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Instructional Design: Teaching Algebraic Equations to Grade 8 Students with Involvement of Mathematical Reasoning in Cambridge IGCSE Curriculum

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Abstract

Mathematics tends to be a subject that is not favored due to a misunderstanding of the whole concept. The author believes that through involvement of mathematical reasoning skills and proper instructional strategies, students understanding can be transformed and students will be able to relearn the concept. The aim of this paper is to help teachers to recreate their lesson plans in a form of an instructional design with the involvement of mathematical reasoning, specifically in learning and relearning algebraic equations (constructivism), that can further diminish the anxiety and frustration students experience due to misconceptions in their algebraic comprehension. Through a combination of theories related to the teaching and learning of algebra in secondary school and frameworks regarding instructional strategies, the betterment of mathematical reasoning is expected to go along the relearning process, and the students will be equipped to move forward in learning mathematics. This instructional design will provide a variety of learning activities ideas, including a sample lesson plan along with other supporting documents for learning activities that teachers can use in the classroom.

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INTRODUCTION

In school settings, mathematics oftentimes, is seen by students as a set of formulas and computations that they have to memorize (Cafarella, 2014). There are a lot of people, be it students nowadays, or just adults who studied mathematics before, think that mathematics is not a source of satisfaction, but rather a starting point of frustration, discouragement, anxiety, and tend to think that mathematics is just a tiresome chore (Ignacio, Nieto, & Barona, 2006).

Indonesia's low numeracy skills have been shown in various international testing. Based on TIMSS (Trends in International Mathematics and Science Study) survey in 2015, it shows that Indonesia is in the 45th rank out of 50 countries being tested, scoring only 397 points in compare to the average being 500 points. Reasoning, for example in algebra and geometry, becomes the substance in the test.

Algebraic thinking or reasoning refers to the ability of forming generalizations from experiences with number and various forms of computation, formalizing these

ideas with the use of a meaningful symbol system, and exploring the concepts of pattern and functions (Van de Walle, Karp, & Bay-Williams, 2013). Algebraic comprehension is deemed to be important as it underpins all mathematical thinking, allowing for students to explore the structure of mathematics (Ontario Ministry of Education, 2013; Yuni et al., 2021).

However, the teaching and learning of algebra is associated to various difficulties and challenges. Students often acquire a formal and routinized method, where they are bound to make errors while executing said algebraic procedures (Kontorovich, 2020). Due to the following of steps and absence of mathematical reasoning in students, they are unable to trace or correct their errors regarding algebraic problems (Wagner, 1983) Students who are able to perform routine questions at a formal level correctly often reflect a limited recognition of the algebraic ideas, and hence, are lost when the problem situation is slightly changed. There is a lack of mathematical flexibility to adapt to algebraic problem-solving procedure, unless students are able to refer to the more informal and natural method (Küchemann, 1981)

This brought light to mathematical misconceptions. Salah satu jenisnya adalah miskonsepsi, yaitu kesalahan pada sistem belief dikarenakan penalaran, intuition, culture, life experience or something else (Parwati & Suharta, 2020). Sarwadi and Shahrill (2014) researched on mathematical errors and misconceptions to have found that students' misconceptions contribute a major impact towards students' progress and achievement in mathematics. Hence, eradication of mathematical misconceptions can further improve students' scores in mathematics. In order to do so, teachers should be able to deliver materials to students in a way that students can understand, that students will be able to perceive mathematics in a new light. This is where mathematical reasoning comes in. Mathematical reasoning allows students to go beyond the routine use of procedures, and move towards learning concepts and properties as being logical, interrelated and coherent aspects of mathematics (Mata-Pereira & Ponte, 2017).

According to ISC Research in 2017, Indonesia has the largest number of international schools in Southeast Asia, placing Indonesia as the 10th position globally, with 192 international schools (Partami, Padmadewi, & Artini, 2019). Thus, it may come as a surprise that in Indonesia, there is a limited source for teaching mathematics in international schools. Most of the times, teacher relies heavily on curriculum-based text books, whereas instructions for the students are oftentimes not specified (Haggarty & Pepin, 2002) There is a need to break language barriers in such a diverse country, yet no solution has been addressed. Therefore, it is of the utmost importance that an instructional design is to be made: to cater the needs of teachers in the growing number of international schools in Indonesia.

RESEARCH METHODS

The methodology in this paper refers to the instructional design construction methodology, whereas it reflects a specific take of the ADDIE model of instructional design (Kurt, 2017) along with the logic of Backward Design (Wiggins & McTighe, 2005) The figure below (Figure 1) refers to the chart of the construction of the instructional design.

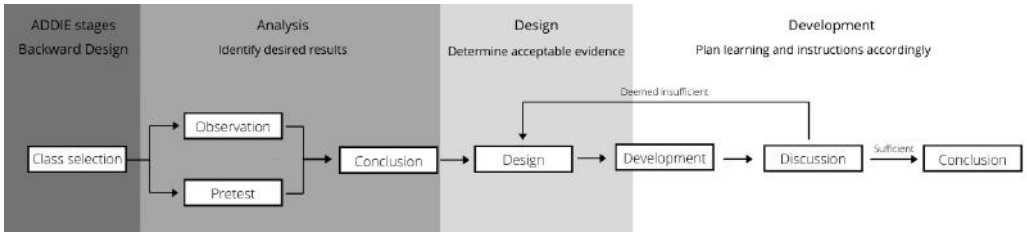

Figure 1: Construction of Instructional Design Based on ADDIE Model and The Logic of Backward Design

Going into details, this section will cover the steps in which the construction of the instructional design took place, according to the chart above (Figure 1) Before any construction of instructions was done, the author undergo class selection, which will be the basis of the analysis of needs, which is the first stage in the ADDIE model (Kurt, 2017), alongside with the first step in the logic of Backward Design (Wiggins & McTighe, 2005) This includes an observation and pretest, which serves as a form of analysis and not intended to be done as a proper research, as its sole purpose is to analyze the needs of the classroom for the formation of the instructional design; to identify the gaps in teaching and learning in the classroom, and to identify any misconceptions present in the students that may be inflicted in future teaching and learning activities.

The conclusion that can be made through the analysis of needs will be the grounds of the second stage in the ADDIE model, which is design. More specifically, it happens concurrently with the second step of the logic of Backward Design, which is to determine acceptable evidence. The construction of the instructional design starts from the literature review and selection of various frameworks that can support the instructional design, including the evaluation plan, which shows the complementary aspects of both ADDIE model and the logic of Backward Design. More precisely, the design will be based on the algebra content provided in the Cambridge Mathematics IGCSE Syllabus 2020-2022 and with involvement of mathematical reasoning through NCTM Reasoning Standards for grade 6-8.

Afterwards, it is followed by the actual construction of each part of the instructional design, whereas it is considered to be the third stage in the ADDIE model, which is development, and third step in the logic of Backward Design which is to plan learning and instructions accordingly. This means to start creating lesson plans that will make up the instructional design. The construction of the instructional design is not limited to the leson plans, but to the worksheets, presentations, and any additional teaching and learning support that will be utilized in the classroom as the instructional design is implemented. This part will utilize the logic of Backward Design from Understanding by Design (Wiggins & McTighe, 2005) whereas it will be the structure of the lesson plans, and the constructivist teaching steps, which will be utilized as the order of the learning activities that take place in the classroom.

The development stage is the stopping point of the instructional design, as further implementation and evaluation is going to be done under a specified context coming from each school. Following the development, it is then discussed and revised – going back and forth between design and development until it is deemed sufficient. Once it is deemed sufficient, conclusions regarding the limitations,

strengths and weaknesses of the instructional design will be further elaborated based on the result of the instructional design constructed.

RESULT AND DISCUSSION

This section will further elaborate the actions taken in the effectuation of the ADDIE model that refers to the previously attached chart. This section will be divided into four subsections, each stand for each process and stage in the chart; analysis, design, development, evaluation.

Analysis

The analysis of needs in the ADDIE model of instructional design intends to measure the students' capability in algebra to find the underlying problems that exists in the classroom. This information will further guide the development of the instructional design. According to Brodie (2010), we can obtain traces of mathematical reasoning from classroom work and interactions. Hence to properly assess and identify the problem, the author conducted an observation in a class of 17 students for one week (7×40 minutes), and then gave the students a test of the algebraic topic that has been previously taught and tested until finished, which was translating general statements into mathematical statements (algebraic expressions.) Students are instructed to answer as best as they could, and if they cannot answer, they just need to explain why. Figure 2 shows the problem identification test questions.

Instruction: Translate the following statements into mathematical statements!

1	The product of two consecutive integers is 342.
2	The sum of two consecutive positive numbers is 1105.
3	A girl's age in 12 years time is the square of her present age.
4	The product of two consecutive integers is 380.
5	The sum of three times a number and two less than four times that same number is 61.
6	There are two consecutive positive odd numbers. The sum of the squares of the larger number and 4 times the smaller number is 349.

Figure 2. Problem Identification Questions

Corresponding to the proposition that mathematical communication is connected to mathematical reasoning (Kaur & Toh, 2012), and that involvement of mathematical reasoning will be part of the instructional design, the author relates students' ability in algebraic equations to mathematical communication. Hence, the questions of the problem identification refer to one type of question on algebraic comprehension that relates to mathematical communication; to translate statements into algebraic expressions (Molina et al., 2017) It is worth noting that the students are fluent in spoken English, whereas they earn their mathematical knowledge in the English language. The ethnic composition of the classroom consists of 60%

Indonesian students, while the rest are of various ethnicities. Thus, there should be no problem for students in interpreting the questions due to the language factor.

Problem Identification Result

The result shows that none of the students capable on answering all six questions. There are only 5 students capable of answering 5 out of 6 questions, and 5 students who are incapable of answering any of the questions. Table 1 and Figure 3 describe the distribution of the data based on the scores:

Table 1. Students' score on Problem Identification Sheet

Score Range	Number of students	Percentage
0-25	9	56%
26-50	2	13%
51-75	0	0%
76-100	5	31%
Total	16	100%

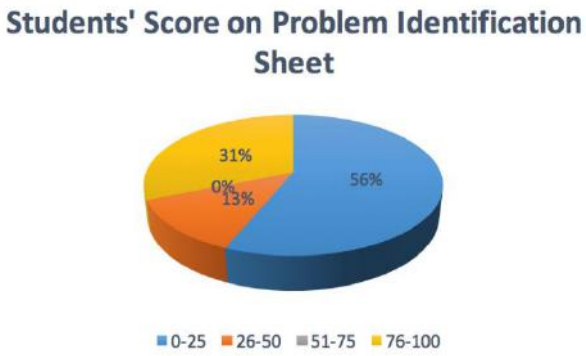

Figure 3. Students' score on the Problem Identification Sheet

The scoring system is made to be simplistic, students who are unable to reflect any form of mathematical thinking or to answer in any way are given 0, meanwhile an incomplete answer that reflects mathematical thinking is scored half. The full 1 score is given to students who are able to answer the question correctly. The score distribution is as follows; the majority of the students (56%) are unable to answer any of the questions, followed by the second majority of the students (31%) being able to answer most of the questions scoring 76-100. Additionally, a minority of the students are able to score 26-50. Looking at the score distribution, it can be inferred that most of the students do not understand how to answer the questions, considering the majority of the students were unable to answer any question. On the other hand, most of the students have problems in making mathematical models, as part of reasoning and generalization.

Observation and Reflection

The classroom observation is done by the author's presence in the classroom. The author floated around the classroom while assisting the teachers with helping the students with their worksheets, talking with them as well to find the dynamic of the

classroom. Additionally, the author conducted a reflection at the end of each session to ask how the students feel towards the class session each day.

According to classroom observation, teachers tend to only focus on the high-achieving students to confirm formative assessments; in-process evaluations relying on only a number of students instead of the whole class, making it easier for other students to be left behind, which suggests the score distribution. The students tend to be disengaged from the classroom and prefer to just stand by and idle. When it comes to structure, students, especially low achieving students, tend to be left behind in terms of their mathematical knowledge. For instance, in class, when discussing algebraic expressions, the observation result discovered a trend that there are students who do not know how to do basic arithmetic, how a mathematical expression is formed, or how algebraic manipulation work. Thorpe (2018) states that this indication shows how students are lacking in reasoning.

Through the reflection session, it is also observed that students are unfamiliar with mathematical terms, which is a problem, considering the teacher converse using mathematical terms. However, it is worth noting that the students came from an international school background where they converse in English, and they are not familiar with mathematical terms in Indonesian, hence, language barrier is not the issue. The students also express frustration towards mathematics, and they also complained about their classes. Hence, the problem revolves around students' comprehension in mathematical terms as well, as the students will not be able to understand the material being delivered if they are not familiar of the terms being used in the classroom, which includes the ability to make generalizations. If teachers are unaware of its presence, and are not in the habit of getting students to work at expressing their own generalizations, then mathematical thinking is not taking place (Zazkis, Liljedahl, & Chernoff, 2008).

After the completion of the problem identification test and each observation session, the author sat down and discuss the results with the mathematics teacher that is in charge of the class. The teacher stated that the class' performance by and large, also overwhelmed the teacher, as the teacher never had prior experiences with such low achievement in classroom performance (e.g. inability to do basic arithmetic or following instructions.) The teacher referred to the class as a result of excessive leniency on their mathematical performance. However, this is mere observation of the teacher, and it will be a part of the consideration in the construction of the instructional design.

According to NCTM's Reasoning Standard (NCTM, 2008), students who fail to understand and make sense of mathematical ideas and instead resort to rote learning, experience continued failure and withdraw from mathematics learning (Battista, 2017). This is a main problem that circles around the classroom; during the observation, students sent negative remarks related to mathematics and how they want to give up because mathematics cannot be understood. This may offer explanation to the students' behavior in the classroom. The author sees this as an opportunity to familiarize students with the mathematical concepts at hand, until they manage to be comfortable in making their own generalizations.

All in all, it can be concluded that the gap between the students' comprehension and capability is the unfamiliarity with mathematical terms that are commonly used in secondary school, the lack of overall mathematical comprehension (not knowing how to perform basic arithmetic, not knowing the differences between algebraic

equations and expressions, etc.), and inability to reason nor identify the mathematical structure in questions. Hence, the instructional design should address the issues that act as a gap in the aforementioned grade 8 students' learning.

Design

The design stage is the second stage in the ADDIE model of instructional design which goes hand in hand with the second step in the logic of Backward Design (Wiggins & McTighe, 2005) The design stage will be based on the algebra content provided in the Cambridge Mathematics IGCSE Syllabus 2020-2022 along with NCTM Reasoning Standards for grade 6-8.

In Cambridge curriculum, students are introduced to algebra as early as their elementary school years. However, since it has been discovered that students in the problem identification struggle with the basics of algebra, the author give credence to a reintroduction to algebra as an attempt to familiarize students with the algebraic content that they have covered. This process leads students to communicate between themselves and their knowledge (Musanti, Celedón-Pattichis, & Marshall, 2009). Hence, a reinstitution of algebraic comprehension is done to straighten misconceptions that students may have regarding algebraic equations. This step may not be necessary when the context of the classroom differs and students do not face the same issues.

Furthermore, the reinstitution of algebraic comprehension will several aforementioned learning objectives (Cambridge International Examinations, 2016), which then will be implicated with the reasoning standards (NCTM, 2008) to form multiple activity designs that might support the learning activities in the respective content and reasoning standards. Table 2 shows the general recommendation of the practical activity design in reference to the IGCSE content section and NCTM reasoning standards. The design of this activity will be designed in the lesson plan.

As for the lesson plans, it will be made according to the structure suggested by Wiggins and McTighe (2005) alongside with the aforementioned constructivists' teaching steps that is part of the learning activities. The structure will include as follows. First, learning objectives; made using the Principles of Creating Learning Objectives in order to maximize the incorporation of reasoning in the lessons, the learning objectives will be closely knitted to the reasoning standard coverage. Second, reasoning standard coverage; incorporated in each part of the lessons to act as a reference. Reasoning standards are not hierarchical and are embedded in all parts of the lesson plans. This part of the structure is intended to also encourage teachers to take into their own initiatives to improve parts of the lesson plan. Third, resources; to help teachers prepare for the class with the aid and support of external resources, such as PowerPoint presentation, handouts, videos, index cards, small white boards, etc. Fifth, learning activities; to elaborate the activities that will take place in the classroom. Sixth, indicators and guidance; made as an attempt of formative assessment in the classroom, while giving teachers the freedom to adjust parts of the lesson according to the students and classroom environment.

Table 2: Activity Design According to IGCSE Content Sections and NCTM Reasoning Standards

IGCSE Content Section	NCTM Reasoning Standards	ActivityDesign
Reinstitution of algebraic comprehension 1. Use letters to express generalized numbers and express basic arithmetic processes algebraically. 2. Substitute numbers for words and letters in formulas. 3. Construct simple expressions and set up simple equations. 4. Manipulate directed numbers, use brackets, and extract common factors. 5. Derive and solve simple linear equations in one unknown.	Recognize reasoning and proof as fundamental aspects of mathematics.	Through the betterment of understanding the concept of algebra, students will recognize the importance of reasoning, it being the fundamental aspect of learning mathematics (Ramdani, 2011)
	Make and investigate mathematical conjectures.	The activities of making conjectures can be done in the classroom through discussions and provoking/scaffolding questions in worksheets and activities. When students are able to communicate clearly in mathematics, as they better their comprehension, students are able to make conjectures which then would further their understandings and make it easier for them to structure their thinking.
	Develop and evaluate mathematical arguments.	Following students learning on how to make conjectures, students are expected to be able to make arguments of their conjectures. This will help them intrinsically, as defending (arguing) to one's own statement is natural, and they will also then practice how to communicate their reasoning, making it easier for teachers to understand their train of thoughts. This takes place in discussions within group mates, which emphasizes the importance of group work (Prideaux, 2007)
	Select and use various types of reasoning and methods of proof.	Although the types of reasoning and methods of proof are limited due to the application to 8^{th} grade students, students are at least expected to know how to reason and be aware that there is more than one way of thinking to achieve an answer to a question (NCTM, 2008) by knowing their own reasoning, the betterment of algebraic comprehension will be more complete.

Development

The development of the instructional design starts with the consideration of the learning objectives and the reasoning standards for the learning activities in the lesson plans. The development stage is also the stopping point of the construction of the instructional design as aforementioned. The product of the instructional design will include lesson plans, worksheets (opening activities and assessments), learning aids, and presentations. Figure 4 shows a sample of the lesson plan structure.

<table>
<tr><th colspan="4">Instructional Design: Reinstitution of Algebraic Comprehension</th></tr>
<tr><td>Year:</td><td>8</td><td>Unit:</td><td>Algebra Review 1</td><td>Time:</td></tr>
<tr><td colspan="2">Learning Objectives:
1. Use letters to express generalized numbers and express basic arithmetic processes algebraically.
2. Substitute numbers for words and letters in formulas.
3. Construct simple expressions and set up simple equations.</td><td colspan="2">Reasoning Standards:
- Recognize reasoning and proof as fundamental aspects of mathematics.
- Make and investigate mathematical conjectures.
- Develop and evaluate mathematical arguments.
- Select and use various types of reasoning and methods of proof.</td><td>Resources:
- PowerPoint presentation
- Opening activity sheets
- Scissor & glue
- Algebra tiles paper (to cut)
- Algebra tiles worksheet</td></tr>
<tr><td>Indicators</td><td>Guidance</td><td colspan="2">Learning Activities</td><td>Reasoning Standard Coverage</td></tr>
<tr><td>Students' attention is directed towards the teacher and students are willing to answer or ask follow-up questions.</td><td>Q+A</td><td colspan="2">Orientation: learning objectives, introduction to the importance of algebra.
1. Today, we are going to review algebra and learn the following learning objectives. (Slide 1&2.)
2. We all know how to answer basic mathematics questions. But in real life, we don't always know everything. There's always unknown values here and there that we need to</td><td>Recognize reasoning and proof as fundamental aspects of mathematics.</td></tr>
</table>

Figure 4: Sample of lesson plan structure

However, the worksheets will be discussed here to elaborate on the reasoning aspects of the activities that will be present in the classroom. One of the activities involved in the classroom is the presence of an opening activity that is expected to trigger students' critical thinking and reason along with the questions in the worksheet. Figure 5 shows the opening activity titled "Making Homemade Orange Juice" where the activity will act to bridge students' prior knowledge to algebra through a familiar activity.

The questions present in the opening activity worksheet are not exactly algebra, but yet it involves algebraic thinking. This is to foster the previous gap that is present in the students, whereas prior knowledge that are considered to be the requisites for algebra are to emerge in students, such as ratio and proportions. For instance, question 1A attempts to trigger students into forming an informal algebraic expression/equation, to bridge students' thinking in everyday life to mathematical thinking. Meanwhile question 1B attempts to make students reason between the differences in variables, as students think about what makes them similar and different. Through scaffolding questions such as question 1B, students are expected to make conjectures of what they think is right or wrong in mathematics.

Question 1C attempts to formalize students' thinking of the recipe in the form of an algebraic equation, giving students the freedom to choose their own variables to represent each of the parts in the recipe. The questions present in the opening activity are not limited to those shown in Figure 5. This opening activity also presents an opportunity for the teachers to bring the activity into real life, whereas students can bring the ingredients and they can make the orange juice whilst discovering their prior knowledge aspects as they start to renew their algebraic thinking.

It is worth noting that the activities provided are not limited to the ones elaborated in the form of worksheets. There are various ways of assessing students and provoking their algebraic thinking. For instance, some activities may be made from the evaluation plan of the instructional design (formative and summative assessments).

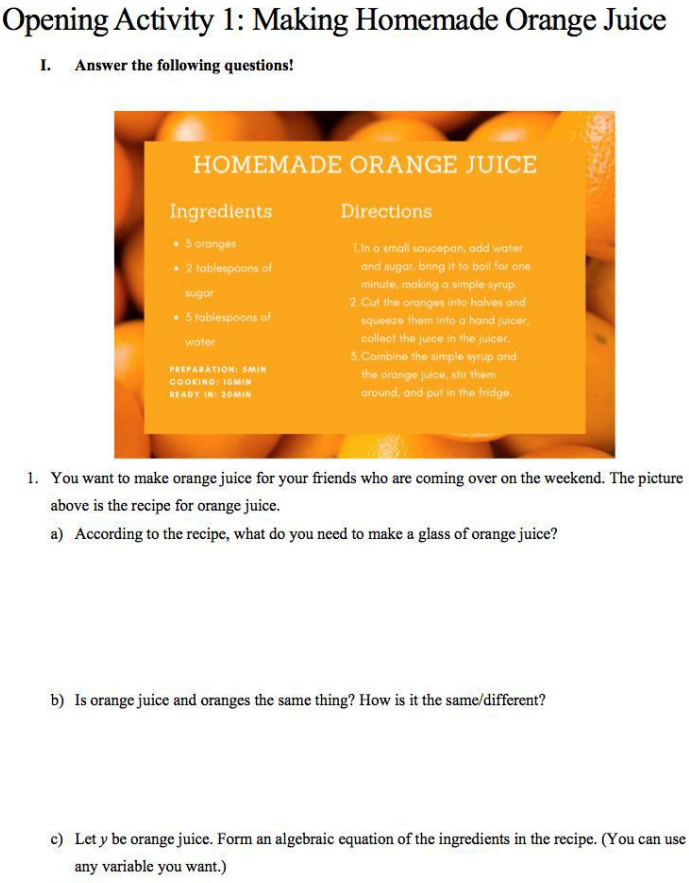

Figure 5: Opening Activity Worksheet

Evaluation

The evaluation plan is the last step in the ADDIE model for instructional designs. As the implementation stage is not conducted, the evaluation stage is not conducted as well, although planned. The evaluation will cover specifically on the learning evaluation that the students undergo during the implementation of the instructional design.

Table 3. Evaluation plan and implementation

Evaluation level	Measurement activities	Potential Implementation
Level 1 – Reaction	▪ Write, Pair, and Share: pose a problem/question related to the learning objective being taught to the classroom for students to answer on their own. Let them switch with their seatmates and let them give inputs to each others' answers. Float and check around the class, make checkmarks on a personal clipboard as assessments for each student. The notes the students make will be the data that the teacher can use to observe and assess reasoning standards coverage, especially in making and investigating mathematical conjecture. ▪ Fist to Five: for a very brief formative assessment, teachers may use this strategy every 15-30 minutes of their class to check what students are feeling towards the lesson at hand. Ask students to raise their hands, a fist represents 0, and they can put up one to five fingers to represents their understanding and how they are feeling to the topics being learned.	All lessons in the lesson plans; the activities can be done in the form of worksheets to be shared with students' seatmates (or any form of pairs that is appointed by the teacher.) All lessons in the lesson plans; fist to five is incorporated almost in every section to check the students' progress. If it is deemed as necessary, the teacher can implement
Level 2 – Learning	▪ Round Robin: students form groups and teacher provide a question for them to solve. Students form a line and taking turns answering the question periodically; teachers get to decide the answering duration of each student. Through this activity, students are revealed to rely on their friends reasoning and work on it together, which will induce the students to make and revise their own mathematical conjectures.	All lesson plans except the first can incorporate this activity. Any of the questions in the presentations can be done through Round Robin. It can also be a filler activity (additional free time). This activity is better to be implemented further along the lesson due to the types of questions that the worksheets can cover. Teacher can manipulate any form of worksheet into a mock worksheet for Be the Teacher

	▪ Be the Teacher: teacher presents a sample worksheet of an imaginary student, where there are questions answered with mistakes along the way. Ask students to mark the paper and give feedbacks to the imaginary student, telling them what they did wrong and what to fix. With this activity, students get the chance to see mistakes from an outsider perspective, which helps them to learn from the mistakes without having to experience making the mistakes. Students will also form arguments as they mark the worksheet, which will take place concurrently with gaining the ability to develop and evaluate mathematical arguments.	activity. This activity is similar to Write, Pair, and Share, but with detachment of their seatmates, hence they can be more open in terms of sharing their mathematical reasoning.
Level 3 – Behaviors/ Transfers	▪ Students' coming worksheets and unit tests transcript; teachers can see if the students utilize the previous lessons in the coming worksheets and unit tests; as students who fail to learn will commit repeated mistakes and students who did learn will be able to work on the problem that possesses previous learning objectives. ▪ Post-test: students are given a problem that incorporates the previous learning objectives taught, so teachers can see if students are able to apply what they acquire, given that they have learned it. The post-test may also include a reasoning section where students are given the chance to explain how they come up with the solution. The post-test can also be done in a form of interview, where the teacher can observe the students' train of thought, given that it is the necessary approach the	This level of evaluation is done separately of the implementation of the instructional design. This level can only be done after the instructional design is fully implemented. For second hand data, teachers can use students coming worksheets and tests, and for first hand data, teachers can create a form of post-test to measure students' improvements.

	classroom needs. This post-test evaluation can serve to measure students' reasoning standards in terms of recognizing reasoning and proof as fundamental aspects of mathematics, and in selecting and using various types of mathematical reasoning.

The author chose Model of Learning Evaluation by Kirkpatrick (1994) because it covers both formative and summative evaluation rigorously. The evaluation will further be separated into four levels, that is done in order. It will be adapted to the algebraic equations topic to further the relevance of the evaluation plan. However, since the Kirkpatrick's Model was not tailored specifically for teaching and learning mathematics, the evaluation of the reasoning standards coverage may not take place at every level of the evaluation. The evaluation plan is made to assist teachers in figuring out whether if the lesson plans have been customized to attend to the students' needs in the classroom and to improve the lesson plans at hand.

Teachers are suggested to follow all four levels, but if they deem one step to not be as necessary as the rest, it is also acceptable. This instructional design is created to make the lessons customizable and easy to follow, adapting to the varying needs of teachers to the vast types of classroom environment. Table 3 below describes examples of the activities corresponding to the levels in the evaluation plans, except level 4, as level 4 is done separately. The teachers can use these activities interchangeably in the lesson plans present in this instructional design, according to the potential implementation provided in Table 3.

CONCLUSION

In retrospect, through the development of the instructional design, the author realizes that there are always more layers to pay attention to in teaching a lesson. With that being said, it is challenging to decide upon which layer to focus on, because each seems to have their own importance. The instructional design has been made rigorous, but the author believes that it would be more meticulous if the author focused more on just one specific part of the lesson instead of attempting to broaden the coverage.

Teachers who implement this instructional design can adjust the learning activities accordingly to the needs of the classrooms through the evaluation plan and the activity design, which provides various activities ideas that teachers may implement in lieu of the previously suggested activities. If the activities are deemed to fit the teaching and learning activities, the teachers are also recommended to prolong the activity for upcoming lessons by adjusting the content while using the same learning activities. Furthermore, teachers can refer to the evaluation plan for various assessments and evaluation of the learning activities.

With regards to the structure of the lessons, it is possible to implicate more aspects of Understanding by Design, because the details of each lesson can always be made more intricate, with the assortment of strategies that is provided in Understanding by Design. In terms of the reasoning standards, there are many

interpretations that can be implemented, in which the definition of mathematical reasoning can be broadened. The breadth of this instructional design can be increased through more synthesis of various reasoning standards.

To conclude this report of the construction of the instructional design, the author will describe the overall content present. The aim of this instructional design was to address the problems identified in an international private school institution that uses English as the language of instruction, which is inability to work on algebra due to prior misunderstanding and undeveloped mathematical reasoning in grade 8 students. The author addresses this problem through the involvement of mathematical reasoning in teaching algebraic equations.

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Mathematical Problem Solving Ability in Indonesia

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Abstract

This study aims to provide knowledge and references to researchers as a basis that will be used in further research. The method used is the Systematic Literature Review (SLR), which identifies, classifies, and categorizes certain topics related to research on students' mathematical problem solving abilities in Indonesia. The data used are 33 articles that have SINTA 1 and SINTA 2 accredited criteria, such as in the journals AKSIOMA and KREANO, which were taken within the last 3 years, namely 2019 to 2021. The data are grouped into 6 discussions, namely a list of journal names, year published articles, methods used, research subjects, teaching materials used, and research results. In most articles, the most widely used research method in qualitative research methods, and the research subject is 8th grade of junior high school. It was also found that 10th grade of senior high school, 11th grade of senior high school, and 10th grade of vocational high school were also research subjects. While the material in the research is mostly found about constructing flat side spaces.

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INTRODUCTION

Problem solving in mathematics is a skill that must be possessed because one indicator of success in learning mathematics is the ability to solve problems (Dewi, 2018; Septian et al., 2021). As stated by Mulyati (2016), problem solving is one of the skills that must be mastered by students after learning mathematics. This ability is needed by students, related to the needs of students to solve the problems they face in everyday life and be able to develop themselves. Mathematical problem solving ability is a real effort in order to find solutions or ideas regarding the goals to be achieved (Koenigstein et al., 2020; Legowo et al., 2019). Mathematical problem solving ability is an ability to solve problems using appropriate procedures.

In problem solving ability, there are several steps put forward by experts. One of them is proposed by polya. The stages of problem solving based on polya steps are as follows. First, understand the problem (understanding the problem). At the stage of understanding the problem, students need to identify what is known and asked about the problems presented. Second, make a plan (devising plan). At this

stage, students need to make a strategy or plan by transforming the problem in the form of mathematical modeling. Third, carry out the plan (carrying out). At this stage, what is done depends on what has been planned in the previous stage. Fourth, check back (looking back). At this stage the things to pay attention to is to re-check the results obtained and prove that the answers obtained are correct, then conclusions are made (Rachmawati & Adirakasiwi, 2021; Son, Darhim, & Fatimah, 2020).

Research on mathematical problem solving abilities has been widely carried out in Indonesia. This is done in an effort to improve quality mathematical problem solving ability in Indonesia. There are several things that are usually investigated, such as examining the effect of a learning model on mathematical problem solving abilities, analyzing mathematical problem solving abilities, applying a model in an effort to improve mathematical problem solving abilities and others. Some examples of published research articles include, "Analysis of Mathematical Problem Solving Ability of High School Students" (Rachmawati & Adirakasiwi, 2021), "The Influence of Pair Checks Learning Model Based on Problem Submission Tasks on Students' Mathematical Problem Solving Ability" (Yuli, Siswono, & Ekawati , 2020), The Effect of Reciprocal Teaching on Mathematical Problem Solving Ability in terms of Students' Self-Efficacy" (Chotima, 2019), "Description of Mathematical Problem Solving Ability of Class VIII Students on Timss Problems in terms of Initial Ability" (Prasetyo & Ramlah, 2021), “Mathematical Problem Solving Ability in View of Gender Differences” (Lestari et al., 2021), and many more.

From the results of the literature review conducted, there are many research articles that discuss students' mathematical problem solving abilities, with various levels of education, and learning materials and methods. Research using the SLR method on problem solving abilities has also been widely used by researchers. With this, we would like to analyze and classify 33 articles that have been published in 8 mathematics education journals indexed by SINTA 1 and SINTA 2 in the last 3 years, to obtain a comprehensive classification of research on mathematical problem solving abilities of students in Indonesia using the SLR method. . However, there are some differences in research conducted by other researchers, with research conducted by us, the differences include, research conducted by other researchers has problems that are focused on one problem, while our research discusses many problems from various articles that have been published. we are looking for.

From the results of this study, researchers can contribute in providing detailed information about trends in research on the problem solving ability of students in Indonesia. The trend in question is, the research method used, the learning materials used, the learning model, the focus of the problem, the content and context used in the research.

RESEARCH METHODS

The method used is the SLR method. SLR research is carried out for various purposes, including identifying, reviewing, evaluating, and interpreting all available research with topic areas of interest to phenomena, with certain relevant research questions (Triandini et al., 2019). Systematically, the researcher collected

journal articles from SINTA 1 and SINTA 2. The keyword was Indonesian Student Mathematical Problem Solving. The articles collected were only articles published in the period 2019 to 2021. From various articles, researchers selected 33 articles that were closely related to the keywords used. The next step, articles related to Indonesian Mathematical Problem Solving are grouped into 6 discussions, namely based on a list of journal names, year of publication of articles, methods used, research subjects, teaching materials used and research results. Categorization of most/majority based on the highest number.

RESULT AND DISCUSSION

Name of Journal of Mathematical Problem Solving Ability in Indonesia List of Journal Names on Mathematical Problem Solving Ability. The highest number of articles is in the AKSIOMA Journal while the lowest number of articles is in the Journal on mathematical education and Educandum: Jurnal Pendidikan Dasar dan Pembelajaran. The highest number of articles is in the AKSIOMA Journal with 15 articles. The lowest number of articles was found in the Journal of Mathematical Education and Educandum: Jurnal Pendidikan Dasar dan Pembelajaran, each of which amounted to 1. The articles in the AKSIOMA Journal were the most because articles on mathematical problem solving abilities were mostly published in the AKSIOMA Journal. The AKSIOMA Journal discusses a lot about journals in the field of mathematics education. The following is shown in Figure 1 of the breakdown by number of publications.

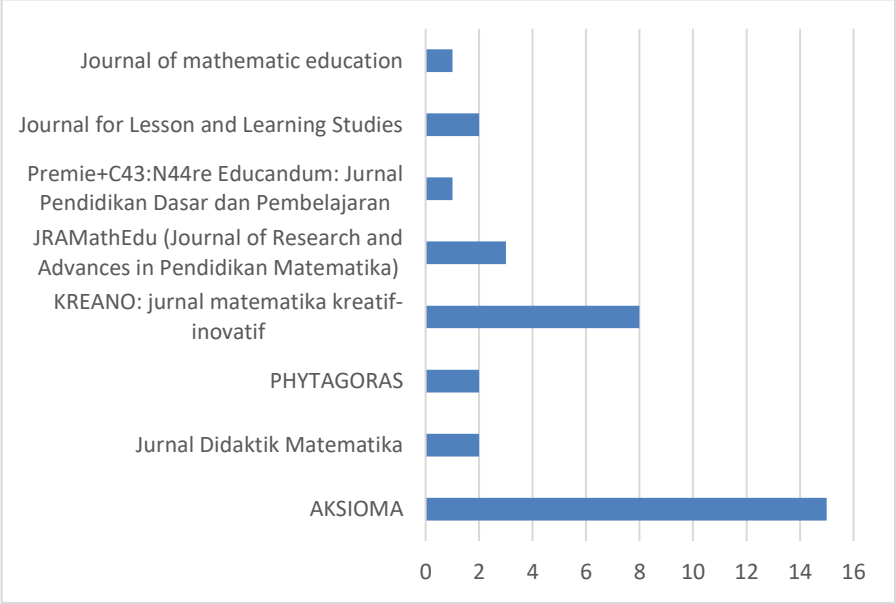

Figure 1. List of Journal Names on Mathematical Problem Solving Ability

There were 8 journals from 2019 to 2021 which did not experience an increasing decline, but there was an increase in the number of articles in 2020, the largest in AKSIOMA, Jurnal Didaktik Matematika, Kreano: Jurnal Matematika Kreatif-Inovatif, JRAMath Edu. But journal publications decreased in 2019. Journals from 2019-2021 are presented in Figure 2.

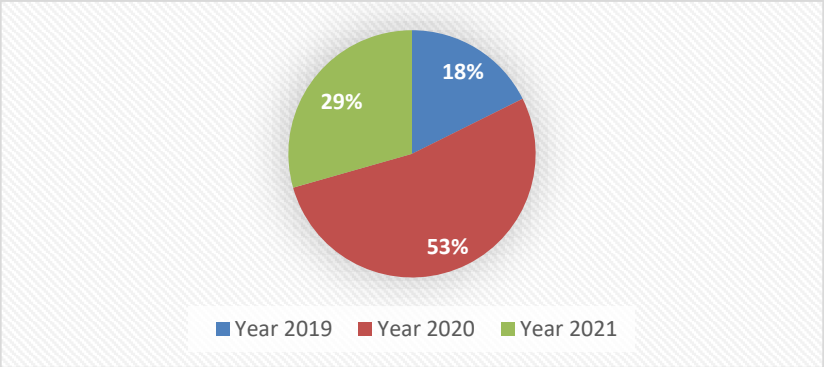

Figure 2. Year of publication of the article about Mathematical Problem Solving Ability

Many problem solving ability articles were published in 2020 because learning that started off face-to-face (offline) became online learning (online) which motivated researchers to solve various problems in education. As written in existing research, it is stated that when conducting interviews in class, students have low problem solving abilities because students are not ready to face math problems due to the lack of students' willingness to learn (Artika & Karso, 2019; Mulyasari, 2018: Septian, Inayah, et al., 2019).

The method used in the Research on the Assessment of Students' Mathematical Problem Solving Ability in Indonesia

Articles on mathematical problem solving abilities in 8 journals are the result of research using various methods. The methods used include qualitative, quantitative, experimental, descriptive, survey, research and development, and case studies.

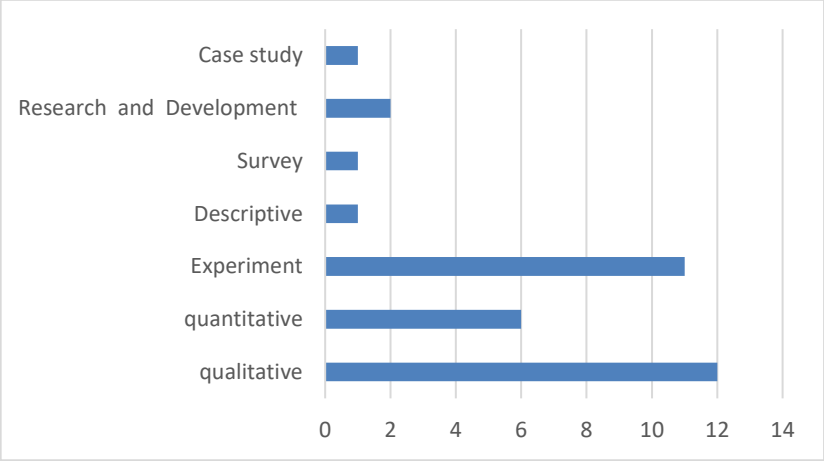

Figure 3. Methods Used in Research Mathematical Problem Solving Ability of Students in Indonesia

The data shows that most of the research on mathematical problem solving abilities using qualitative research methods reaches 12 articles. Research using qualitative methods is found in the journal AKSIOMA and Kreano, then the rest is spread in other journals. In other words, almost all journals on mathematical problem solving ability use qualitative methods. The second research method used by the researcher is the experimental method. The number of articles using the

experimental method in the AKSIOMA journal is 5 articles, Kreano is 2 articles and the others are 1 article each. The third largest research method is the quantitative method with a total of 5 articles. The fourth research method is research and development with 2 articles. The fifth, sixth and seventh largest research methods are descriptive, survey, and case studies with 1 article each. The above statement is listed in Figure 3.

Qualitative research methods are widely used in articles about research on the assessment of students' mathematical problem solving abilities in Indonesia. This is because qualitative methods allow researchers to examine selected issues, cases or events in depth and detail, facts in the form of data collections are not limited by predetermined categories. Furthermore, qualitative methods help provide rich descriptions of phenomena. Qualitative encourages understanding of the substance of an event. Thus, qualitative research is not only to fulfill the researcher's desire to get an overview/explanation, but also to help get a deeper explanation (Ardianto, 2019). Thus, in qualitative research, researchers need to equip themselves with adequate knowledge related to the problems to be researched.

Research Subjects Assessment of Students' Mathematical Problem Solving Ability in Indonesia

Articles on mathematical problem solving abilities have varied research subjects. There were 8 research subjects including fourth grade elementary school students, 7th grade of junior high school, 8th grade of junior high school, 10th grade of senior high school, 11th grade of senior high school, 10th grade of vocational high school, university students, and others mentioned. The majority of the subjects of this study were students of 8th grade of junior high school from 11 articles.

The research was dominated by 8th grade of junior high school, for example the problem found in the research conducted by Jana and Fahmawati (2020) that students' mathematical problem solving abilities were still very low. Students are still very difficult to work on problems in the form of problems. Students also have difficulty in what steps to take first to solve the problem. Then 7th grade of junior high school is contained in 6 articles. Research subjects that are rarely used are 10th grade of senior high school, 11th grade of senior high school, 10th grade of vocational high school, each of which is in 1 different article. The research subject of the Assessment of Students' Mathematical Problem Solving Ability in Indonesia can be seen in Figure 4.

The study was dominated by 8th grade of junior high school because many mathematical problems were found at the 8th grade junior high school level, for example the problems found in the research conducted by Jana and Fahmawati (2020) that students' mathematical problem solving abilities were still very low. Students still have difficulty working on problems in the form of problems (Parlina, Septian, & Inayah, 2021; Septian, Komala, & Komara, 2019). Students also find it difficult what steps to take first to solve the problem (Jana & Fahmawati, 2020). Likewise, research conducted by (Yuli et al., 2020), states that Based on preliminary studies obtained from mathematics teachers in 8th grade of junior high school that there are still many students who have not reached the KKM set by the school, which is 60.

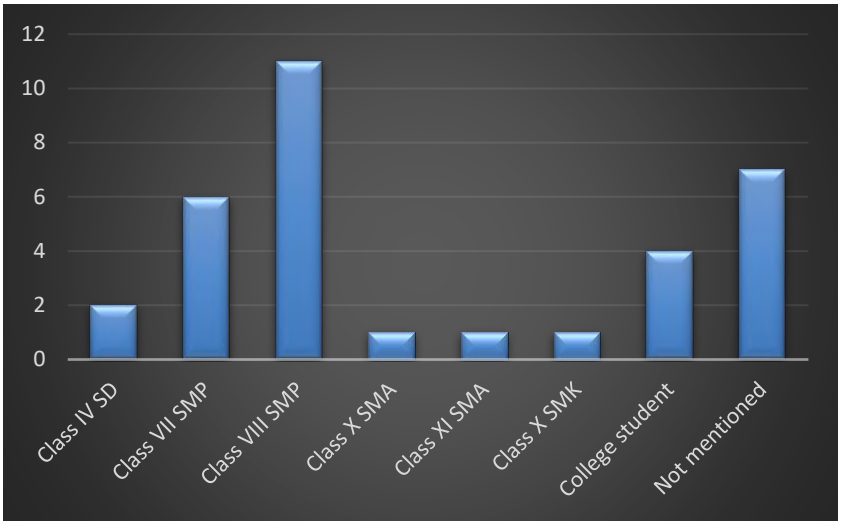

Figure 4. Research Subjects of Student Ability Assessment in Indonesia in Solving Mathematical Problems

Teaching Materials used in Research on the Assessment of Students' Mathematical Problem Solving Ability in Indonesia

The use of teaching materials in research on the assessment of mathematical problem solving abilities varies widely, namely the material of flat side shapes, trigonometry, cubes and blocks, social arithmetic, integral calculus, functions, matrices, exponentials and logarithms, elementary mathematics, number operations and geometry, pythagoras, calculus, two-variable system of linear equations, variable solving, mathematical statistics. Then the research on the assessment of mathematical problem solving abilities that used certain teaching materials amounted to 19 articles compared to those that did not mention certain teaching materials which only amounted to 14 articles.

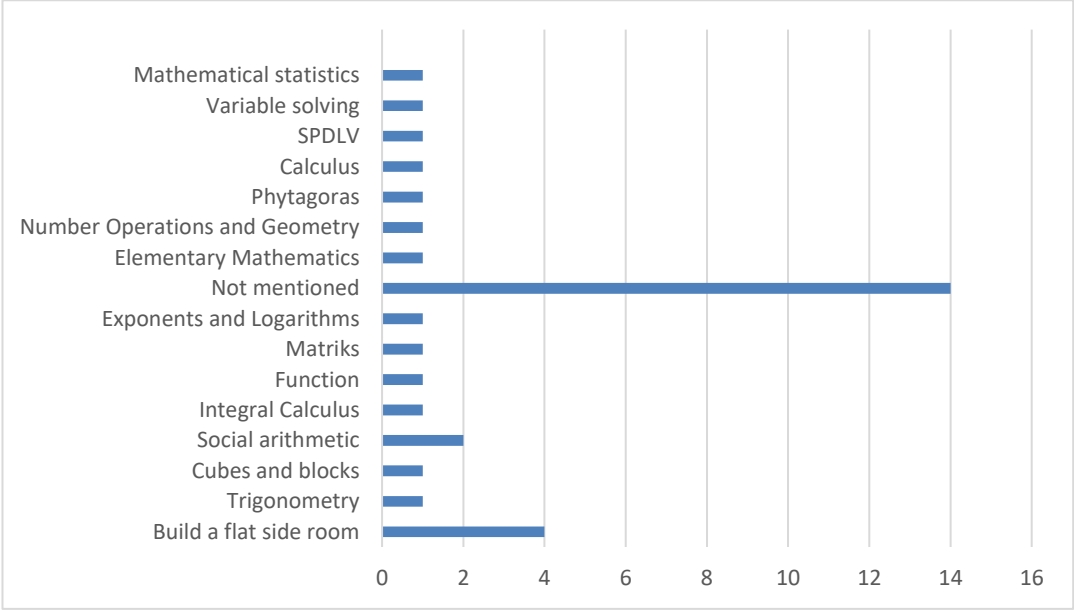

Figure 5. Teaching Materials used in Assessment Research Mathematical Problem Solving Ability of Students in Indonesia

The teaching materials used in the research on the assessment of mathematical problem solving abilities are listed in Figure 5. The material that is widely used from several articles on mathematical problem solving abilities is spatial structure, because the material is deepened in the 8th and 9th grade of junior high school. Which the researchers collected were dominated by the junior high school level. The material for building space in 8th grade of junior high school is contained in Chapter 8 concerning Constructing Flat Side Spaces, and in 9th grade of junior high school it is contained in Chapter 6 concerning Constructing Curved Side Spaces.

Research Results on Articles About Mathematical Problem Solving Ability

The results of research on articles about mathematical problem solving abilities. Most of the research results have a good influence on mathematical problem solving abilities. The results of the study showed that the ability to solve mathematical problems was low. From 33 articles there are 12 articles which show that research has a good influence on mathematical problem solving and there is 1 research article which shows that the subject has low mathematical problem solving abilities. The results of the research on the assessment of mathematical problem solving abilities in Indonesia are listed in Figure 6.

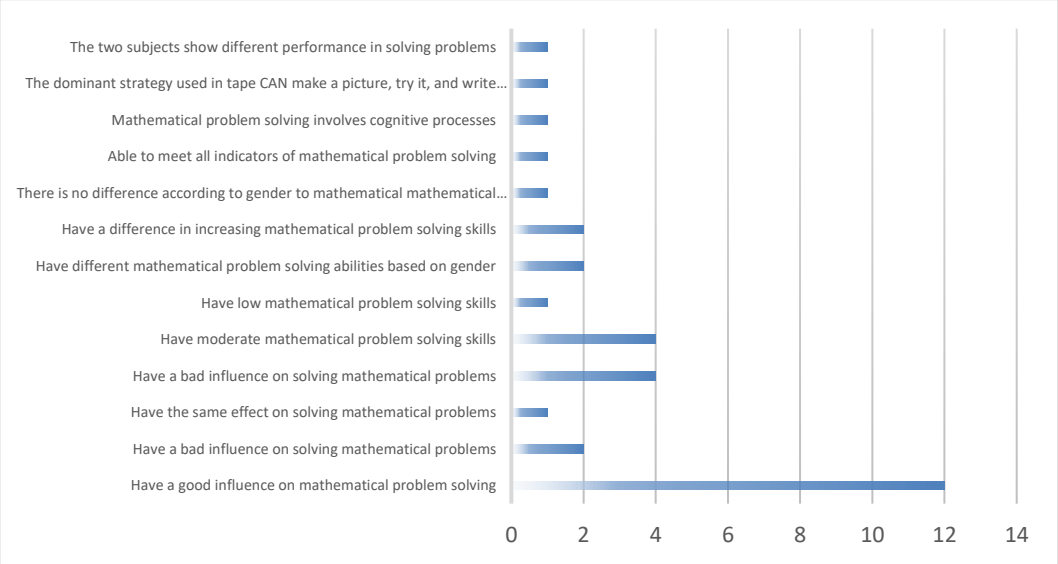

Figure 6. Assessment Research Results
Mathematical Problem Solving Ability in Indonesia

The results show that the mathematical problem solving ability that has been studied has a good effect on various school circles, especially for Junior High School students, as seen in the research conducted by Nuraini, Maimunah, and Roza (2020), stating that based on the analysis of the results of the validity and practicality of the research This is a mathematics learning tool in the form of Syllabus, RPP, LKPD and Mathematical Problem Solving Ability Problems in the Problem Based Learning model that have met the valid and practical criteria, so it is stated that these devices can be used in learning mathematics on social arithmetic material.

Research Articles on Assessment of Student Mathematical Problem Solving Ability in Indonesia during 2019-2021

A total of 33 research articles on mathematical problem solving abilities in Indonesia from 8 journals accredited by the Science and Technology Index (SINTA) which assess the performance of journals based on accreditation and citation standards, by indexing all national journals that have been accredited by the National Journal Accreditation (ARJUNA). All published journals must be available online or have an E-ISSN (online ISSN) so that articles can be searched, can be checked transparently, especially related to plagiarism or so that there is no overlap in scientific development, and improve reading power (journals are proven to have attractiveness to read and cite).

CONCLUSION

Researchers have summarized the 33 articles listed in the table, then grouped them into 6 discussions, namely a list of journal names, year of publication of articles, methods used, research subjects, teaching materials used and research results. Most of the articles on research on mathematical problem solving abilities were found in the journals AKSIOMA and KREANO, with the most widely used research method being qualitative research methods. The majority of the research subjects were 8th grade of junior high school, but it was also found that 10th grade of senior high school, 11th grade of senior high school, 10th grade of vocational high school were also the subjects of this research. Most of the materials used in the research on the assessment of mathematical problem solving abilities in Indonesia are flat-sided shapes. The results of this study can serve as information and reference material for researchers as a basis that will be used in further research.

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The Learning Process with Contextual Approach to Improve Students' Motivation and Mathematics Learning Achievement

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Abstract

The aim of this study was to describe the learning process with a contextual approach to improve motivation and Mathematics learning achievement on Integer topic for seventh grade students of State Junior High School 1 Bonggo in the 2019/2020 academic year. This research was conducted in the seventh grade of State Junior High School 1 Bonggo, Sarmi Regency, Papua Province. The Classroom Action Research (CAR) was used as the research method. The research object involved the whole process of implementing Mathematics learning with a contextual approach to improve motivation and Mathematics learning achievement of seventh grade students of State Junior High School 1 Bonggo, Sarmi Regency, Papua Province. Based on the research results, the Mathematics score of pre-cycle to cycle I improved from 50.4 to 67.2, in cycle II it improved further to 79.4. Meanwhile, the motivation in Mathematics learning obtained pre-cycle score of 65.8, cycle I score of 70, and cycle II score of 91. It is advised that teachers should use the CTL learning method on other subjects to improve students' motivation and Mathematics learning achievement.

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INTRODUCTION

The implementation of Mathematics learning in the classroom is still concerning, both in terms of the students learning process and the teacher learning method. Mathematics is famous as a hard subject. Students view Mathematics as a frightening enemy for them. They always assume that Mathematics is always synonymous with bad grades (Setiyaningrum & Istiqomah, 2015). Thus, teachers are required to be more creative in choosing interesting learning methods with the objective of making it easier for students to comprehend the material being delivered and the learning objectives can be achieved. It is therefore important for teachers to use active learning methods, where they are no longer the center of learning. Teacher-centered learning tends to make students learn concepts in the abstract without going through the use of the concepts or without experiencing it. This will result in low students' achievement (Kesuma, 2010). Students' achievement serves as an indicator of changes in students after experiencing the teaching and learning process. From the learning achievement, it can be seen

whether students understand or comprehend the subject matter (Astuti & Istiqomah, 2015).

Teacher-centered learning was also implemented at State Junior High School 1 Bonggo, Sarmi Regency, Papua Province. The teacher used expository method, in which the teacher conveyed the material first using lecture method and then continued with practice questions as well as questions and answers session. At the end of the lesson, students were given individual assignment. The use of the expository method in Mathematics learning for seventh grade on Integer material had not produced maximum results. It could be seen from the students' learning achievement in the even semester of the 2018/2019 academic year averaged 53.57, lower than the Kriteria Ketuntasan Minimum (KKM) score of 64 for Mathematics. There were still many students who had not achieved the minimum criteria, amounting to 22 students (51.52%) out of 43 students. Another problem was that there were students in seventh grade students of State Junior High School 1 Bonggo, Sarmi Regency, Papua Province who were not yet fluent in reading and writing, so they found it difficult to understand the mathematics topic being delivered.

The results of preliminary observation conducted on seventh grade students of State Junior High School 1 Bonggo, Sarmi Regency also showed that their motivation in Mathematics learning was very low. This could be observed from the number of students who were late when they joined the class, when given assignments they did it slowly, when asked to come in front of the class they felt embarrassed or could not answer the questions. These had proven that their motivation was in even lower state. Learning motivation can arise because of intrinsic factors in the form of desire to succeed as well as encouragement of learning needs and expectations of ideals (Khamid & Santosa, 2016).

Mathematics learning is currently still teacher-centered, while students are still considered as objects in learning that must be given teaching materials. This way, the existing learning becomes less meaningful because it is only delivered without adequate understanding and learning experience. Actually, teacher-centered learning has begun to be abandoned. Teachers begin to use active learning methods where students are invited to create, investigate, and express ideas in the classroom. Students' activeness is a very important element in determining learning success (Silberman, 2006). Student-centered learning is expected to improve the students' understanding of the material. The use of appropriate learning methods will be able to help both teachers and students in the teaching and learning process. Teachers will be facilitated in delivering the material and students will be facilitated in understanding the material; these two together have a great effect on improving learning achievement. Given the characteristics of the classroom that tend to be crowded when the teachers deliver the material, the majority of students being passive when asked to express their opinions, and students being unafraid when they get low grades, a good learning approach that can be used to improve students' learning motivation is needed. The use of a certain learning approach greatly influences students' learning motivation. The use of such approach is expected to overcome boredom in learning which results in improved students' motivation.

A learning approach that can be implemented by teachers is the Contextual Teaching and Learning (CTL). The contextual approach is able to link the material taught by the teachers with real-world situations faced by the students (Masni, 2016). The implementation of contextual approach can improve students' life skills,

concept understanding, achievement, and learning quality. The reason is because the contextual learning approach is oriented towards solving daily life problems that can trigger critical, logical, and creative thinking processes. Therefore, students will have the ability to become problem solvers (Mulhamah & Putrawangsa, 2016).

Several previous research have proven the effectiveness of learning using the CTL approach compared to conventional approach, the results show that the CTL-based learning model can improve students' learning motivation, teacher skills in developing CTL-based learning models, and student learning experiences compared to the use of monotonous conventional learning models such as lecturing (Hidayati & Purwantini, 2017; Khamid & Santosa, 2016; Saepuloh, 2014). It is in line with the opinion of Sulianto (2012) that the CTL learning approach in elementary school Mathematics learning can improve critical thinking as a way of understanding material deeper and better, which is quite strategic in improving the professional quality of Mathematics teachers. Several research also have shown that CTL-based learning models in lessons can improve students' achievement (Agustyaningrum & Widjajanti, 2016; Gita, 2007; Nababan, 2018; Narendrati, 2017; Selan, Amsikan, & Klau, 2020).

Based on the aforementioned explanation, a question was identified whether giving feedback on exercises and tests would affect students' achievement. Therefore, the researchers were encouraged to conduct a research related to the problem. The purpose of this research was to describe the learning process with a contextual approach to improve motivation and achievement in Mathematics learning on Integer material for seventh grade students of State Junior High School 1 in the 2019/2020 academic year.

RESEARCH METHODS

This research was conducted in seventh grade students of State Junior High School 1, Sarmi Regency, Papua Province. The research took place in the odd Semester of the 2019/2020 academic year, from July 2019 to December 2019. This Classroom Action Research (CAR) followed a procedure which consisted of planning, action, observation, and reflection. The research subjects were seventh grade students of State Junior High School 1, Sarmi Regency, Papua Province in the 2019/2020 academic, amounting to 31 students. The research object was the whole process of implementing Mathematics learning with a contextual approach to improve motivation and Mathematics learning achievement for seventh grade students of State Junior High School 1, Sarmi Regency, Papua Province.

The research instruments consisted of test of Mathematics learning achievement and questionnaire of motivation. The mathematics learning achievement tests in cycle I and cycle II each consisted of 15 multiple choice questions, while the questionnaire consisted of 10 statements. The research data were in the form of qualitative data; the student's score motivation from questionnaire and the student's score of achievement from the tests. After the data were collected, they were described and analyzed using the following equation.

$$P = \frac{F}{N} \times 100\%$$

Description: P = percentage number, F= frequency of activities conducted, and N = number of activities conducted. Meanwhile, to find out students' test results, the following equation was used.

$$\overline{X} = \frac{\sum X}{N}$$

Description: $\overline{X}$ = the average score, $\sum X$ = the sum total score of all students, N = the total number of students.

The indicator for the success of this research is the increase or improvement in the average score of students' motivation and Mathematics learning achievement from a cycle to the next cycle by at least 3 points. While the percentage of completeness reached 75% of students who met the minimum completeness criteria (KKM) of 70.

RESULT AND DISCUSSION

This research involved two different cycles. The following session describes the stages in cycle I.

1. Planning

This planning stage began with preparing lesson plan (RPP), student worksheets, evaluation questions, learning media, and other resources related to Integer topic based on the CTL model. The teacher prepared everything needed in the delivery of the subject matter. The teacher also made some observations and documentations.

2. Action

At this stage, the teacher carried out learning process that lasted for 70 minutes (2×35 minutes). The activity began with setting the students down. After the students were ready and orderly, the teacher started delivering the material. The next activity was to form groups and explain group working, with 1 group consisted of 4 students. After the groups were assigned, the teacher distributed tasks that must be completed through group discussion. After group discussion, one of the students presented the results of their group work. After that, the students returned to take the cycle I evaluation test.

3. Observation

At this stage, the teacher made some observations regarding the unconducive classroom situation, monitored students' motivation while attending lessons, paid attention to students' attitude when someone was presenting in front of the class. The students then prepared to take individual test.

4. Reflection

At this stage, the teacher performed reflection on the learning implementation with a contextual approach. This was done to determine the level of success in learning. Based on the test and questionnaire results after learning using a contextual

approach, there was an improvement in students' learning motivation from pre-action to cycle I action, but the improvement had not met the indicators of success in this research. Therefore, it was necessary to do cycle II.

The score data on pre-cycle and cycle I of Mathematics learning achievement are presented in Table 1.

Table 1. Data of Mathematics Learning Achievement in Pre-cycle and Cycle I

Detail	Pre-cycle	Cycle I
Average	50,4	67,2
Highest	93,8	90
Lowest	18,8	40
Incomplete	83,9%	71,9%
Complete	16,1%	28,1%

Based on Table 1, it can be seen that the average score in pre-cycle was 50.5 and the average score of cycle I was 67.2, still below the KKM (70). The percentage of students who reached KKM in pre-cycle was 16.1% and in cycle I was 28.1%. The low achievement percentage in cycle I was because the learning method used was relatively new to the students, they were not familiar yet with group discussions, so that students could not work together well when discussing the answers.

Meanwhile, data on students' learning motivation showed an improvement between pre-cycle to cycle I, namely motivation at pre-cycle was 65.8% and improved in cycle I to 70%. Based on the observation during learning, there were some students who still looked disinterested in learning. This was evidenced by the students playing with their markers or putting their heads on the table.

In cycle II learning activities, the researchers prepared similar implementation as in cycle I. However, this time the researchers provided more motivation and guidance to the students. The following describes the stages of cycle II.

1. Planning

At this stage, the researchers and the teacher determined and prepared the material to be taught in cycle II based on SK and KD continued from cycle I. Then we prepared lesson plan and learning media, student worksheets, and modules using the CTL model, and prepared the questionnaire of learning motivation.

2. Action

The lesson lasted for 70 minutes (2×35 minutes) at 08.10 to 09.20. The earning activities began with setting the students down. After the students were ready and orderly, and ready to take part in learning, the teacher greeted and checked their attendance. After that, the teacher provided apperception by asking questions and motivating students by explaining the benefits of integers in everyday life, and after that conveying the learning objectives. In the next activity, students explored their knowledge by reading integer material text books. In this activity, the researchers conducted a direct experiment using marbles media, then the students tried to work on the questions. In the next activity, students were assigned into 6 groups and then performed group discussion to solve the questions and then presented the results of the discussion in front of the class. At that time, the researchers provided

reinforcement about the material being studied by students. After that, the students returned to take cycle II evaluation test.

3. Observation

At the observation stage of cycle II, the preparation was better, more optimal, the classroom atmosphere was more conducive, as seen from the high enthusiasm of the teacher and the students. In managing time more effectively, learning activities according to plans and objectives could be achieved.

4. Reflection

In this stage, the researchers and teachers reflected on the actions of cycle II to determine the success of learning. Based on the questionnaire result after implementing the CTL model in learning, there was an improvement in students' learning motivation in Mathematics from cycle I to cycle II. This improvement has made them reaching the indicator of success in this research. Based on the observation, the quality of the mathematics learning process by applying the CTL model in this seventh grade improved from cycle I to cycle II. This could be seen from the successfulness of activities done by the teacher and the students in learning. The teacher in applying the CTL model had carried out activities in accordance with the prepared lesson plan. The students as objects in this research had also experienced improved motivation to learn. This could be seen from their enthusiasm in participating in learning. In addition, the class conditions were also calmer and conducive on cycle II action. Based on the reflection above, it can be concluded that classroom action research was sufficient and unnecessary to be continued to the next stage.

The data on the value of the second cycle of mathematics learning outcomes can be seen in Table 2.

Table 2. Data of Learning Achievement in Cycle II

Detail	Score
Average	79,4
Highest	100
Lowest	62,5
Incomplete	19,35%
Complete	80,65%

Based on Table 2, it can be seen that the average Mathematics learning achievement in cycle II was 79.4, which has increased from cycle I by 12.2 points. The highest score was 100 and the lowest score was 62.5. While the percentage of completeness reached 80.65%.

From the data collection results starting from pre-cycle to cycle II, the data on Mathematics learning achievement after using the CTL method can be presented as shown in Figure 1.

Based on Figure 1, it can be seen that the average score from one cycle I to another has kept improving. This was because the students were more enthusiastic in participating in learning, even when working on evaluation questions, students did not give up easily because they knew the correct problem solving technique.

When making presentations in front of the class, the students were seen as more confident.

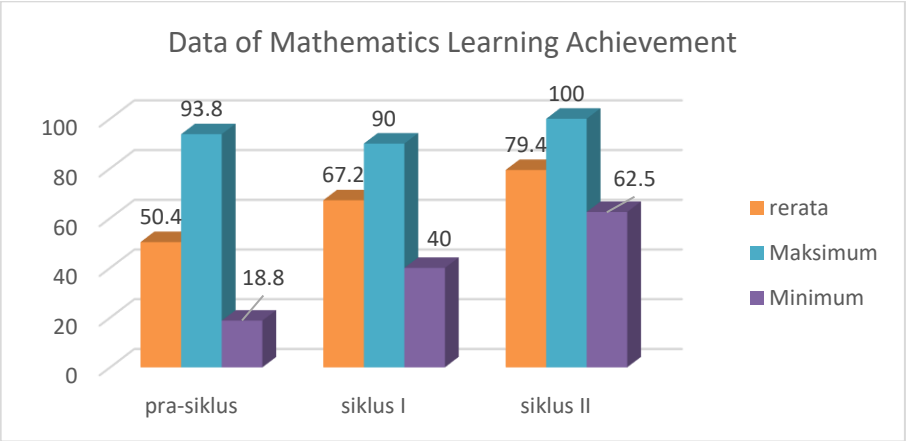

Figure 1. Comparison of Mathematics Learning Achievements

The results of this research are in accordance with several previous research, showing that CTL-based learning model in lessons can improve students' achievement (Agustyaningrum & Widjajanti, 2016; Gita, 2007; Nababan, 2018; Narendrati, 2017; Selan et al., 2020).

It is expected that by applying the CTL approach, it can further improve the motivation and achievement for seventh grade students of State Junior High School 1 Bongo. The data regarding students' learning motivation from pre-cycle to Cycle II are presented in Table 3.

Table 3. Data on Student's Learning Motivation in Pre-cycle, Cycle I, and Cycle II

Detail	Cycle Stage		
	Pre-cycle	Cycle I	Cycle II
Average	65,8	70	91,0
Highest	72,0	78	100,0
Lowest	58,0	62	78,0
Percentage of Students' Learning Motivation Optimization	65%	73%	100%

Based on the data obtained from pre-cycle to cycle II, it was revealed that there was improvements in students' motivation in learning Mathematics. The average score in pre-cycle was 65.8, cycle I was 70, and cycle II was 91. From this data, it was obvious that there was improvement from pre-cycle to cycle II by 21 points (38.3%). The highest score at pre-cycle was 72, cycle I was 78, and cycle II was 100, so it can be seen that from pre-cycle to cycle II there was improvement by 28 points (38.3%). The lowest score in pre-cycle was 58 and in cycle II was 78, it can be emphasized that there was improvement from pre-cycle to cycle II by 20 points (20%). The percentage of motivation optimization at pre-cycle stage was 65% and in cycle II was 100%. Thus, it can be emphasized that there was improvement from pre-cycle to cycle II by 35%. The improvement in students' learning motivation is

because students felt comfortable with learning in cycle II and were already familiar with the activities carried out in the learning process. Students knew correctly the importance of motivation in learning, this was solely for the good of students in developing their current and future knowledge.

This research supports several previous research by Khamid and Santosa, (2016); Hidayati (2012); and Saepuloh (2014) stating that the CTL-based learning model in lessons can increase students' learning motivation.

From the results of data collection from pre-cycle to cycle II, data on the progress of teacher observations in learning are presented in Table 4.

Tabel 4. Teacher Observation Data on Learning in Pre-cycle, Cycle I, and Cycle II

Detail	Cycle Stage		
	Pre-cycle	Cycle I	Cycle II
Percentage of Teacher Observation in Learning	47,1%	57%	90%

Based on the data obtained from pre-cycle to cycle II, the teacher's progress in learning was 47.1% in pre-cycle, 57% in cycle I, and 90% in cycle II. These data shows that there was improvement from pre-cycle to cycle II by 42.9%. Thus, the results of teacher observations in learning revealed improvement.

From the results of data collection starting from pre-cycle to cycle II, the data on the progress of the teacher's observations in class preparation for learning are presented in Table 5.

Table 5. Teacher Observation Data on Class Preparation for Learning in Pre-cycle, Cycle I, and Cycle II

Detail	Cycle Stage		
	Pre-cycle	Siklus I	Pre-cycle
Percentage of Teacher Observation in Class Preparation for Learning	54%	60%	96%

Based on the data obtained from pre-cycle to cycle II, the improvement of the teacher in class preparation for learning was obtained, in pre-cycle by 54%, in cycle I by 60%, and in cycle II by 96%. From these data, it shows that there was improvement from pre-cycle to cycle II by 42%. Thus, the results of teacher observations in preparing the class for learning showed improvement.

CONCLUSION

Based on the research results conducted at State Junior High School 1 Bonggo of Papua by using two CAR cycles, which is the learning process using a contextual approach to improve students' motivation and achievement on integer material, the following three conclusions can be drawn.

First, based on the learning process the purpose of implementing learning is to increase learning motivation and learning achievement in Mathematics. The

implementation of learning is carried out in two cycles, each cycle consists of 2 meetings. Each cycle uses 4 stages that have been planned in classroom action research, namely: planning, observation, action, and reflection. The learning process using the contextual approach is carried out well in accordance with the learning steps.

Second, based on the results of learning, the improvement in students' mathematics learning achievement can be seen in the average score of students in each cycle, namely the pre-cycle average score of 50.4, cycle I average score of 67.2, and cycle II average score of 79.4. So it can be concluded that the implementation of contextual approach can improve Mathematics learning achievement for seventh grade students of State Junior High School 1 Bonggo of Papua.

Third, based on the motivation to learn Mathematics. The improvement in students' motivation can be seen from the average percentage obtained from the questionnaire; pre-cycle learning motivation of 65.8%, cycle I learning motivation of 70%, and cycle II learning motivation of 91%. So it can be concluded that the implementation of a contextual approach can improve the motivation to learn Mathematics for seventh grade students of State Junior High School 1 Bonggo of Papua.

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Analysis of Students Learning Ethics in Online Learning via Zoom in Mathematical Communication Ability at Senior High School Bunda Kandung Jakarta

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Abstract

This research is based on the results of observations of class X IIS regarding student's mathematical communication in online learning ethics via zoom. Initial findings indicate that mathematical communication skills have emerged but are not optimal. In general, the research objective is analyzing student's online learning ethics via Zoom in mathematical communication. The method used is descriptive qualitative method to reveal facts. The data are collected through observation, interviews, documentation and triangulation/combination. This study involved three students from class X IIS and the teacher as a validator at Senior High School Bunda Kandung. The data analysis technique uses an interactive model through four stages, which are data collection, data reduction, data display, and drawing conclusions/ verification. The results showed that student's learning ethics via zoom on student's mathematical communication skills for subjects 1 and 2 were optimal because subjects 1 and 2 were able to communicate, express ideas, manage thoughts, analyze and evaluate mathematical thoughts. However, subject 3 has not been optimal in communicating their mathematical thoughts coherently and clearly. Subject 3 is unable to analyze his thoughts and unable to behave well with his friends.

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INTRODUCTION

Currently, the demand for book-based literacy is getting lower and moving to online platform. This phenomenon is further exacerbated by the outbreak of the COVID-19 pandemic. Recommendations from the government to work from home and study from home force everyone to do anything independently in order to keeping their distance and avoiding crowds. This effort was made by the government to stop the spread of the Corona virus.

The era of revolution 4.0 is a sign of real scientific progress (Harahap, 2019), where progress is followed by advance technology developments (Trisna, 2019), and requiring us to not only understand (Lina, Ulfatin, & Sultoni, 2021), but also follow the flow (Haqqi & Wijayati, 2019). Distance Learning (DL) is a form of adjustment in the education sector during the COVID-19 pandemic to keep learning process continues (Latip, 2020; Saifulloh & Dervish, 2020). Technology is the key

to the sustainability of distance learning which can connect teachers and students who are separated by distance (Zam, 2021). However, the existence of technology will become useless if it is not accompanied by tech-savvy user (Latip, 2020).

Mathematics class include an activity in learning mathematics that is well structured so that students get better knowledge about mathematics (Putra, 2016). Someone who has the ability to understand mathematics is required to be able to communicate it properly and correctly so that it can be understood by others. This is not easy to do during the offline period and getting harder during the online period. There are several important reasons that make communication necessary to be the focus of attention in learning mathematics, one of them is 'mathematics as language' (Saputro, Masrukan, & Agoestanto, 2017).This shows the importance of studying mathematics in building the ability to think, reason, solve problems, communicate, and connect mathematics to the real situation.

One of learning failure factor's is due to obstacles in the communication process between students and teachers (Budiman, 2016). The selection of the right media is important in order to maximazing the transfer of knowledge from teachers to students so that students not only hear what the teacher says, but also see the process which is in line with Hikmah, Roza, and Maimunah's (2019) research on analysis of student's mathematical communication skills.

The use of learning media at the learning orientation stage will greatly help the effectiveness of the learning process and the deliver of messages and lesson content at that time. One of the goals in learning mathematics is providing the widest opportunity for students to develop and integrate communication skills through modeling, speaking, writing, talking, drawing, and presenting what has been learned (Collins, 1995). Through mathematical communication, students should be able to express their mathematical ideas in solving problems (Gordah & Nurmaningsih, 2016)

In the online education era, students are subjects and objects of education who need guidance from others to direct them, develop their potential and guide them to maturity. Students must be able to behave well when dealing with the teacher.

Learning Ethics

Ethics is the knowledge of what is good and what is bad, of moral rights and obligations (Abadi, 2016). A collection of principles/values relating to morals and values regarding to right and wrong that followed by society (Tanyid, 2014). Actions and predicates of ethical values, both are an inseparable unit (Wijaya, 2018). It's required an action that can be observed and researched to assess the value because "values" do not float in a vacuum, but toward the object of experience (Ismail & Aryati, 2020). In relation to ethical values, actions are used as material for reviewing the placement/application of one's ethical values. If it is likened, value is the basis and form, while action is the content. As a basis and form, it can only be understood clearly, if the content is included along with the action. The combination of ethical values and actions as its implementation produces something called morals or decency. Thus, the subject of ethics can not be separated from "actions" as "content" from the basis and form (values) (Ismail & Aryati, 2020).

This fact places ethics as a knowledge that talks about good and bad, but it is different from other normative form which are character and morals. Character is the science of good and bad based on God's revelation, if it is Islam then the source

is the al-Quran and as-Sunnah which is universal and absolute (Hardiono, 2020). While morals are good and bad based on the size of tradition and culture that are temporal, relative, and dynamic (Wathoni, 2020). Ethics is used to provide considerations and assessments of human attitudes and behavior both individually and in groups, so that commonly accepted values and norms can be rationally accounted for, and it does not even rule out the emergence of new values and norms because the previous norms did not have a strong basis.

Mathematical Communication Ability

Communication is something that can not be separated from human life. Humans need communication in order to conveying ideas, opinions, and finding information related to things they want to know. Humans are not able to interact, get to know each other, seek knowledge, and draw conclusions if there is no communication. Therefore, the ability to do something that each individual is capable of. This ability is commonly considered as potential.

In education, every student must develop their abilities because abilities develop in accordance with better education. One of the mathematical abilities that must be developed by students is communication skills because communication is important in mathematics education. This agrees with Turmudi's (2009) statement that communication is an essential part of mathematics and mathematics education/class. This is a way to share ideas and clarify understanding. The communication process helps establish the meaning and completeness of ideas and makes them public.

Student's mathematical communication skills are student's abilities in communicating mathematical thoughts clearly in correct and easy-to-understand language to friends, teachers, and others (Abdi & Hasanuddin, 2018). Student with good mathematical communication skills will be able to explain ideas, situations, and mathematical relations orally or in writing with real objects, pictures, graphs, and algebra to make conjectures, develop arguments, formulate definitions and generalize conjectures, compose arguments, formulate definitions, and generalization (Niasih, Romlah, & Zhanty, 2019). To have good mathematical communication skills, students must be able to represent, listen, read, discuss and write in learning activities (Lanani, 2013).

Online Learning via Zoom

The difference between conventional learning and distance learning is that in a conventional class, the teacher is considered as all-knowing person and is assigned to transfer knowledge to students. While in distance learning the main focus is students. Students are independent at certain times and are responsible for their learning. The atmosphere of e-learning will "force" students to play a more active role in their learning process (Arifin & Herman, 2018). Students make plans and look for materials with effort and on their own initiative. For example, learning through zoom meet. Zoom meet is one of the face-to-face conference platforms where teachers and students can interact directly like offline face-to-face meeting (Kusmiati & Lie, 2021). On this application, there are many features ranging from file sharing in PDF format that can be done easily, offers the facility to join with just a link or room number, and also includes two-way live broadcast lectures, online courses are becoming very popular because they save time and travel costs,

fuel costs, and their impact on the environment, low financial costs and offer great webinar experience, allows to write and talk together through the process. Zoom can be used in educational options and for community-based discussions (Abdillah, 2020).

RESEARCH METHODS

This study uses a qualitative approach which is descriptive qualitative research in specific. The qualitative research proposed by Moleong (2010) that defines qualitative methodology as a procedure in research that produces descriptive data in the form of written or spoken words from people and observable behavior. This research was conducted at Senior High School Bunda Kandung, South Jakarta, with a sample of class X-IIS with three students in that class. The data is collected through observation, interviews, documentation and triangulation or a combination of the three students. Data analysis or interpretation is the process of systematically searching for and compiling records of research findings through test observations, observation sheets, interview guidelines and documentation. The data analysis techniques in this study were data collection, data reduction, data display and conclusion/verification drawing. The purpose of analysis is to increase the researcher's understanding of the focus points studied and make findings for others, edit, classify, reduce and present them.

RESULTS AND DISCUSSION

Based on the results of data analysis, the 3 research subjects coded with S1-S3. The recapitulation is presented below. In this study, there were obstacles in student's mathematical communication skills which is poor communication between teachers and students. The following Table 1 is the results of mathematical communication skills recapitulation.

This invention is in accordance with research conducted by Ariawan and Nufus (2017) that students who are subjects in the low ability category get a low score, the medium ability category gets an average score and the high ability category gets a high score as well. Students who have high abilities have opportunities, encouragement, and support for speaking, writing, reading, and listening in mathematics classes reap dual benefits: they communicate to learn mathematics, and they learn to communicate mathematically (NCTM, 2000).

In the online period, students must discipline themselves by respecting time because when online learning is carried out, students still have to prepare everything so that it remains on time. It shows student's learning ethics, as the results of the analysis are summarized in Table 2.

Using polite language. Polite language is not only applied in the video call learning process, but also used in the learning process through chat or other media or when asking the teacher. This finding is in accordance with research conducted by Qori (2020) that learning and teaching must be based on ethics which is the regulator of action and the good & bad in teaching and learning. Students must have ethics to their teacher who has given them an outpouring of knowledge so that they can become a useful human being, this ethical attitude to the teacher is our respect for what the teacher has given.

Table 1. Recapitulation of Mathematical Communication Ability Results

Indicator	Code	Findings and Analysis		
		Test	Interview	Observation
Communicating mathematical thoughts	S1	Capable to write the process of completion	Capable to explain in an organized manner but a little error	Capable to answer questions properly and correctly
	S2	Quite capable to write down the completion process	Quite capable	Capable to answer
	S3	Capable to write but takes too long to communicate mathematical thinking	Quite capable	Quite capable
Using mathematical discussion to express ideas appropriately	S1	Capable to generate ideas	Capable	Quite capable in learning process
	S2	Capable to generate ideas	Capable	Quite capable
	S3	Quite capable to come up with ideas	Quite capable	Less fortunate
Analyze and evaluate the mathematical thoughts and strategies of others	S1	Capable to generate ideas	Capable	Quite capable in learning process
	S2	Capable to generate ideas	Capable	Quite capable
	S3	Quite capable to come up with ideas	Quite capable	Less fortunate

Table 2. Recapitulation of Learning Ethics Results

Indicator	Code	Findings and Analysis
Attitude	S1	Capable to listen and understand the teacher who explains materials using online media platform (via zoom).
	S2	Quite capable to listen and understand the teacher who explains materials using online media platform (via zoom).
	S3	Less capable to listen and understand the teacher who explains materials using online media platform (via zoom).
Courtesy	S1	Capable to be polite when meeting with teachers in digital media and friendly to their colleagues.
	S2	Capable to be polite when meeting with teachers in digital media and listen to the advice of teachers.
	S3	Capable to be polite when meeting with the teacher in digital media, but not really responsive in greeting the teacher.
Behavior	S1	Always reprimand his friends for being careless, causing harm to me and always asking the teacher when they don't understand the explanation of the material.
	S2	Occasionally reprimand his friend for being careless, causing harm to me and always asking the teacher when he didn't understand the explanation of the material.
	S3	Lack of interaction in reprimanding his friend for being careless, causing harm to me and being silent when he didn't understand the explanation of the material (not asking the teacher).

CONCLUSION

Ethics is a philosophical reflection on values and morals that are held, carried out diligently in life, and become the basis for behaving and acting. Therefore, ethics must be taught and inculcated from childhood. Meanwhile, bad ethics must be corrected since the bad things begins to appear. Students who are not familiar with many activities in online learning will easily commit ethical violations. Therefore, it is necessary to form study groups to familiarize students with communicating with their friends. Therefore, they will not feel burdened and think that it is a natural activity. Students, especially at the high school level, find it easier to understand learning in a fun way compared to being given a lot of assignments.

Mathematical communication ability for subject one with high ability is able to meet four indicators of mathematical communication ability, subject two with moderate learning ethic is also able to meet four indicators of mathematical communication skills and subjects with low mathematical communication skills are only able to meet two indicators of oral mathematical communication skills.

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The Relationship of Offline Learning with Discrete Mathematics Learning Interests After the Pandemic

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Abstract

This article aims to determine the relationship between offline learning and interest in learning discrete mathematics after the pandemic. The research method used is quantitative. The sampling technique in this study used purposive sampling. Data collection in this study used a questionnaire with a Likert scale of 1 to 5. The variables in this study consisted of variable X, namely offline learning and variable Y, namely interest in learning. Each variable consists of 4 indicators. The result of this research is that there is a relationship between offline learning and students' interest in learning in discrete mathematics courses of 0.801. So it can be said that the relationship between offline learning and learning interest is very strong. This is because in offline learning students can interact directly with the lecturer so that discrete mathematics material that has not been understood can be directly asked during learning. Offline learning can also encourage interest in learning so that students are more enthusiastic and enthusiastic about participating in discrete mathematics lectures.

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INTRODUCTION

During the COVID-19 pandemic, students and students are encouraged to study online because it reduces interactions between teachers and students in order to minimize disease transmission. However, online learning has several weaknesses, according to Sadikin and Hamidah (2020) the weakness of online learning is the absence of direct supervision during the learning process and a weak internet network. Since the end of 2021 until the beginning of 2022, the transmission of the corona is getting weaker and the sickness is also decreasing, so schools and campuses are advised to implement offline learning even though it is not yet 100%. So learning is done by combining offline learning and online learning.

Offline learning is learning outside the network, Ambarita, Jarwati, and Restanti (2021) states that offline learning is learning that is done offline or learning that is not connected to the internet, one of which learning can be done face-to-face. Malyana (2020) said that offline learning is a face-to-face learning system or a learning system that can be done directly. Suhendro (2020) states that offline learning can be done using the home visit method. From several opinions,

it can be concluded that offline learning is a direct interaction between teachers and students or between lecturers and students.

According to Nengrum et al. (2021) offline learning has several advantages, namely in the learning process, students are more effective and enthusiastic in participating in lessons and teachers can explain the material directly and thoroughly, namely being able to explain on the blackboard using markers. Ketaren, Kanca, and Lesmana (2021) said that offline learning can be studied directly where the results can be directly evaluated by the teacher. Based on the opinions about offline learning that have been put forward by Nengrum et al. (2021) and Ketaren et al. (2021), the offline learning indicators used in this study are 1) student responses, 2) discrete understanding mathematics courses with offline learning, 3) Materials can be delivered completely and directly by educators to students, 4) use of facilities and infrastructure such as blackboards, projectors, classrooms and adequate markers in providing material.

According to Lestari (2014), interest in learning is an internal drive that grows from within students to improve study habits, one of the factors that can foster interest in learning is when students want to get the best grades. According to Yunitasari and Hanifah (2020) there are several ways to foster student learning, namely by providing positive motivation so that students are enthusiastic about learning and by paying attention to students when learning takes place. From several existing opinions, it can be concluded that interest in learning is one of the important factors in the form of students' willingness or desire to get good learning outcomes.

Research conducted by Wahyuniar et al. (2021) has 4 indicators of interest in learning, namely feelings of pleasure in learning, concentration of attention and learning thoughts, willingness to learn, willingness from within to actively learn. Friantini and Winata (2019) states that there are 5 indicators of student interest in learning, namely 1) feelings of pleasure towards learning, 2) concentration of mind and attention in the learning process, 3) willingness to learn, 4) willingness from within to learn actively, 5) efforts made to realize the desire to learn.

Research conducted by Wahyuniar et al. (2021) found that online learning has an influence on students' interest in learning in discrete mathematics courses. Research that has been conducted by Putra, Juniawan, and Atzmi (2021) shows that students' interest in learning is higher when learning is done offline than online.

During the pandemic, learning is recommended to be done online. Familiarizing learning online during the pandemic turns out to be correlated with student interest in learning, one of which is that students tend to be more passive and encounter many obstacles during online lectures. But gradually, students feel comfortable with online learning because they are used to this situation. After the pandemic period, re-learning is carried out offline, where lecturers can interact directly with students and students can also directly ask questions that are not yet understood. If offline learning is re-applied, it is not yet known whether students still have an interest in learning, considering that online learning has been going on for approximately 4 semesters. Therefore, the purpose of this study was to find out how strong the relationship between offline learning and interest in learning discrete mathematics in discrete mathematics courses was after the pandemic.

RESEARCH METHODS

This research is a type of quantitative research. This research was conducted by applying offline learning to the Discrete Mathematics course in Informatics Engineering Study Program class 1B, 1C, 1D, 1E and 1F.

The subjects of this study were students of level 1 of the Mathematics Study Program, namely grades 1B, 1C, 1D, 1E and 1F and the population used was 232 students. The sampling technique used in this research is purposive sampling. According to Sugiyono (2011), purposive sampling is a sampling technique by determining certain criteria. In this study, 3 criteria were used, namely 1) Male, 2) The final score of the discrete mathematics course was ≥ 80, 3) Students who did not work. The three criteria were taken because 1) in the Informatics Engineering study program the majority of students are male, 2) according to Lestari (2014), one of the factors that can foster interest in learning are students who have high or best scores and 3) the third criterion that taken are students who do not work, this is because students who have not worked only focus on lectures, if students are already working the priorities are different and interest in learning is very low. From the predetermined criteria, 51 students were obtained as samples in this study.

Table 1. Questionnaire indicators

Variable	Indicator	Statement Items
Offline Learning (X)	a. Student response	2
	b. Understanding discrete mathematics courses with offline learning methods	2
	c. The provision of material can be delivered completely and directly by educators to student	2
	d. Facilities and infrastructure	2
Interest in Learning (Y)	a. There is a feeling of pleasure towards discrete mathematics courses	2
	b. There is a concentration of attention and thought on discrete mathematics	2
	c. Willingness to learn discrete mathematics	2
	d. There is a willingness from within to actively participate in discrete mathematics lectures	2

Data collection techniques in this study were observation and questionnaires. Observations are made to find out how much students want to study in discrete mathematics courses. Questionnaires are used to collect data taken from respondents/students. The questionnaire contains statements about offline learning and students' interest in learning. The questionnaire used a Likert scale of 1 to 5, then the questionnaire was distributed to the students who were sampled.

The instrument test in this study used a validity test and a reliability test to see that the instrument was valid and reliable. The data analysis technique in this study used a correlation test. The data analysis tool in this study used SPSS version 22.

Variables in this study include variable X and variable Y. Variable X is offline learning with 4 indicators. Variable Y in this study is interested in learning with 4

indicators and each indicator of each variable consists of 2 statement items. The indicators for each variable are presented in Table 1.

RESULTS AND DISCUSSION

Data were collected from questionnaires that had been filled out by 51 students who were set as samples. Then the data is processed using SPSS 22 to test the validity, reliability and correlation test.

Validity Test

The validity test was obtained from the results of a questionnaire regarding offline learning and student interest in learning which was then processed using SPSS version 22.

Table 2. Validity of offline learning (X)

Statement Number	Correlation Value	Correlation Probability	Information
1	0,770	0,000	Valid
2	0,733	0,000	Valid
3	0,703	0,000	Valid
4	0,652	0,000	Valid
5	0,784	0,000	Valid
6	0,587	0,000	Valid
7	0,719	0,000	Valid
8	0,517	0,000	Valid

(Source: SPSS 22 output results)

Then the data results are presented in the form of Tables 2 and 3 below. Potu (2013) states if the correlation probability (significant level) is less than 0.05 (5%), then the statement/questionnaire is said to be valid, otherwise if the correlation probability (significant level) is more than 0.05 then the statement/questionnaire is said to be invalid.

Table 3. Validity of learning interest (Y)

Statement Number	Correlation Value	Correlation Probability	Information
1	0,758	0,000	Valid
2	0,709	0,000	Valid
3	0,832	0,000	Valid
4	0,861	0,000	Valid
5	0,658	0,000	Valid
6	0,540	0,000	Valid
7	0,442	0,000	Valid
8	0,880	0,000	Valid

(Source: SPSS 22 output results)

Table 2 shows the results of the validity of the variable X (Offline Learning) with 8 statement/questionnaire items. The results of the validity test obtained from

Table 2 show that statements number 1 to statement 8 are declared valid because the correlation probability (significant level) is less than 0.05.

Table 3 shows the results of the test of the validity of the Y variable (Learning Interest) with 8 statement/questionnaire items. The results of the validity test obtained from Table 3 show that statements number 1 to statement 8 are declared valid because the correlation probability (significant level) is less than 0.05. Because all statement items in the questionnaire were declared valid, the next step was a reliability test to find out whether the questionnaire was reliable.

Reliability Test

Sugiyono (2013) states that the reliability test is the extent to which the measurement results using the same object will produce the same data. An instrument is said to be reliable if the Cronbach's Alpha value obtained is more than 0.70. As stated by Riyadi and Mulyapradana (2017), an instrument is said to be reliable if it gives Cronbach's Alpha value is more than 0.7. The results of the reliability test are presented in Table 4.

Table 4. Reliability test

Variable	Number of items	Cronbach's Alpha	Information
Offline Learning (X)	8	0,831	Reliabel
Interest Learning (Y)	8	0,865	Reliabel

(Source: SPSS 22 output results)

Table 4 shows that the results of the reliability test for variable X (offline learning) and variable Y (student interest in learning) obtained Cronbach's Alpha is more than 0.7, so it can be said that both variables are reliable and deserve to be tested for correlation.

Correlation Test

To find out the relationship between offline learning methods and students' interest in learning in discrete mathematics courses, correlation analysis was used. Astuti (2017) states that correlation analysis is used to measure the closeness of the relationship between two variables regardless of the affected variable or the influencing variable and how much influence one variable has on other variables. Two variables can be said to have a relationship/correlation if there is a change in one of the variables and the other variables will follow regularly in the same direction (positive correlation) or opposite (negative correlation).

Table 5. Interpretation of correlation coefficient

Coefficient Interval	Relationship Level
0.00	No Connection
0.00 – 0.25	Very Weak Correlation
0.25 – 0.50	Enough Correlation
0.50 – 0.75	Strong Correlation
0.75 – 0.99	Very Strong
1	Perfect Correlation

(Source: (Sarwono, 2009))

To determine the size of the correlation found in this study, it is necessary to have the same interpretation guidelines. Table 5 shows the interpretation of the correlation coefficient.

The following will be presented in Table 6. regarding the results of the correlation test between the X variable (offline learning) and the Y variable (interest in learning).

Table 6. The results of the correlation test of offline learning and learning interest

X Variable	Y Variable		Coefficient Interval
Offline Learning	Interest Learning	Correlation	0.801
		Significance	0.000

(Source: SPSS 22 output results)

The results from Table 6 show that the correlation/relationship between variable X (offline learning) and variable Y (student interest in learning) is 0.801 with a significance value of 0.000, which means that the relationship between the two variables X and Y is very strong. These results refer to Table 5 regarding the interpretation of the correlation coefficient, where if the interval coefficient/correlation value is between 0.75-0.99, it can be said that the relationship between variables is very strong. So it can be said that offline learning has a strong relationship with students' interest in learning, especially in discrete mathematics courses.

This study is in line with research conducted by Putra et al. (2021) which obtained the results that students' interest in learning was very high when learning was carried out offline. The similarity with this study is that they both use the offline/offline learning model as the independent variable and use learning interest as the dependent variable, besides that students' interest in learning is very high if learning is carried out offline/offline. The difference is that the research conducted by Putra et al. (2021) on the independent variables used in addition to the offline/offline learning model also uses online learning, then the test used in the study Putra et al. (2021) is a different test, while in this research this is using correlation test.

Research conducted by Laili et al. (2021) concludes that the correlation coefficient is 0.45, so it can be said that the relationship between offline learning and interest in learning is in the moderate category. The similarity with this study is that they both use the offline learning model as the independent variable and use learning interest as the dependent variable, besides that the offline learning model also has a relationship with students' interest in learning. The difference is that the research conducted by Laili et al. (2021) on the independent variables used in addition to the offline learning model also uses online learning, besides that the correlation value/relationship between offline learning and learning interest is 0.45 while in this study the correlation value is 0.801. Then the tests used in the study Laili et al. (2021) were correlation and regression tests, while in this study only correlation tests were used.

Research conducted by Mardiati et al. (2021) concluded that students' interest in learning with the offline learning model was higher than students' interest in learning during online learning. The similarity with this study is that they both use the offline learning model as the independent variable and use learning interest as

the dependent variable, besides that the offline learning model produces high learning interest. The difference is that the research conducted by Mardiati et al. (2021) on the independent variables used in addition to the offline learning model also uses online learning, so the test used in the study Mardiati et al. (2021) is a different test, while in this study using correlation test.

Based on the correlation results obtained, the relationship between offline learning and student interest in learning is very strong. It can be seen that during offline learning, students can interact directly with the lecturer so that discrete mathematics material that has not been understood can be directly asked during learning. In addition, lecturers can also freely convey material, because the material can be explained directly on the blackboard or through PowerPoint, so that students can more easily understand discrete mathematics material. Offline learning can also encourage students' interest in learning to be more enthusiastic, enthusiastic and active in participating in discrete mathematics lectures.

CONCLUSION

Based on research that has been conducted to determine how strong the relationship between offline learning and interest in learning discrete mathematics after the pandemic, it can be concluded that the relationship between offline learning and student interest in learning in discrete mathematics courses is very strong with the correlation value obtained is 0.801.

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