicum method of interviewing is indeed considered enough to be able to train mentally because this is one of the many obstacles that are conveyed. The students feel nervous when interviewed so that they often make it unable to think clearly, difficult to string words well, and nervous. This causes the interview process to be hampered. In addition to the interview method, the problem of time is the main reason they did not choose this method.

The third option is the absence of pre-practicum activities. According to those who choose there is no pre-practical activity because it saves time and is practical. Moreover, all this time there were no pre-practical activities. But when they were asked to write down the obstacles they faced, they realized that if there were no pre-practicum activities, they would have difficulty when practicing. Especially the Modern Physics Experiment practice the things observed are about atoms and electrons, which cannot be seen by the eye. So that if it is not studied and understood the workings of the tool then do not know what should be observed and why it can happen that way. As a result, the orientation of this practical activity is to obtain data only. This is certainly not the goal of the planned practical work.

Conclusion

Students choose an online quizzes pretest as a pre-practicum activity because it can help them prepare themselves before conducting a practicum and it doesn't take much time because it can be done at home. While the interview pretest method takes a lot of time to practicum, other than that nervous factors make it difficult for them to answer well.

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High Order Thinking Skills in One of the Private Elementary Schools in Sleman Yogyakarta District (Case Study)

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Abstract: This study aims to find out: (1) whether the teacher has compiled a thematic learning plan that contains indicators of high-level thinking skills; (2) whether the teacher has implemented learning activities that lead to high-level thinking skills; and (3) whether the implementation of class assessment at midterm assessments has led to the measurement of high-level thinking skills. This research is a qualitative research with case study research design. The subjects of this study were the fifth grade teachers who arranged the implementation of learning planning and applied the implementation of learning. Data were collected using questionnaire, observation, interview, and documentation techniques. The results of the study show that: (1) the lesson plan prepared by the teacher already contains indicators of high-level thinking skills; (2) the teacher is able to apply learning activities that contain high-level thinking skills; (3) class assessment in the form of PTS (Mid Semester Assessment) leads to the measurement of high-level thinking skills.

Keywords: learning implementation plan (RPP), Learning Implementation, High-level thinking skills, Implementation of class assessment

Introduction

The current era of globalization is characterized by competition in the development of information and communication of technology that has changed the human lifestyle in working, socializing, playing and learning. In the 21st century technological progress has entered the joints of life, including in the field of education. Where 21st century education has student output which is expected to have "the 4Cs" abilities or the ability to learn and innovate learners namely critical thinking, creativity, collaboration and communication BSNP (in Yuni, Agus, & Nyoto, 2016: 4). Critical thinking skills are critical thinking skills where students are able to think clearly, rationally, openly and argue about something (Zubaidah, 2016: 4), creative students are asked to think creatively, work creatively and be able to create new innovations Triling & Fadel (in Yuni , Agus, & Nyoto, 2016: 7), collaboration of students is expected to be able to work in teams, and for communication, students are asked to be skilled in oral and written communication (Mufidah & Wijaya, 2017: 2).

Efforts to create a transformation of life that is able to compete in the global community and demands change itself to equip students in order to develop information literacy skills such as basic literacy (reading, mathematics, and science), critical thinking skills, creative thinking skills in solving problems as the core to face the challenges and demands of global life to equip students to have information literacy skills aimed at developing high-level thinking skills of students (Saputra, 2016: 85-86)

The problem of achieving high-level thinking skills for Indonesian students is seen in UNDP data that the quality of education is related to basic literacy (reading, mathematics, and science). Indonesia is still lagging behind from neighboring countries in the Organization for Economic Cooperation and Development (OECD) report on the PISA (Program for International Assessment) showing that Indonesia ranks 64th out of 65 countries or second from below above Peru. The OECD report and UNDP show a low level of literacy mastery. Mastery of literacy is a general marker of the quality of learning that exists in Indonesia that has not yet presented an educated generation that has sufficient literacy modalities to compete in the era of globalization (Saputra, 2016: 86).

By looking at the results of the PISA test, it was found that the education system which refers to planning, implementation, and assessment only is connected to the ability of memorizing. As a result, the education system in this curriculum is not well implemented. 2013 curriculum is an effort to improve

the quality of education to produce graduates who are creative and able to face life in the future (Prastowo, 2015: 5)

Curriculum 2013 has 3 components in learning, namely content standards (learning planning), standardized portions (learning activities), and standards of assessment (class assessment). Learning plan is a plan prepared by the teacher that refers to the syllabus (Mitri, 2016: 76), learning activities are processes of activities of interaction between teacher and students and reciprocal communication that takes place in educational situations. Rusmana (in Prasetya, 2018: 1), while class assessment is a series of activities to obtain, analyze and interpret data about the process and learning outcomes of students (Sunarti & Rahmawati, 2014: 7) the three components of the curriculum above make the demands of changing times very important in developing the progress of the 21st century education and solutions for the future of increasingly competitive students where students will be led to learn high-level thinking skills to empower the potential of reason with complex thinking skills will make students accustomed to facing something difficult by requiring high-level thinking skills (Higher Order Thinking Skill) that will be able to compete in the world of globalization.

The ability of high-level thinking skills (Higher Order Thinking Skill) is a thought process that involves mental activities in an effort to explore complex, reflective and creative experiences that are consciously carried out to achieve the goal of acquiring knowledge of analytical, synthesis and evaluative thinking. Wardana (in Mitri, 2013: 27). The levels in high-level thinking skills or what are often called Higher Order indicators Thinking skills in the theories of Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016: 216-218) include analyzing the skills that have been learned about information that is not yet known, evaluating that is determining the value of an object or information provided is useful, and creating that is making something that already exists or does not yet exist. In reaching the level of high-level thinking students first master the initial thinking that is remembering that is re-expressing what has been learned, understanding that managing knowledge learned becomes something new, and applying that is using knowledge such as concepts, procedures, and principles.

On the other hand, a high-level thinking skills ability is very important in elementary school that is not merely being mastered early in the learning activity, but requires higher other capabilities, according to research from Mulyadi, Marzuki, & Usman which has the result that a high level of thinking ability on thematic learning which most of the participants have already gained a high degree of thinking ability in the form of analyzing, evaluating, and applying. In contrast to research proposed by A, Agusti Riche Cynthia J, Mohammad Ali, their research results the influence model of learning in increasing the ability of higher-order thinking.

See the above research and existing problems in the field found that there has been no research that examines at the elementary school level, deals with three aspects, namely planning, implementation, and assessment. So the researchers examined about high level thinking skills on three aspects, namely planning, implementation, and assessment.

Research Method

Researchers used the case study method. Case study is in-depth studies of individual and timed relative long, continuous as well as use a single object, meaning that the case experienced by one person Furchan (Triwiyatno, 2015:32). In addition, the case study research is needed to examine or disclose completely and thoroughly against the case that drew attention to meticulous (Gunawan, 2013:113).

The research was applied in one of elementary school in Sleman Regency, Yogyakarta in the 2018/2019 school year. This research carried out for less than three months. The main subject of this research is the master class of second subject in the study for grade V which has 19 students, while the objects of research are the implementation of plan P, the learning and implementation process the evaluation question.

In this Study using data collection techniques i.e., questionnaires, observation, documentation, and interviews using questionnaire instrument students and teachers, observational instruments in the implementation of learning using processed 4 c, the instrument guidelines for the interview, bloom

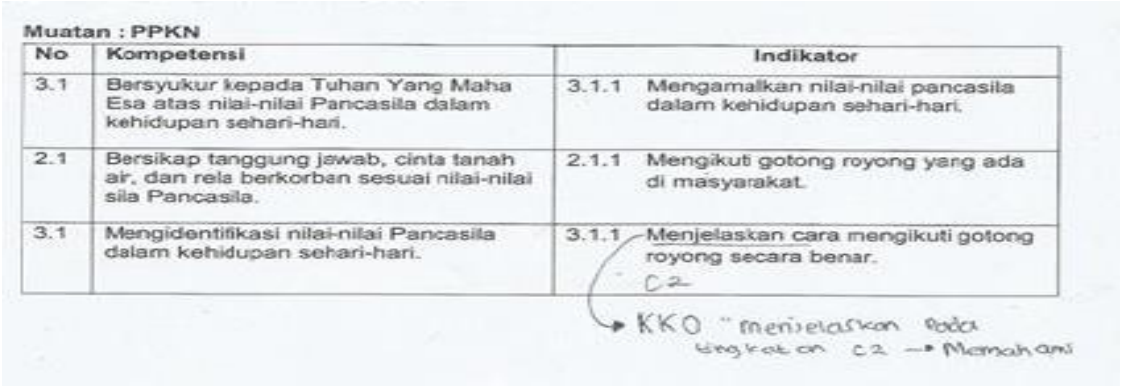
taxonomy analysis instruments to see indicators of implementation plan of learning and evaluation Problem.

Researchers used the credibility and transferability which is a redirect triangulation carried out by researchers, two fellow researchers, and expert judgment conducted by professors to analyze the plan of implementation of the learning and reserved midterm assessment. While the data analysis techniques do are learning plan, implementation of the Learning, and Assessment of the class.

Result and Discussion

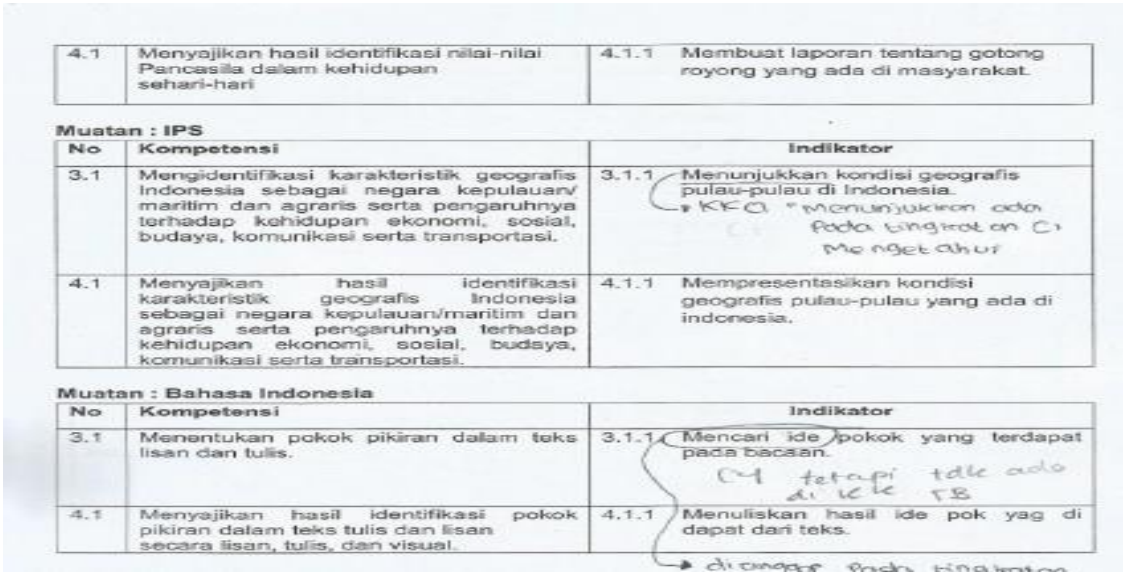
Results and discussion on the application of learning plan

On the learning plan created by the teacher of grade V, the researcher got results from three indicators with the charge of three subjects such as PPKn, IPS, and Bahasa Indonesia. There is only one indicator that contains high levels of thinking skills in charge of Bahasa Indonesia with a verb on the operational level on bloom's taxonomy of the C4 that is analyzed. Following are the results of the analysis from the three indicators compiled by the teacher of the grade V.



Muatan : PPKN

No	Kompetensi	Indikator
3.1	Bersyukur kepada Tuhan Yang Maha Esa atas nilai-nilai Pancasila dalam kehidupan sehari-hari.	3.1.1 Mengamalkan nilai-nilai pancasila dalam kehidupan sehari-hari.
2.1	Bersikap tanggung jawab, cinta tanah air, dan rela berkorban sesuai nilai-nilai sila Pancasila.	2.1.1 Mengikuti gotong royong yang ada di masyarakat.
3.1	Mengidentifikasi nilai-nilai Pancasila dalam kehidupan sehari-hari.	3.1.1 Menjelaskan cara mengikuti gotong royong secara benar. C2 → KKO "menjelaskan" pada tingkatan C2 → Memahami



4.1	Menyajikan hasil identifikasi nilai-nilai Pancasila dalam kehidupan sehari-hari	4.1.1 Membuat laporan tentang gotong royong yang ada di masyarakat.

Muatan : IPS

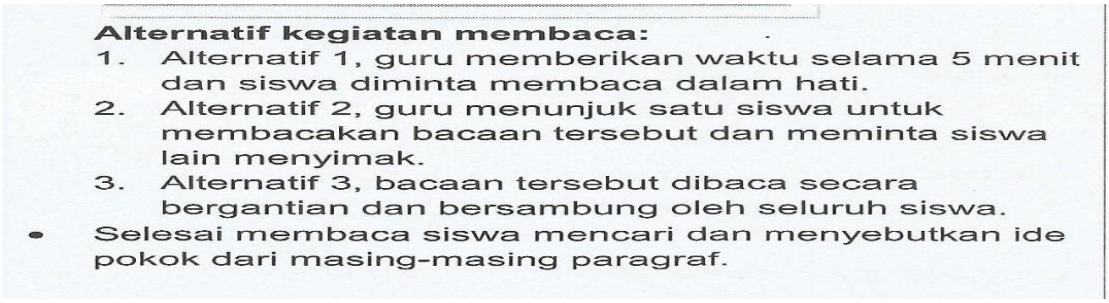
No	Kompetensi	Indikator
3.1	Mengidentifikasi karakteristik geografis Indonesia sebagai negara kepulauan/ maritim dan agraris serta pengaruhnya terhadap kehidupan ekonomi, sosial, budaya, komunikasi serta transportasi.	3.1.1 Menunjukkan kondisi geografis pulau-pulau di Indonesia. → KKO "menunjukkan" ada pada tingkatan C1 Mengetahui
4.1	Menyajikan hasil identifikasi karakteristik geografis Indonesia sebagai negara kepulauan/maritim dan agraris serta pengaruhnya terhadap kehidupan ekonomi, sosial, budaya, komunikasi serta transportasi.	4.1.1 Mempresentasikan kondisi geografis pulau-pulau yang ada di indonesia.

Muatan : Bahasa Indonesia

No	Kompetensi	Indikator
3.1	Menentukan pokok pikiran dalam teks lisan dan tulis.	3.1.1 Mencari ide pokok yang terdapat pada bacaan. C4 tetapi tdk ada di ICK TB
4.1	Menyajikan hasil identifikasi pokok pikiran dalam teks tulis dan lisan secara lisan, tulis, dan visual.	4.1.1 Menuliskan hasil ide pok yag di dapat dari teks. → di ranah pada tingkatan

From the result of the learning plan implementation, this study will discuss the indicators that contain a high level thinking skills which concludes that the Indonesian Language Lesson contains high level thinking skills with the indicators of "finding the main idea in reading" included in the verb operational "Analyze" C4, although actual indicators "searching" is not found in the verb operational Taxonomic Bloom. However, by doing a triangulation process in determining the results of the operations of the verb by researcher and two other researchers who discuss together which will then be

the expert judgment by lecturers who ultimately obtained the results that " finding the main idea found in the text" was included in the operational verb, i.e "analyze" where the students are asked to seek out the main idea. It would then be analyzed by students so that students are able to mention the underlying idea in the readings on the learning steps which can be seen below.

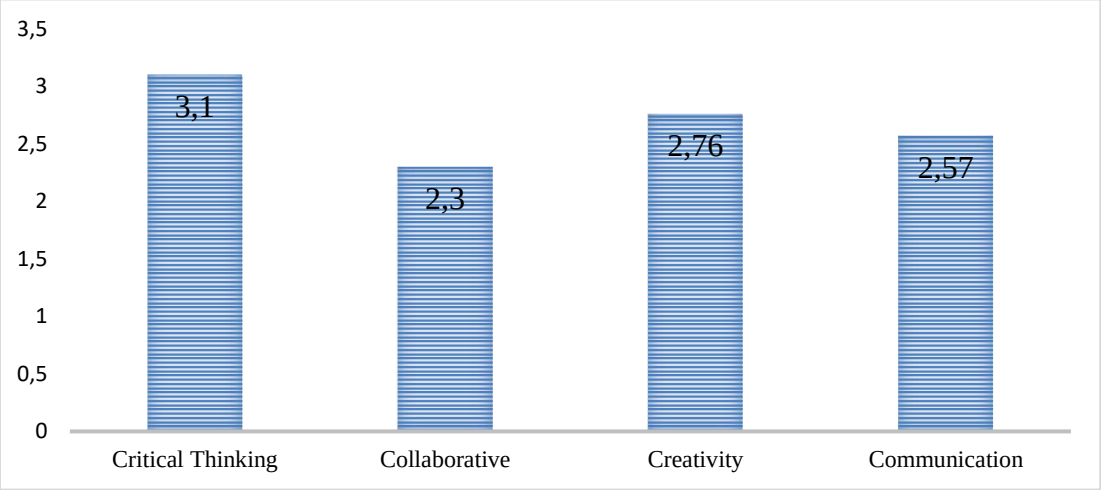

Alternatif kegiatan membaca:
1. Alternatif 1, guru memberikan waktu selama 5 menit dan siswa diminta membaca dalam hati.
2. Alternatif 2, guru menunjuk satu siswa untuk membacakan bacaan tersebut dan meminta siswa lain menyimak.
3. Alternatif 3, bacaan tersebut dibaca secara bergantian dan bersambung oleh seluruh siswa.

- Selesai membaca siswa mencari dan menyebutkan ide pokok dari masing-masing paragraf.

The reason researchers decide to choose C4 analysis as levels of higher-order thinking in accordance with the theory of the Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016:216-218) explaining that levels of C4 "Analyze" is ability grouping objects based on the similarities and differences, to determine whether one group is parallel/higher, finding the interconnectedness of facts with inferences, determining the consistency between what is expressed, find the thought of principal and find the similarities in the way of thinking. While on the both indicators that contain only an operational verb with low level of thinking are included in charge of PPKn and IPS. On PPKn lesson, the researcher determine the verbs that describe operations exist on levels C2 "Understand". Not unlike the verb on the operational IPS lesson, the researchers also found that the operational verb used by the classroom teacher is showing on the level C1 "Knowing". The reason the researcher chose levels C2 and C1 is also on the theory of Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016:216-218) because at level C2 "Understand" which is the ability to cultivate the knowledge learned into something new replacing, rewriting, changing the form of communication, giving the interpretation, and estimating. Meanwhile, the C1 "Knowing/Remembering" is a memorized knowledge. Based on the explanation above, it can be concluded that teacher of grade V still uses the operational verb on a high level thinking skills yet still in dominance with lower-level thinking skills.

Results and discussion the application of the implementation Study

In the process of lesson plan implementation, the researcher got perception results obtained by students against teachers when the learning process and the results of questionnaire toward teacher lessons conveyed in the implementation of a learning, the teacher already implemented a high-level thinking using "the 4Cs" capability that are critical thinking ability, creative thinking skill, collaboration and the ability to communicate. The application of each of these abilities can be calculated using the Likert Scale. Below is a diagram of the results of the analysis of the questionnaire students and teachers.



The results of the application of the student questionnaire using Likert Scale calculations to find out in the execution of the application of the 4 c conducted by the teacher according to the perceptions of students are very often, often, rarely or never performed with the results in below:

Number	Criteria	Average Score The Entire Student	Statement The application of the
1	*Critical Thinking*	3.1	Often
2	*Collaborative*	2.3	Never
3	*Creativity*	2.76	Often
4	*Communication*	2.57	Often

The results of the application of a questionnaire teachers by using Likert Scale calculations to find out in the execution of the application of the 4Cs were showed in the table. The results that conducted by the teacher was according to the perception in the lesson are very often, often, rarely or never done. The results showed below,

Number	Criteria	average score	Statement Of Emergence
1	Critical Thinking	3.75	Very often
2	Collaborative	3.25	Very often
3	Creativity	3.25	Very often
4	Communication	3.5	Very often

From the analysis results, those results were discussed regarding to the application of the implementation study done by teachers. It was the perceptions of students against teachers and teachers' perception towards learning process. The observation were supported by the existence of direct observation in the classroom that used an observation guidelines conducted by researchers. The reason was to see if teachers really did "the 4Cs" exercises learning ability or not yet in applying "the 4Cs" learning capabilities processed.

From the results of the students' questionnaires above, it showed that the ability of the 4C had an average score. The critical thinking ability had the highest median that was an average of 3.1. The results included the highest average meant that the perception of students towards critical thinking ability was often applied by teachers in the classroom. It was different from the other abilities. The other abilities were creativity, collaborative, and communication. Creativity ability had an average score of 2.76. It could be said that the perception of creativity ability for students were did often. The ability of the collaboration had an average score of 2.3 from 19 students, so it said that based on the students' perception of the ability, this ability was rarely performed by teacher. The last was communication

ability. This ability had an average score of 2.57. It meant that based on the student's perception of this ability, it was often done by teacher.

On the other hand, the results of the questionnaire of teachers towards learning obtained that from the four 4C abilities, the ability of critical thinking has highest score of 3.75. It can be said that the teacher's perception towards the learning process were very often. Furthermore, the abilities of collaborative and creativity were features the same score namely 3.25. It can be concluded that the both abilities were very often done in the learning process. In contrast, the ability of communication got an average score of 3.5 that meant this ability was very often done by the teacher.

By looking at the results of the questionnaire obtained from students and teachers, it showed of different scores. The results of this questionnaire will be matched with the observations conducted in the classroom learning. The observation showed that there were same result with the implementation of 4C in students and teachers questionnaires. The results were creativity ability was often done at the time of study. In accordance with observations, it conducted in the moment when teacher gave students a chance to solve problem. The other moments was when the teacher provided opportunities for students seeking information independently. Those moments were match with the theory of Triling & Fadel (in Yuni, Agus, & Nyoto, 2016:7) where students are asked to be able to think creatively, to work creatively and creating new innovations beyond the existing customs, involves a new way of thinking, gain the opportunity to convey ideas and new solutions, the filing an unusual question, and tried to submit suspected. It can be seen in the table below:

4.	*Creativity and Innovation* (Kreativitas dan Inovasi)	2. Di dalam langkah-langkah pembelaja-ran memper-lihatkan proses guru memberikan kesempatan siswa untuk memecah-kan masalah dengan caranya sendiri.	√		Guru memberikan kesempatan siswa untuk memcahkan soal yang diberikan oleh guru dengan mencari sumber lain
		3. Di dalam langkah-langkah pembelaja-ran memper-lihatkan proses guru memberikan kesempatan siswa untuk mencari informasi secara mandiri	√		Guru memberikan kesempatan siswa untuk mencari informasi dari sumber lain

On the other hand, the ability to have the same result between students and teachers' questionnaire as well as adjustment of observations in communication skills are often applied at the moment of learning. The teachers' activities provided opportunities for students to present the results of the given tasks. The tasks that teachers' given were based on the theory of Mufidah & Wijaya, (2017:2), which revealed that the ability to communicate emphasis on students to skilled in communicating both verbally as well as writing. The learning process of this communication can encourage students to develop the ability to communicate at the same time a high level of ability in thinking with the table below:

No	4 C	Kriteria	Ya	Tidak	Keterangan
1.	*Communication*/ Komunikasi	1. Di dalam langkah-langkah pembelaja-ran memperlihatkan proses guru memberikan kesempatan siswa untuk mempresen-tasikan hasil dari pembelaja-ran.	√		Guru memberikan kesempatan pada masing-masing kelompok untuk mempresntasikan hasil pekerjaan yang diberikan guru ketika melakukan diskusi kelompok
		2. Di dalam		√	Guru tidak

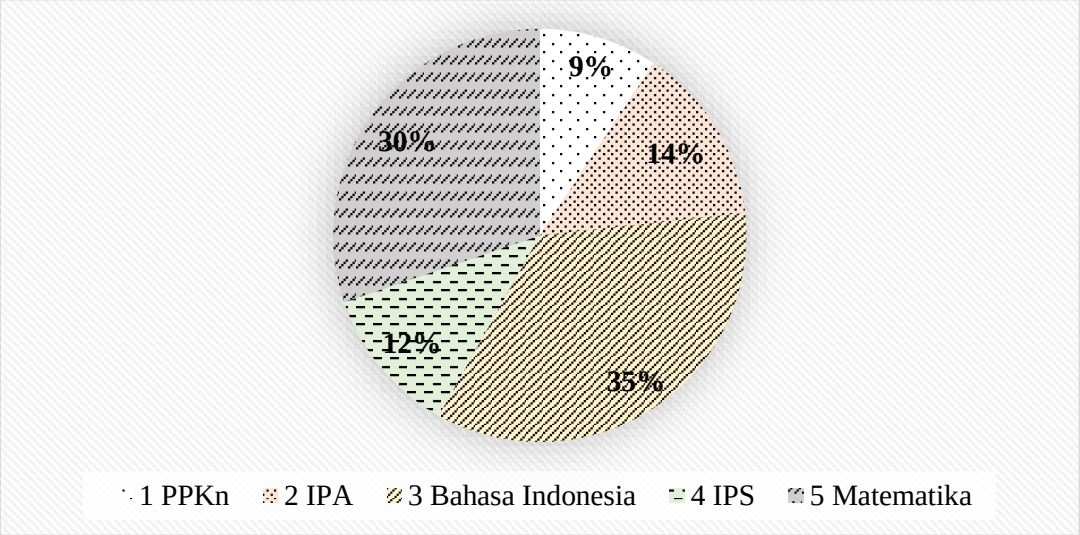
Based on the above explanation, it showed that the abilities which were often used by the teachers when teaching and the observation results, the combination of the ability of creativity and communication that often done. In contrast, the ability of critical thinking and collaboration had a difference in students nor teachers' questionnaire. However, in observing an ability of critical thinking, it applied at the time when the teacher provided opportunities for students seeking other sources, in order to improve the high level of critical thinking skills in accordance with the theory of Zubaidah (2016:4) about critical thinking in which critical thinking is fundamental to the study skills of the 21st century. Critical thinking skills include the ability to access, analyze, and synthesize the information that can be learned, trained and ridden by the students. The students are able to think clearly, rationally, openly and be able to argue. As for the collaboration capabilities that have a different perception between teachers and students, it is tailored to the observation then in the time of the observation the student is given the opportunity to cooperate in a team to discuss and opportunities to exchange ideas in accordance with the theory of Mufidah & Wijaya (2017:2). The theory says that places emphasis on collaboration skills in students to be able to work efficiently in a diverse team where this ability can encourage students to develop the ability in the team when discussing or working groups at the same time can improve capabilities in higher-order thinking, acquired a different student questionnaire because students lack understanding of the activities of the collaboration.

Results and Discussion the application of Midterm Assessment

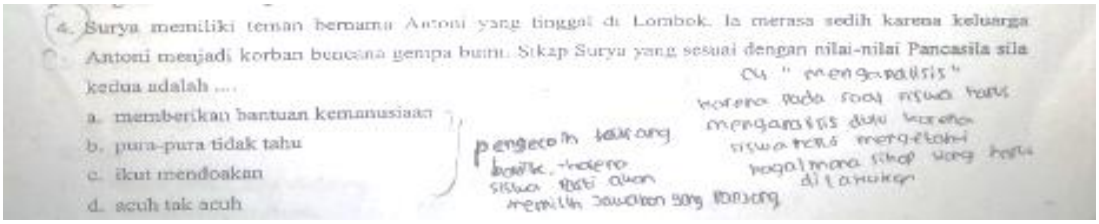
On the results and discussion, the researchers will analyze the 5 areas of subjects namely, IPA, IPS, Mathematics, PPkn and Bahasa Indonesia on a midterm assessment prepared by the teachers. The analysis is done using triangulation by researchers and two fellow researchers to determine the test containing an operational verb high order thinking skills (HOTS) and a test of containing the operational verb lower order thinking skills (LOTS). After the triangulation was done, the researchers will conduct an expert judgment to the professional lecturers that will determine the ultimate outcome of the test that contain the HOTS and the test that contain the LOTS.

The data showed that test which is containing LOTS is on subjects PPKn there are four tasks and HOTS are thirty six tasks. IPA which is containing LOTS are six tasks and HOTS are thirty four tasks. Bahasa Indonesian that including LOTS are fifteen tasks and HOTS twenty eight tasks. IPS reserved five LOTS and thirty five HOTS. Last, Math contain thirteen LOTS and twenty seven HOTS.

It found that the percentage of five learning areas, IPA, IPS, PPKn, Bahasa Indonesia, and Mathematics, are 21% of HOTS and 79% of LOTS in the test. These five subjects are in charge of the lesson domination with lower-level thinking skills. The lessons that containing a high level of thinking is in the Bahasa Indonesia, it has 35% compared with the fourth lessons, PPKn is 9%, math is 30%, IPA is 14%, and IPS is 12%. This results can be seen in the picture below:

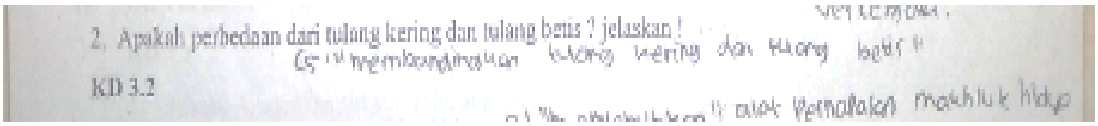


Here is a sample of operational verb which contain an operational high order of thinking,



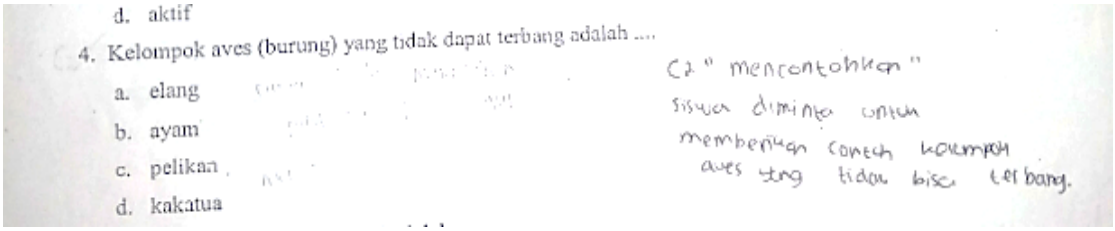
The question above is an example of a task on PPKn subject which encourage students to think high level on C4 level category "analyze". It is included in the theory of the Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016:216-218). The theory explains that the level of C4 "Analyze" is a skill that has been learned by getting information and grouping information, specifying connectivity between one group/groups/information among other information about the facts between the concepts, such arguments with the conclusion, the connection of thought between one works with other works. Class five (V) where the students must understand a passage that is missing information, know how to apply the act that is in question. Then, the students analyze the right answer in accordance with the act on the question, unfortunately the distractors are not good enough.

A high levels of thinking skills in IPA's question is below:



The question is including in the operational verb "Compare" contained on the level of C5 i.e. evaluate where in accordance with the theory of the Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016:216-218). It explains that evaluate is determining the value of an object or information based on criteria. It is in an accordance with the demanding problem which the higher-order of thinking question. It is because the students require to compare between the shin and calf bones base on the criteria.

In contrast to the question above, which are high order of thinking, some questions are lower order of thinking.


d. aktif

4. Kelompok aves (burung) yang tidak dapat terbang adalah ....

a. elang

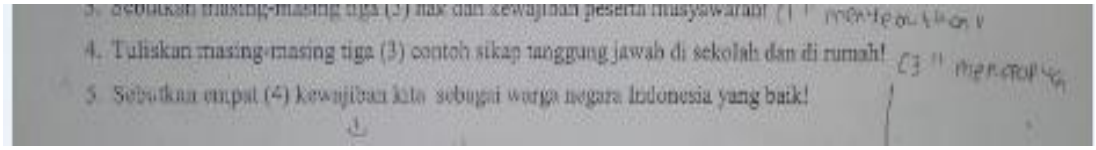
b. ayam

c. pelikan

d. kakatua

C2 " mencontohkan "
siswa diminta untuk memberikan contoh kelompok aves yang tidak bisa terbang.

The question above including on levels C2 i.e. understand operational with the verb "Exemplifies". It fits with the theory of the Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016:216-218) which revealed that understanding is the ability of managing the new knowledge that is replacing, rewriting, changing shape, and estimating in accordance with the students' question. It asked to estimate the group of aves types. Unfortunately, the distraction is not good, it makes the students confuse. The examples of the answers are eagles, chickens, pelican, and parrot. Chickens are included as aves, chicken could fly but not as high as other birds. Then, the example of lower thinking level in IPA subjects as follows:


4. Tuliskan masing-masing tiga (3) contoh sikap tanggung jawab di sekolah dan di rumah!

5. Sebutkan empat (4) kewajiban kita sebagai warga negara Indonesia yang baik!

The question is in the level of C3 "apply" in accordance with the theory of the Andreson and Krthwohl (in Mulyasa, Iskandar, & Aryani, 2016:216-218). The theory reveals that apply is the ability of knowledge using information, concepts, procedures and principles because the students had to use the information to understand it first then apply the way in applying it.

Based on the analysis above, it found that the fifth class' teacher makes few high order of thinking questions in Midterm assessment. This is because high order of thinking refers to levels of C4 and C5, but most of the questions are below.

Conclusion

There were several conclusions that could be drawn from the high level thinking skills on thematic learning class V in one private primary school in Sleman Regency of Yogyakarta. First, from a high order of thinking, lesson plan on cognitive indicators were already contained higher-order thinking skills in learning Bahasa Indonesia. With the basic idea of finding indicators included in the operational work of analyzing the words. However, it still dominated by lower-order of thinking skills in PPKn, which was C2 and IPS, which was C1.

Second, on the application of higher-order thinking skills in one private primary school in Sleman Regency Yogyakarta class V, it was already encouraged students to have a higher-order thinking which rarely done that was collaboration and communication abilities. While the high level thinking ability was done by the teachers were the ability of critical thinking and creativity.

Third, on the assessment of higher-order of thinking in private primary school in Sleman Regency Yogyakarta, it was already contained the verb that was an operational verbs at a higher level of C4, C5, and C6 but still dominated by operational level of verb C1, C2, and C3.

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Reflective Thinking Ability of Teacher Candidate Students Based on Ability Level and Gender

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Abstract: The purpose of this study was to describe the reflective abilities of teacher candidate students based on their level of ability and gender. This research is a qualitative descriptive study. The subjects in this study were TMA students in the 7th semester of the 2018/2019 academic year, which amounted to 6 people selected by purposive sampling. Subjects are divided into several groups based on high, medium and low ability levels and by gender. The instruments used in this study were tests and interviews. To see the validity of the research data was carried out triangulation (reducing data, presenting data in narrative form and drawing conclusions). Based on the results of research and discussion it can be concluded that 1) male and female students at both high, medium and low ability levels have been able to interpret a case based on the mathematical concepts involved even though it is not yet complete, 2) on indicators identifying mathematical concepts or formulas that involved in the question is not simple, male and female students of high and medium level have been able to do it, but at a low level students are still unable to identify mathematical concepts or formulas but correct calculations, 3) students are generally able to solve mathematical problems even though they have not complete both at high, medium and low levels and 4) at high and medium ability students both male and female are incomplete and still wrong in generalizing and analyzing generalizations, while in low ability students have not been able to generalize and analyze generalizations.

Keywords: the thinking ability, reflective thinking, ability level, gender

Introduction

One of the thinking abilities that must be owned and important to be develop is reflective thinking. An educator should pay attention to these abilities. But the reality in the field, most of the learning outcomes evaluation process only assesses how students solve problems and the final results of the problems given. Several studies have discussed the importance of reflective thinking ability, including Zulmaulida (2012) who defines reflective thinking as an activity of thinking that can make students try to connect the knowledge gained to solve new problems related to their old knowledge (Zulmaulida, 2012). In addition, according to Chee (in Mentari et al., 2018), reflective ability is an awareness of what is known and what is needed, it is very important to bridge the gap in the learning situation (Mentari, Nindisar, & Pamungkas, 2018). Whereas according to Gurol (in Suharna, 2013) reflective thinking is a process of directed and precise activities in which individuals analyze, evaluate, motivate, get deep meaning and use appropriate learning strategies (Suharna, 2013). In line with this, Bruning, et al (in Jiuan, 2007) said that reflective thinking ability include interpreting problems, making conclusions, assessing, analyzing, creative and metacognitive activities (Jiuan, 2007). Dewey (in Song, 2005) states that reflective thinking is an active, persistent and careful consideration of a supposed belief or form of knowledge, about reasons that support that knowledge, and conclusions which are the estuary of that knowledge (Song, 2005).

Some experts say that reflective thinking is part of critical thinking. This is in accordance with the opinion of Phan (2006) who said that there are four stages in reflective thinking, they are: habitual actions, understanding, reflection and critical reflection (Phan, 2006). Whereas according to Nindiasari (2013) there are several indicators that can be used to measure reflective thinking ability, namely:

1. Can interpret a case based on the mathematical concepts involved
2. Can identify mathematical concepts or formulas involved in non-simple questions
3. Can distinguish between relevant data and not
4. Can draw an analogy from two similar cases

5. Can evaluate / check the truth of an argument based on the concept used
6. Can analyze and clarify questions and answers
7. Can identify and evaluate assumptions
8. Can solve math problems
9. Can generalize and analyze generalizations (Nindiasari, 2013)

In addition, according to Shermis (in Weast, 1996) reflective indicators consist of:

1. Identifying conclusions
2. Identifying reasons and evidence
3. Identify ambiguous and vague language
4. Identifying valuable assumptions and conflicts
5. Identifying descriptive assumptions
6. Evaluate logical reasoning
7. Evaluate sampling and measurement
8. Evaluate statistical reasoning
9. Identify omitted information
10. Recite the values they have in full understanding without prejudice (Weast, 1996)

Based on some expert opinions above, the indicators of reflective thinking ability used in this study are:

1. Can interpret a case based on the mathematical concepts involved
2. Can identify mathematical concepts or formulas involved in non-simple questions
3. Can solve mathematical problems
4. Can generalize and analyze generalizations

In solving a mathematical problem, a lecturer does not only have to pay attention to his students' thinking ability, but also pay attention to the initial abilities of each student. In early ability learning is one of the factors that can help students in the process of receiving and absorbing new information. In Piaget's theory (in Suherman, 2003), it is said that in constructing or constructing a mathematical concept, students experience the process of processing and incorporating information based on existing knowledge (assimilation), while existing knowledge is accommodated to accommodate new information (accommodation) (Suherman, 2003). Suharna (2012) said that each student has different mathematical abilities in solving mathematical problems. This is closely related to the readiness of students to begin learning (Suharna, 2012). When students already have initial knowledge about new material or information to be learned, then they are at least ready to receive new material based on the knowledge or experience they have had before. For that, in the learning process readiness of each student needs to be considered so that learning objectives can be achieved properly. This is supported by Thorndike's theory (in Slameto, 2003) which says that readiness is a prerequisite for further learning. Based on some of the opinions above, it can be concluded that initial ability is one of the factors that can also influence learning outcomes (Slameto, 2003).

In addition to the initial abilities, the ability to solve one's problems is also influenced by gender. According to Zhu (2007) there are many factors that cause gender differences in the process of solving mathematical problems, one of which is cognitive abilities. Zhu also said that there were differences between men and women in solving math problems in high school and college with varied problems (Zhu, 2007). This is supported by Santrock (2007) statement that boys are slightly better than women in mathematics and science. In general, the ability of male students is similar to that of women, but male students have better abstraction compared to women, enabling them to be better than women in the field of mathematics (Santrock, 2007). Lubinski (in John, 2002) also says that boys clearly seem to be able to work on very difficult categories better than girls (Van de Walle, 2002). Based on studies conducted by Bassey (2008) "Gender Different and Mathematics Senior Achievement of Rural Secondary Students in Cross River State, Nigeria", it can be concluded that in mathematics subjects men are superior to women (Bassey, Joshua, & Asim, 2008). If it is associated with reflective thinking ability, in his research Demirel, Derman & Karagedik (2015) showed that the mathematical problem-solving process using reflective thinking ability depends on gender differences (Demirel, Derman, & Karagedik, 2015).

Research Method

This research is a qualitative descriptive study with the aim of knowing the reflective thinking abilities of students based on their level of ability and gender. The subjects in this study were TMA students in the 7th semester of the 2018/2019 academic year, which amounted to 6 people selected by purposive sampling. Subjects are divided into several groups based on high, medium and low ability levels and by gender. The instruments used in this study were tests and interviews. The test consists of two parts are the initial ability test and the final test. The initial ability test is used to classify students based on their initial level of ability are high, medium and low initial abilities. Whereas for the final test is a reflective thinking ability test consists of 4 questions with indicators: 1) Can interpret a case based on the mathematical concepts involved, 2) Can identify mathematical concepts or formulas involved in non-simple questions, 3) Can solve mathematical problems and 4) Can generalize and analyze generalizations. Whereas interviews are conducted in depth and are semi-structured. To see the validity of the data triangulation is done, namely by way of: 1) reducing data, reducing unnecessary information, organizing data and verifying the answers of the subjects, 2) presenting data in the form of narratives that are well arranged and sequential so that they are easily seen, read, and understood, and 3) drawing conclusions or verifying data.

Result and Discussion

The research begins with the classification of students according to their level of ability, namely high, medium and low ability by giving a test. After the data was obtained, 6 subjects were selected by purposive sampling as representatives of students consisting of 1 female and 1 male each with high, medium and low abilities.

Table 1. The Results Data of Reflective Thinking Ability Test

Gender	Level Of Ability	Reflektif Thinking Ability Test				Total
		1	2	3	4	
Male	High	4	3	3	2	12
	Medium	4	2	3	2	11
	Low	3	1	3	0	7
Female	High	3	2	4	2	11
	Medium	3	3	2	2	10
	Low	2	1	3	0	6

After students are grouped based on their level of ability, they are given material and trained to work on questions that can improve their reflective thinking ability. At the end of learning, 4 students were given a written test in the form of an essay which aimed to see their reflective thinking ability. The tests given are designed based on indicators of reflective thinking ability, namely 1) Can interpret a case based on the mathematical concepts involved, 2) Can identify mathematical concepts or formulas involved in non-simple questions, 3) Can solve mathematical problems and 4) Can generalize and analyze generalizations. The range of assessment scores for reflective thinking ability is 0-4 with the maximum score of each student is 16. The results of test processing can be seen in table 1 above.

Based on table 1 above it is known that the reflective thinking ability of male students is higher than that of female students. For high level students, the total score of male students is 12 and female students are 11. At the medium level, male students have a total score of 11 and female students 10. Whereas at the low level male students have a total score of 7 and female students have a total score of 6. Data on the percentage value of the test of reflective thinking ability based on the level of ability and gender of students can be seen in table 2 below.

Table 2. Percentage of Value Test of Reflective Thinking Ability based on Level Ability and Gender

Gender	Level Ability	Score	Persentase (%)	Average
Male	High	12	75	63%
	Medium	11	69	
	Low	7	44	
Female	High	11	69	56%
	Medium	10	62	
	Low	6	37	

In table 2 above, it is found that the average percentage of reflective thinking abilities of male students is higher than female students, namely 63% > 56%. This is in accordance with Santrock (2007) opinion that boys are slightly better than women in mathematics and science (Santrock, 2007). To deepen the data obtained, interviews were conducted with 6 subjects in this study. The interview was conducted after being given a test, by giving open questions. The results of test and interview analysis of students' reflective thinking ability based on their level of ability and gender, seen from each indicator of reflective thinking ability can be seen in the following explanation:

1. Analysis of student data with indicators can interpret a case based on the mathematical concepts involved.

   After the research data is obtained from the results of tests and interviews conducted on the subject, then the next step is to compare these data to see the validity of the data obtained. The results of the data triangulation can be seen in table 3 below.

   Based on table 3 below some conclusions are obtained, namely:

   a. Male students of high and medium ability level have been able to interpret a case based on mathematical concepts that are involved properly and correctly. Whereas female students in both high and medium ability levels are still miscalculated even though they have been able to interpret a case based on the mathematical concepts involved.
   b. Low ability male students have been able to interpret a case based on the mathematical concepts involved but the calculation is wrong. While female students of low ability level are still incomplete in interpreting a case based on the mathematical concepts involved and their calculations are still wrong.

Table 3. Triangulation of Answers and Student Interviews Based on Level Ability and Gender

Gender	Indicator of Reflective Thinking Ability	Level of ability	Test Results	Interview Result
Male	Can interpret a case based on the mathematical concepts involved	High	4	Already able to interpret a case based on the mathematical concepts that are involved properly and correctly
		Medium	4	Already able to interpret a case based on the mathematical concepts that are involved properly and correctly
		Low	3	Already able to interpret a case based on the mathematical concepts involved but wrong calculations
Female	Can interpret a case based on the mathematical concepts involved	High	3	Already able to interpret a case based on the mathematical concepts involved but wrong calculations
		Medium	3	Already able to interpret a case based on the mathematical concepts involved but wrong calculations
		Low	2	Already able to interpret a case based on the mathematical concepts involved but not complete and wrong calculations

2. Analysis of student data with indicators can identify mathematical concepts or formulas involved in non-simple questions

After the research data is obtained from the results of tests and interviews conducted on the subject, then the next step is to compare these data to see the validity of the data obtained. The results of the data triangulation can be seen in table 4 below.

Based on table 4 below some conclusions are obtained, namely:

a. High-ability male students have been able to identify the mathematical concepts or formulas involved in the problem not simple but wrong calculations. While female students of high ability level are incomplete and are still wrong in identifying the mathematical concepts or formulas involved in non-simple questions.
b. Medium level male students have been able to identify the mathematical concepts or formulas involved in the problem not simple but incomplete and wrong calculations. While female students of medium ability level have been able to identify the mathematical concepts or formulas involved in the problem not simple but wrong calculations.
c. Male and female students at low ability levels are equally unable to identify the mathematical concepts or formulas involved in the problem not simple but correct calculations.

Table 4. Triangulation of Answers and Student Interviews Based on Level Ability and Gender

Gender	Indicator of Reflective Thinking Ability	Level of Ability	Test Results	Interview Result
Male	Can identify mathematical concepts or formulas involved in non-simple questions	High	3	Already able to identify the mathematical concepts or formulas involved in the problem are not simple but wrong calculations
		Medium	2	Already able to identify mathematical concepts or formulas involved in the problem are not simple but incomplete and wrong calculations
		Low	1	Not yet able to identify the mathematical concepts or formulas involved in the problem are not simple but correct calculations
female	Can identify mathematical concepts or formulas involved in non-simple questions	High	2	Already able to identify the mathematical concepts or formulas involved in the problem are not simple but incomplete and wrong calculations
		Medium	3	Already able to identify the mathematical concepts or formulas involved in the problem are not simple but wrong calculations
		Low	1	Not yet able to identify the mathematical concepts or formulas involved in the problem are not simple but correct calculations

3. Analysis of student data with indicators can solve mathematical problems

After the research data is obtained from the results of tests and interviews conducted on the subject, then the next step is to compare these data to see the validity of the data obtained. The results of the data triangulation can be seen in table 5 below

Based on table 5 above some conclusions are obtained, namely:

a. Male students both high, medium and low ability levels have been able to solve mathematical problems but incorrect calculations.
b. High-ability female students are able to solve math problems properly and correctly. At the level of medium ability, students have been able to solve mathematical problems but not yet complete and wrong calculations. While at the low ability level, they are able to solve mathematical problems but the calculation is wrong.

Table 5. Triangulation of Answers and Student Interviews Based on Level Ability and Gender

Gender	Indicator of Reflective Thinking Ability	Level of Ability	Test Result	Interview Result
Male	Can solve math problems	High	3	Already able to solve mathematical problems but wrong calculations
		Medium	3	Already able to solve mathematical problems but wrong calculations
		Low	3	Already able to solve mathematical problems but wrong calculations
Female	Can solve math problems	High	4	Already able to solve mathematical problems properly and correctly
		Medium	2	Already able to solve mathematical problems but not complete and wrong calculations
		Low	3	Already able to solve mathematical problems but wrong calculations

4. Analysis of student data with indicators can generalize and analyze generalizations
After the research data is obtained from the results of tests and interviews conducted on the subject, then the next step is to compare these data to see the validity of the data obtained. The results of the data triangulation can be seen in table 6 below

Table 6. Triangulation of Answers and Student Interviews Based on Level Ability and Gender

Gender	Indicator of Reflective Thinking Reflektif	Level of Ability	Test Results	Interview Result
Male	Can generalize and analyze generalizations	High	2	Already able to generalize and analyze generalizations but not complete and wrong calculations
		Medium	2	Already able to generalize and analyze generalizations but not complete and wrong calculations
		Low	0	Not yet able to generalize and analyze generalization
Female	Can generalize and analyze generalizations	High	2	Already able to generalize and analyze generalizations but not complete and wrong calculations
		Medium	2	Already able to generalize and analyze generalizations but not complete and wrong calculations
		Low	0	Not yet able to generalize and analyze generalizations

Based on table 6 above some conclusions are obtained, namely:

a. Male and female students at both high and medium levels of ability have been able to generalize and analyze generalizations but have not yet completed and miscalculated.
b. Male and female students of low ability level have not been able to generalize and analyze generalizations.

Conclusion

Based on data analysis and discussion obtained several conclusions, namely:

1. On indicators can interpret a case based on the mathematical concepts involved,
   a. Male students of high and medium ability level have been able to interpret a case based on mathematical concepts that are involved properly and correctly. Whereas female students in both high and medium ability levels are still miscalculated even though they have been able to interpret a case based on the mathematical concepts involved.
   b. Low ability male students have been able to interpret a case based on the mathematical concepts involved but the calculation is wrong. While female students of low ability level are still incomplete in interpreting a case based on the mathematical concepts involved and their calculations are still wrong.
2. In the indicator can identify the concept or mathematical formula involved in the problem is not simple,
   a. High-ability male students have been able to identify mathematical concepts or formulas involved in the problem not simple but wrong calculations. While female students of high ability level are incomplete and are still wrong in identifying mathematical concepts or formulas involved in non-simple questions.
   b. Medium level male students have been able to identify the concepts or mathematical formulas involved in the problem not simple but incomplete and wrong calculations. While female students of medium ability level have been able to identify mathematical concepts or formulas involved in the problem not simple but wrong calculations.
   c. Male and female students at low ability levels are equally unable to identify mathematical concepts or formulas involved in the problem not simple but correct calculations.
3. In indicators can solve mathematical problems, male students both high, medium and low ability levels have been able to solve mathematical problems but wrong calculations. While high-level female students are able to solve math problems properly and correctly. At the level of medium ability, students have been able to solve mathematical problems but not yet complete and wrong calculations. While at the low ability level, they are able to solve mathematical problems but the calculation is wrong.

In indicators can generalize and analyze generalizations, male and female students both high and medium ability levels have been able to generalize and analyze generalizations but not yet complete and wrong calculations. While at the low ability level, they have not been able to generalize and analyze generalizations.

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Collaborative Learning Concept for Reducing the Act of Cheating

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Abstract: This article proposes collaborative learning concept to reduce the act of cheating. Based on the result of interview, none of the students from two Critical Listening and Speaking II (CLS) classes claimed that they have not cheated before. The reasons might vary from the difficulty of materials, lack of confidence, the importance of getting good score, bad preparation, and the trend of millennials. The goal of CLS II course is to improve students' critical thinking by watching some videos, answering some questions, and discussing some certain themes. Nevertheless, it would be possible to reach the aim when students tended to cheat. For solving that problem, this article proposes the change of learning concept from individual learning process into collaborative learning process when students do not need to cheat because after they finish doing the exercise, they can share the result and criticize their friend's work. From analyzing the result of observation, document analysis and questionnaire, students could avoid the act of cheating. Furthermore, they could help their friends' difficulty for their grammar, content, and the organization of the idea.

Keywords: collaborative learning concept, cheating, students.

Introduction

In this digital era, students can get a lot of information from googling the materials. When that activity is done based on students' own interest to study certain subject, it can lead to students' progress or improvement. However, when students try to find the answer of the questions given by teacher or lecturer in the class, it can be classified as the act of cheating. The act of cheating in the classroom has occurred for long period (Campbell, 2006; Anderman, et.al, 2009; Anderman, et.al, 1998; Ferriere, 2001). In the past, students tended to cheat by asking their friends answer, making their own note, having certain sign to tell the answer, throwing a piece of paper to other friends, and etc. Nowadays, cheating can be in form of texting to get the answers, browsing the internet, taking the photo of friends' answer, or asking friends directly. Based on previous studies, many reasons caused the act of cheating such as low awareness, high expectation, personal experience, poor condition of the school, or supportive environment for cheating (Murdock, et.al, 2001; Newstead, 1996; Black, et.al, Whitley, 1998).

Knowing the importance of avoiding the act of cheating, this article underlines the concept of collaborative learning to reduce the act of cheating in two classes of Critical Listening and Speaking II (CLS II). CLS II is a main course in the fourth semester and is taken after the students finish Critical Listening and Speaking I. This course has four credits and it is divided into two meetings per week. One meeting is for speaking class and another meeting is for listening class. The goal of this course is that students will be able to give critical response and reflection based on the given topics. The theme of CLS II is different from CLS I. While CLS I deals with education in general and environment, CLS II deals with technology in English language teaching, classroom issues and criticism on education and technology. For listening class, the materials are mostly taken from English audio and video such as TED Talk videos, YouTube videos, podcasts. After listening the audio or watching the video, students do some activities such as note taking, summarizing, paraphrasing, and answering some comprehension questions.

Some students in this course found some videos difficult to be understood especially for TED Talk videos due to the speed of the speaker's speech. It was found that some students simply searched and copied the video subtitle for answering the questions. There were also students who copied other student's answer without changing a single word. The act of cheating in CLS II classes was done because some students did not have good ability for listening and understanding the content of the videos well. Due to that phenomenon, in a meeting of speaking class, the lecturer and the students had a discussion

about cheating. Unsurprisingly, every student had an experience of cheating. There were some reasons why students did that. One of them was because the listening materials were difficult. As mentioned before, students thought that TED Talk videos were not so easy to be understood. Moreover, in two CLS II classes, students had different level of listening skill. The second reason was students' lack of confidence. Some students told that when they could answer the questions, they were not sure that the answer was good enough. They needed to compare their answer with other friends.

Cheating could be also done because of lack of preparation. It happened when students did not master the material well or even did not have enough time to review the material. In fact, GPA was still important for most students. When they failed to get a good score, it would cause to their GPA. They thought that good score mattered a lot. Besides, the culture of the class played important role too. One student who did not want to help other friends might be avoided by the rest of the class. This supportive system could have both negative and positive sides. To overcome this problem, the lecturer then proposed a collaborative learning.

Collaborative learning has been discussed as a solution for learning in digital era. The concept of collaborative learning itself comes from two experts, namely: Piaget and Vygotsky. Based on Law, et al. (2019), Vygotsky underlines the interaction between students to construct their knowledge. It does not merely mean a group work. Collaborative learning occurs when students can understand the material. Moreover, students can have different perspective toward classroom material as Smith and MacGregor (1992) say that students come from different background and social condition. It can enrich their interaction too. Law, et al. (2019) also demonstrate the benefit of collaborative learning to foster students' engagement in the class. The success of Law's collaborative learning lays on students' participation as an evidence of engagement. Tracking down the concept of collaborative learning in 20th century, Gokhale (1995) defines collaborative learning as follow.

The term "collaborative learning" refers to an instruction method in which students at various performance levels work together in small groups toward a common goal. The students are responsible for one another's learning as well as their own. Thus, the success of one student helps other students to be successful (p. 22).

An interesting point from Gokhale's research is that this collaborative learning can increase students' critical thinking by having the activity of discussion and sharing. The finding is presented quantitatively. It shows that the students who do collaborative learning perform better on critical thinking test due to the presence of different interpretations and group diversity. There was also an article discussed the absence of teacher assistance in electrical engineering when collaborative and autonomous learning was done by having augmented reality (Martín-Gutiérrez, et al., 2015). It was proven that students could understand the practical thing by having the tools in a collaborative way. In the field of education especially for pre-service teachers, collaborative learning also gives many benefits. Brown, et al. (2019) suggested the presence of peer leader, instructors, and effective relationships was needed. In this case, instructor could arrange some roles and strategies so that collaborative learning could run well.

The concept of collaborative learning in this article is an adaptation from previous concept that has been explained in the paragraph above. This collaborative learning concept prioritizes students' ability to work together with friends after they finish their own work. It means that they know to do their own duty first before helping others. The steps to apply this collaborative learning are described below.

1. Lecturer strengthens the concept of positive learner that they may answer the question by themselves because they are not cheaters.
2. Lecturer also informs that they do not need to ask their friend's answer because when they finish their work, their work will be swapped.
3. There is also a statement that the most important thing in learning process is the individual progress not the result. When students are not able to answer the questions, they may leave it blank.
4. The video is played once for getting the main idea.
5. The video is played the second time for answering the questions.
6. Lecturer may ask students whether they need the lecturer to play the video again.
7. When students finish answering the questions, they may swap their work.

8. They read their friend's answer, help their friend's structure of sentences and can learn from friend's answer.
9. Lecturer may discuss the answers of the questions. Lecturer reads the question and allows student to raise his or her hand when they find that his or her friend's answer is good or interesting.
10. Students give written feedback in their friend's work. Then, they submit the work to the lecturer.

The first three steps are called the initiation process where students understand the concept of collaborative learning. Step four, five and six are done so that students can get the main idea and find the answer for each question. In this phase, students' understanding of the material is needed. The most important thing relates to the learning process. The 7th and 8th steps are beneficial for students to broaden their knowledge after reading their friend's answer and to help another friend. Step 9 relates to student's learning process to appreciate their friend's work. When they raise their hand and read their friend's work, it can build the sense of togetherness too. The last step that contains the written feedback can be used as a practice for them to be a preservice teacher. As we know that teacher should be able to give written feedback too.

Research Method

There were three sources for gathering the data. The first was observation. Then, it was supported with document analysis from students work and the questionnaire. Observation was conducted for three times during the implementation. The content of questionnaire dealt with the act of cheating during the implementation, the efficiency of applying collaborative concept, and the achievement of learning goal. Document analysis was done to get detail information about students' work. In participants' working sheet, the researcher could find the answer of the questions as the indication of cheating or not.

Participants were taken from two classes of CLS II which were A class and B class. A class consisted of 27 students. There were 20 female students and 7 male students. B class contained 20 female students and 7 male students. On the day of questionnaire data taken, there were only 25 students coming for each class.

Result and Discussion

This part is divided into three parts. The first deals with the result of collaborative implementation in A class of CLS II. The second part discusses the result of collaborative implementation in B class of CLS II. The last is about the comparison between A and B classes. For the first and second parts, the discussion leads to the number of cheaters after the implementation, the effectiveness of the implementation, and the number of students who agree that this collaborative implementation helps them in the learning process. Below are the tables of the result from two classes.

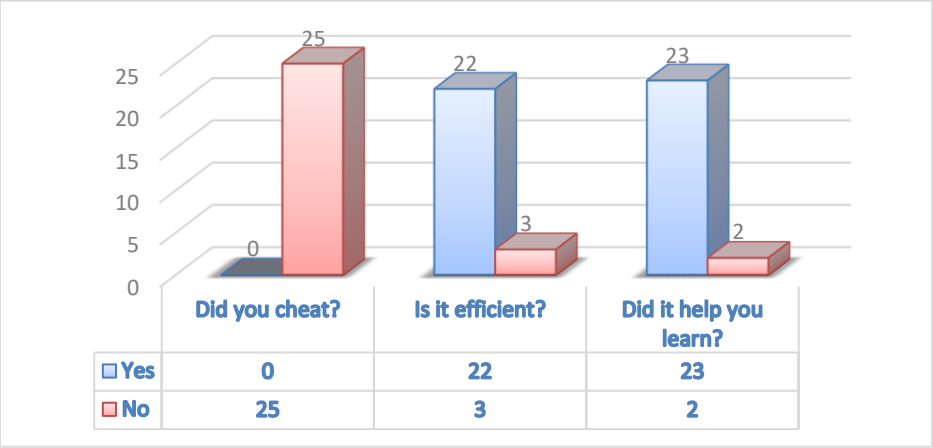

Figure 1. The implementation result of collaborative learning concept in CLS II A class

Based on the table above, it was clearly seen that there was not any cheater from A class after implementing this collaborative learning concept. From the observation, the supporting system from the students in the class took important role. Students in A class had their own commitment to keep their integrity. From students' work, there was no indication of cheating such as same words and same idea for all answers. They tended to have their own critical thinking and to express their idea differently. They also wrote the answers of the questions quietly before they swapped their work to other friend and had discussion.

There were 22 students who thought that this collaborative implementation was effective. Their reasons varied. Five students thought that it was effective because they could help each other. Meanwhile, three students dealt with the reasons of the chance for expressing their idea, avoiding boredom, enriching their perspective by reading their friend's answer. Other three students also argued that by implementing this collaborative concept, they could know their mistake and learn from that mistake. It was efficient due to the fact that they could get the feedback from their friend. This reason was stated by five students.

Furthermore, this collaborative implementation provided the chance to discuss the problem together in relation with both intrapersonal and interpersonal aspects. Two students shared their opinions that they improved their confidence. During the discussion, they could also share their knowledge. By implementing collaborative concept, students could improve their speaking and writing skills during the time they checked their friend's answer. One student also underlined the relax atmosphere that was created by the lecturer. In relation with learning, a student wrote his response "It is yes because with collaborative learning we can complete or discuss the answer with our friend. So, it is useful and helpful for me because sometimes I did not get the answer. The feedback motivated me." But not all students agreed that this collaborative learning was efficient because they thought that some friends did not seriously check their answers. There were 23 students who agreed that this collaborative implementation was helpful for their learning process.

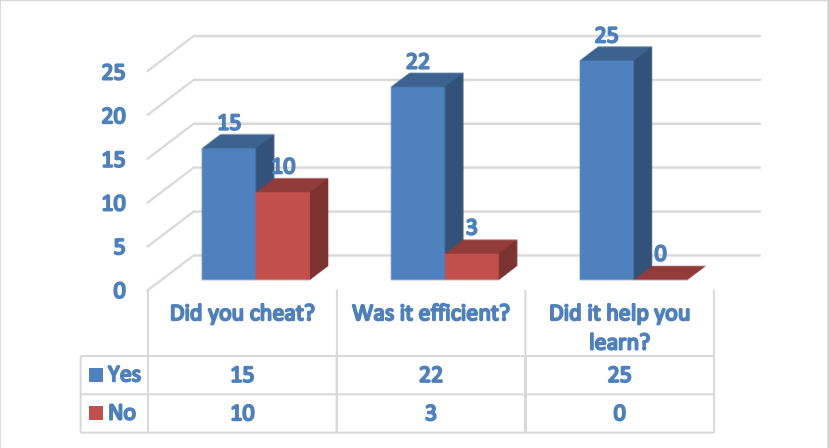

Figure 2. The implementation result of collaborative learning concept in CLS II B class

The result of collaborative implementation in B class of CLS II was different from A class. This collaborative implementation could reduce the number of students who cheated but could not 100% eliminate the cheaters. The result of the observation, students in B class also had supporting community, but they did not have good competence comparing to A class. Besides, this collaborative implementation could not be done fully in three weeks because of holiday. The factor of repetition did not completely exist.

In B class, there were 10 students who did not completely cheat during the implementation. This collaborative concept was found efficient for 22 students. They delivered their opinion that the method was efficient because of lecturer's factor. They could gain new vocabularies and it was practical.

Moreover, by implementing this collaborative concept, two students were more confident when they could read their friend's answer. They also developed creativity by knowing other perspective. One student thought that this method was the best as far as he knew because he has not found other method. Not only develop student's creativity, this developed their competence of understanding the given video, improving listening skill and critical thinking. Other students felt less worried and less ashamed. It was challenging because students could know their mistake and strength. They could also get the information from friends. There were only two students who thought that it was not efficient because one of them should open google translate and another student said that his friend did not completely check his work. Unsurprisingly, all students agreed that this collaborative concept helped them in their learning process.

The similar result from both between A & B class was about the efficiency of implementing this collaborative concept for widening their perspective to understand the materials. Students learned a lot from their friend when they had this collaborative concept. The difference dealt with the number of cheaters. In A class, the implementation of this collaborative concept could reduce cheaters 100%. Meanwhile in B class, it could reduce 40% cheaters. This difference was a result of the nature of the class and students' integrity (McCabe, et al., 2001).

Conclusion

Some ways have been done to reduce the act of cheating. Two of them were done by conducting a tutorial program (Mulatsih, 2018) and improving students' critical thinking with analyzing a literary work (Mulatsih, 2015). In this article, it was proven that collaborative learning concept was able to reduce the number of cheaters in the classroom. This collaborative learning concept was mainly about the integrity of the students who realized that they were not cheaters and who were honest to themselves. Besides, the activities of sharing between at least two students and giving feedback enriched them to have different perspective and to help other friend. Based on the result, this collaborative learning concept was good to decrease the number of cheaters, to help them to learn and was efficient for most students. One factor that influenced this implementation of collaborative learning concept was the nature of the class. Thus, one class had different result from another one. In CLS II A class, this collaborative learning concept could 100% eliminate the number of cheaters. Meanwhile, in CLS II B class, this concept could reduce 40% number of cheaters. To overcome this problem, students' integrity could be done sustainability and continuously after this implementation of collaborative learning concept.

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