MATHEMATICAL LITERACY OF HIGH SCHOOL STUDENTS IN SOLVING PISA MODEL PROBLEMS VIEWED FROM REFLECTIVE AND IMPULSIVE COGNITIVE STYLES

THESIS

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SURABAYA STATE UNIVERSITY
POSTGRADUATE
MATHEMATICAL EDUCATION S-2 STUDY PROGRAM
2021

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THESIS

Submitted to Postgraduate Program at Surabaya State University
to Fulfill Part of the Requirements in Obtaining a Master of Education Degree
in the Mathematics Education Masters Study Program

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2021

AGREEMENT

Thesis by Astrie Pratiwi Damayanti, NIM 18070785008, entitled Mathematical Literacy for High School Students in Solving PISA Model Questions in terms of Reflective and Impulsive Cognitive Styles has met the requirements and approved to be tested

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Surabaya, 1September 2021

Mengatahui

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ABSTRACT

Damayanti, Astrie Pratiwi. 2021. High School Students' Mathematical Literacy in Solving PISA Model Problems in View of Reflective and Impulsive Cognitive Styles. Thesis, S2-Mathematics Education Study Program, Postgraduate Program at Surabaya State University, Advisor: (I) Prof. Dr. Dwi Juniati, M.Sc. and (II) Dr. Susanah, M.Pd.

Key Words: Mathematical Literacy, PISA, Reflective and Impulsive Cognitive Style.

This research is a qualitative descriptive study that aims to describe the mathematical literacy of high school students in cognitive, reflective and impulsive styles in solving PISA model questions.

Cognitive style tests Matching Familiar Figure Test (MFFT) and Mathematical Ability Test (TKM) were used to select research subjects. One student was selected each with a reflective cognitive style and one student with an impulsive cognitive style with equal mathematical abilities and the same sex. The results of the Mathematical Literacy Test (TLM) and test-based interviews were used to collect data on students' mathematical literacy. Time triangulation was used to test the credibility of the findings obtained. Data analysis techniques include data reduction, presentation, and drawing conclusions.

The results of the study show that the mathematical literacy of students with reflective cognitive style (RJ) in solving PISA uncertainty and data model problems (uncertainty and data) when formulating, identifying the information needed in solving problems in the form of information obtained and looking for from the problem in more detail and use their own sentences as well as implied from the results of the test. Representing the concept or material related to the problem, namely the average concept or material and changing the problem into the appropriate mathematical symbol or model. When employing (implementing), designing and using strategies in the process of finding solutions using addition and multiplication rules. Apply facts, procedures, concepts and mathematical reasoning to find solutions using addition and multiplication rules. When interpreting, reinterpreting the mathematical results obtained into contextual problems and stating the correctness of the answer by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

Mathematical literacy of students with reflective cognitive style (RJ) in solving PISA space and shape model problems when formulating, identifying the information needed in solving problems in the form of information obtained and looking for from the problem in more detail and using their own sentences as well as written from the results of the test. Representing the problem mathematically into concepts or material related to the problem, namely

trigonometry concepts or material as well as converting questions into appropriate mathematical symbols or models. When employing (implementing), designing and using strategies in the process of finding solutions using trigonometry. Apply facts, procedures, concepts, and mathematical reasoning to find solutions using the trigonometry formulas sin α and cos α. When interpreting, reinterpreting the mathematical results obtained into contextual problems and stating the correctness of the answer by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

Mathematical literacy of students with impulsive cognitive style (IS) in solving PISA uncertainty and data model problems (uncertainty and data) when formulating, identifying the information needed in solving problems in the form of information obtained and sought from questions. Representing questions into concepts or material related to the questions, namely statistical concepts or materials and changing questions into appropriate mathematical symbols or models. When employing (implementing), designing and using strategies in the process of finding solutions using addition and multiplication rules. Apply facts, procedures, concepts and mathematical reasoning to find solutions using addition and multiplication rules. When interpreting (interpreting), reinterpret the mathematical results obtained into contextual problems and state the correctness of the answers by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

Mathematical literacy of students with impulsive cognitive style (IS) in solving PISA space and shape model problems when formulating, identifying the information needed in solving problems in the form of information obtained and sought from questions. Representing into a related concept or material i.e. Pythagorean concept/matter, but IS tends to guess at it. IS does not change the problem into the appropriate mathematical symbols or models. When employing (implementing), not designing and using strategies in the process of finding solutions. Does not apply facts, procedures, concepts, and mathematical reasoning to find solutions. When interpreting, it does not solve the problem so that it does not reinterpret the mathematical results obtained into contextual problems.

ABSTRACT

Damayanti, Astrie Pratiwi. 2021. Mathematical Literacy of High School Students in Solving PISA Model Problems Viewed from Cognitive Styles of Reflective and Impulsive. Thesis, Mathematics Education Study Program, Postgraduate of State University of Surabaya, Supervisor: (I) Prof. Dr. Dwi Juniati, M.Sc. and (II) Dr. Susanah, M.Pd.

Keywords: Mathematical Literacy, PISA, Cognitive Style of Reflective and Impulsive.

This research is a qualitative descriptive study that aims to describe the mathematical literacy of high school students viewed from a cognitive style of reflective and impulsive in solving the PISA model questions.

The Matching Familiar Figure Test (MFFT) and Mathematical Capability Test (TKM) are used to select the subject of research. Selected each of the students from the cognitive style reflective and impulsive with equal mathematical abilities and the same gender. The results of the Mathematical Literacy Test (TLM) and test-based interviews were used to collect students' mathematical literacy data. Time triangulation is used to test the credibility of the findings obtained. Data analysis techniques include data reduction, presentation, and drawing conclusions.

The results showed that the reflective cognitive style (RJ) students' mathematical literacy in solving uncertainty and data when formulating, identify the information needed in solving problems in the form of information obtained and sought from the question in more detail and using its own sentence and implied from the results of the test. Representing concepts or material related to the problem, namely the average concept or material and converting the problem into the appropriate mathematical symbol or model. When employed, design and use strategies in the process of finding solutions using addition and multiplication rules. Applying facts, procedures, concepts, and mathematical reasoning to find solutions using addition and multiplication rules. when interpret, reinterpret the mathematical results obtained into contextual problems and believe the answers by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

The mathematical literacy of students with reflective cognitive style (RJ) in solving space and shape problems when formulating, identify the information needed in solving problems in the form of information obtained and sought from the questions in more detail and using their own sentences and Explicit from the results of the test. Represent the problem mathematically into concepts or materials related to the problem, namely the concept or material of trigonometry and change the problem into the appropriate mathematical symbol or model. When employing, designing and using strategies in the process of finding solutions using trigonometry. Applying facts, procedures, concepts, and mathematical reasoning to find solutions using the

trigonometric formulas sin α and cos α. When interpreting, reinterpreting the mathematical results obtained into contextual problems and trusting the answers by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

The mathematical literacy of cognitive impulsive students (IS) in solving uncertainty and data questions when formulating, identify the information needed in solving the problem in the form of information obtained and sought from the problem. Representing questions into concepts or material related to the problem, namely statistical concepts or materials and converting questions into appropriate mathematical symbols or models. When employing, design and use strategies in the process of finding solutions using addition and multiplication rules. Applying facts, procedures, concepts, and mathematical reasoning to find solutions using addition and multiplication rules. When interpreting, reinterpreting the mathematical results obtained into contextual problems and states that they believe the answer by providing supporting arguments.

The mathematical literacy of cognitive impulsive students (IS) in solving space and shape problems when formulating, identify the information needed in solving the problem in the form of information obtained and sought from the problem. Representing related concepts or materials, namely Pythagorean concepts/materials, but IS tends to guess at this. When employed, do not design and use strategies in the process of finding solutions. Not applying facts, procedures, concepts, and mathematical reasoning to find solutions. When the interpreter does not solve the problem so he does not reinterpret the mathematical results obtained into contextual problems. Does not explain and provide logical arguments why the mathematical results obtained are acceptable.

FOREWORD

Praise be to the presence of God Almighty for all His blessings, Inayah, Taufik, and guidance, the writer was able to complete this thesis without significant obstacles. The thesis entitled "Mathematical Literacy of High School Students in Solving PISA Model Problems in View of the Reflective-Impulsive Cognitive Style".

The purpose of preparing this thesis is to fulfill the requirements to achieve a master's degree in the Masters in Mathematics Education, Postgraduate Faculty, State University of Surabaya. The author realizes that in the preparation of this thesis received assistance and guidance from various parties. The author's thanks go to:

1. Prof. Dr. Dwi Juniati, M.Sc. as supervisor I who patiently spends time, energy and thoughts to provide guidance in the preparation of this thesis.
2. Dr. Susanah, M.Pd., as supervisor II who patiently spent time, energy, and thoughts to provide guidance in the preparation of this thesis.
3. Dr. Agung Lukito, MS, Dr. Janet T Manoy, M.Pd., Dr. Endah B Rahaju, M.Pd., as the board of examiners who patiently provided input and guidance in improving this thesis
4. Mr. and Mrs. teaching lecturers of the Masters in Mathematics Education Study Program who have provided knowledge while the writer was studying at Surabaya State University.
5. All staff of the Postgraduate Faculty of Surabaya State University.
6. Drs. Slamet Budi Santoso, MM, as Acting Principal of SMA Negeri 12 Surabaya who has given permission to conduct research at the school.
7. Mrs. Iin Nafi'ati,S. Pd, teacher of mathematics in class X IPA 5 SMAN 12 Surabaya who has helped carry out the research.

8. My beloved parents and sister who have provided moral and material support so that this research can be completed
9. Class X IPA 5 SMA Negeri 12 Surabaya who have set aside their time to help carry out this research.
10. All fellow students of the Mathematics Education Study Program who have provided motivation and enthusiasm during the preparation of the thesis.

As well as those who have helped, which the writer cannot mention one by one in this thesis.

The writer realizes that the preparation of this thesis is still far from being perfect. Therefore, the authors expect constructive criticism and suggestions to become a reference in preparing the author for a better future. Thank You

Surabaya, 25 May 2021

Writer

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CHAPTER I

INTRODUCTION

A. Background

The development of the times can certainly bring changes to every aspect of life. Every change that occurs must be able to be addressed wisely, so that it has a positive impact on society. One aspect that is definitely experiencing change is education. Education in Indonesia is currently focusing on 4 main things as an effort to improve in order to be able to compete in the times. These four things are character education, literacy, 4C competence, and higher order of thinking skills (HOTS). The Ministry of Religion of West Nusa Tenggara explained that the latest revised 2018 edition of the 2013 curriculum learning plan must bring up and contain four points, namely strengthening character education (PPK), literacy, 4C competence, and higher order of thinking skills (HOTS) (Rubianingsih, 2018). Literacy itself is categorized in several ways. One of the literacy that is taken into account in the world of education is mathematical literacy or can be called mathematical literacy. NCTM has stated that the objectives of learning mathematics consist of five competencies namely mathematical problem solving, mathematical communication, mathematical reasoning, mathematical connection, and mathematical representation. Making, 1998). Capabilities that include these five competencies can be poured into mathematical literacy (Tasyanti, 2018). Ojose (2011, p. 90) argues that "mathematics literacy is the knowledge to know and apply basic mathematics in our every day living". This statement means that mathematical literacy is a knowledge possessed by individuals to understand and use mathematics in life. According to Mahdiansyah & Rahmawati (2014) individuals can use their mathematical logic to solve problems life problems and make the right decisions based on mathematical and constructive thinking patterns if you have good mastery of mathematical literacy.

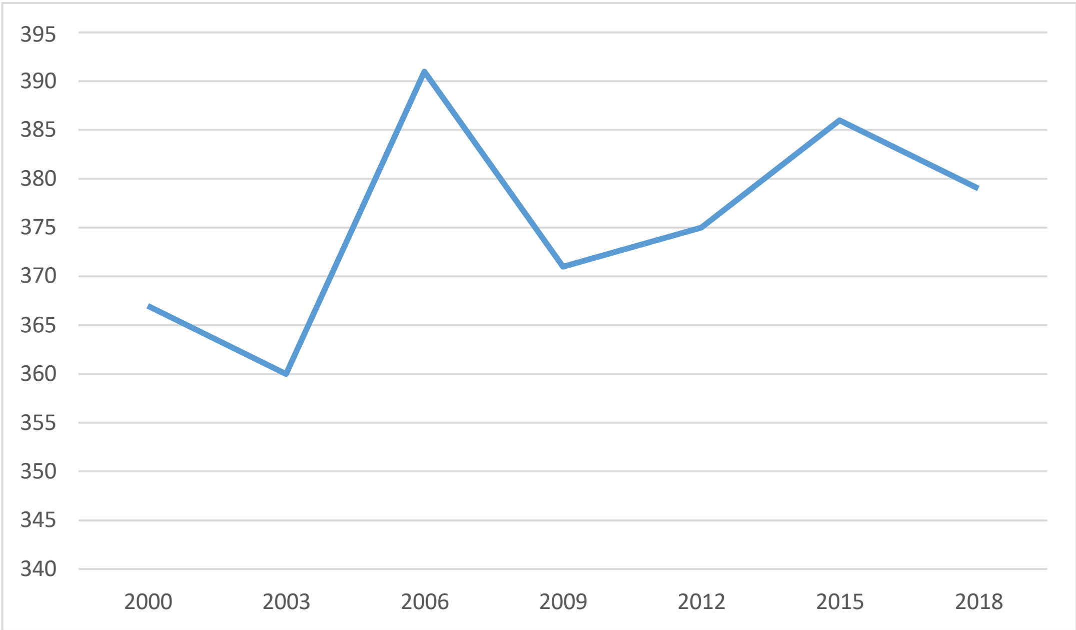
Mathematical literacy is also one of the skills needed in 21st century competition. This is in accordance with the opinion of Pratama & Saputro (2018), namely "The ability of mathematical literacy is indispensable to students in facing 21st-century competition" (p. 3). This statement means that in facing the competition of the 21st century it is very important for students to have good provisions, one of which is mathematical literacy ability. Mathematics national exam questions have included mathematical literacy content since the 2013/2014 school year (Rifai & Wutsqa, 2017). In 2020 it was decided to replace the national exam with a minimum competency assessment, however the Ministry of Education and Culture (2020) stated that the minimum competency assessment was inspired by the PISA assessment and the questions are also attached to PISA. One of the areas assessed in PISA is mathematical literacy. If students and teachers master mathematical literacy well, it is hoped that students can work on national exam questions and complete PKM related to mathematical literacy properly and correctly. Zainiyah & Marsigit (2018) state that in order to grow and improve math skills, students and teachers must master mathematical literacy well. “Mathematical literacy plays an important role as one of life skills. It is a fundamental skill which is as necessary as literacy Marsigit (2018) states that in order to grow and improve math skills, students and teachers must master mathematical literacy well. “Mathematical literacy plays an important role as one of life skills. It is a fundamental skill which is as necessary as literacy Marsigit (2018) states that in order to grow and improve math skills, students and teachers must master mathematical literacy well. “Mathematical literacy plays an important role as one of life skills. It is a fundamental skill which is as necessary as literacy.(Sumirattana, et al., 2017, p. 307). This statement means that mathematical literacy plays an important role as one of the basic skills that must be mastered by students.

There is an international scale assessment as a benchmark for students' mathematical literacy. One of them is the Program for International Student Assessment (PISA). Wardono & Kurniasih (2015) stated that there were 4 areas assessed in the PISA study, namely mathematical literacy, reading literacy, scientific literacy, and financial literacy. Mathematical literacy is one of the components assessed in PISA. Indonesia itself has followed PISA ever since 2000. Following are the details of the results of mathematical literacy in PIA obtained by Indonesian students.

Table 1.1
Achievement of Indonesian Students' Mathematical Literacy Results in PISA

Year	Average rating	Amount Countr y	Score highest	Score average Lowest	Score average Indonesia
2000	39	41	560	292	367
2003	38	40	550	356	360
2006	50	57	549	311	391
2009	61	65	496	331	371
2012	64	65	613	368	375
2015	63	70	564	328	386
2018	74	79	591	340	379

The results in the table above are summarized by the author from the PISA results published by the OECD in 2001, 2004, 2006, 2010, 2014, 2016, and 2019b. Mansur (2018) stated that the achievement of mathematical results on a good PISA assessment will also indicate good mathematical literacy, because the achievement of mathematical results in PISA can be referred to as mathematical literacy. Through this table, we can see the low achievement of Indonesian students' mathematical literacy. Indonesian students took part in the exam seven times, but were still ranked in the bottom 10. In addition, the achievements of Indonesian students' mathematical literacy are still going up and down. Even in the last PISA assessment, namely in 2018, Indonesian students experienced a decline. This can be seen clearly through the following graph:



Graph 1.1
Achievement of Indonesian Students' Mathematical Literacy Results in 2000-2018

However, in several other international-scale mathematics activities such as the Olympics, Indonesian students obtained good results and were quite proud of them. These results are shown by the many awards that Indonesia has won in international-level mathematics Olympiads such as the International Mathematics Olympiad (IMO). The Ministry of Education and Culture (2019) stated that the Indonesian team managed to win six medals at IMO 2019 consisting of one gold medal, four silver medals and one bronze. This achievement made Indonesia rank 14th out of 110 participating countries. Rifai (2016) stated that seeing the success of Indonesian students in IMO with a larger number of participants compared to the PISA study, it is reasonable to suspect that Indonesian mathematical literacy skills will be able to compete with other participants. However, the results of the PISA study which we have discussed above, show that the mathematical literacy of Indonesian students is still low. Thus it is necessary to carry out further studies regarding mathematical literacy.

As an educator, the teacher should pay attention and try to increase students' mathematical literacy in order to make a contribution positive for the achievement of exam results and everyday life. Teachers must make mathematical literacy one of their focuses in the learning process. However, Ovan & Nugroho (2017) stated that the majority of teachers focus on basic competencies (KD), so they are less than optimal in developing students' mathematical literacy. Rifai & Wutsqa (2017) also stated that mathematical literacy is still a foreign thing for most teachers and students, so it is very natural that students' mathematical literacy is still not developing. The various opinions above indicate the importance of mastering and understanding mathematical literacy for teachers and students and the problems that occur. Through good mastery and understanding of mathematical literacy, it is hoped that it will be beneficial for the development of students' mathematical skills,

Assessment of mathematical literacy to see an overview of students' mathematical literacy, can be done using the PISA model questions. According to Mansur (2018) to find out students' mathematical literacy, an assessment can be carried out using PISA questions. Therefore, in this study the PISA model questions will be used to obtain data and an overview of students' mathematical literacy. PISA model questions include processes, content, and contexts that exist in PISA. The process includes formulating, implementing, and interpreting. Context includes personal, social, work, and knowledge. Content includes numbers, space and form, change and relationships as well as uncertainty and data (OECD, 2019a). If the content of the material is adapted to school mathematics or the curriculum in Indonesia, then class IX SMP students will receive teaching for all of these materials. Therefore, this research was carried out with class X high school students, because students had received the material taught and based on OECD data (2019b) class X students had the largest percentage of participation as PISA study participants. This study uses two questions to reveal students' mathematical literacy. The first question is about the uncertainty and data PISA model (uncertainty and data) in an occupational context. This question covers the material This study uses two questions to reveal students' mathematical literacy. The first question is about the uncertainty and data PISA model (uncertainty and data) in an occupational context. This question covers the material This study uses two questions to reveal students' mathematical literacy. The first question is about the uncertainty and data PISA model (uncertainty and data) in an occupational context. This question covers the material statistics selected based on material reasons are very important for students to understand, but students' interest in statistics is still lacking, students also experience difficulties in solving statistical problems (Mahura, 2016). The use of statistical questions in research is expected to help students get used to these questions. The work context was chosen based on the reason that this context is the lowest that is mastered by students (Hamidy and Prabowo, 2020). The second question is a matter of the PISA space and shape model which has a scientific context. This question includes geometry material that is selected based on the reason that junior high school students' Mathematics National Examination results on Puspendik's website from the 2014/2015 to 2018/2019 school year have the lowest gain on geometry material, this shows that Indonesian students still lack mastery of the material. The scientific context was chosen based on the reason that students mastered the scientific context more than other PISA contexts (Hamidy and Prabowo, 2020).

There are several factors that need to be considered when conducting an assessment of students. These factors include the cognitive style of students. Different cognitive styles will affect the way students obtain, process, organize, and remember information obtained from various learning sources. Akramunnisa (2017) states that one of the factors that need attention in learning activities and solving math problems is the difference in students' cognitive styles. This study focuses on reflective and impulsive cognitive styles based on the following considerations (1) Reflective students have higher creativity than impulsive students in geometry material which is one of the content questions tested on students, namely change and relationships. This is in line with Shoimah's opinion, et al. (2018, p. 1) "reflective students are more creative in solving geometric problems"; (2) Fajriyah, et al (2019) stated that reflective students have very good abilities in the aspects of communication, mathematizing, reasoning and argumentation, and developing strategies to solve problems while impulsive students have good abilities in the communication aspect. These aspects are part of basic abilities needed in mathematical literacy (Abidin, et al., 2018). Based on this, differences in cognitive styles are thought to influence students in solving problems.

Students with a reflective cognitive style do tasks more systematically and carefully in making decisions so that it takes longer, while students who are impulsive tend to be in a hurry so that the results obtained are less accurate. The difference in cognitive style will affect students' ability to solve problems. Fadillah, et al. (2019) stated that the choice of solutions to solving student problems was different due to differences in cognitive styles they had. The same thing was also expressed by Muhtarom, et al. (2018) “Students' ability to solve mathematical problems is also influenced by cognitive styles, such as reflective and impulsive cognitive styles” (p. 1-2). Which means that cognitive style also affects students' ability to solve problems, such as reflective and impulsive cognitive styles. When students have different cognitive styles, the method chosen to solve the PISA model questions in this study will be different. Thus the difference in cognitive style will affect the achievement of students' mathematical literacy results. Based on the description above, the researcher wishes to conduct research with the title "Mathematical Literacy of High School Students in Solving PISA Model Questions in terms of Reflective and Impulsive Cognitive Styles".

B. Research question

Based on the background described above, the researcher formulated the research questions as follows:

1. How is the mathematical literacy of high school students in reflective cognitive style in solving PISA model math problems?
2. Howmathematical literacy of high school students with impulsive cognitive style in solving PISA model math problems?.

C. Research purposes

Based on the research questions above, the purpose of this study is:

1. Describe the mathematical literacy of high school students in reflective cognitive style in solving PISA model math problems.
2. Describe the mathematical literacy of high school students with impulsive cognitive styles in solving PISA mathematical problems.

D. Definition of Terms

To avoid different interpretations, the author defines several terms as follows:

1. Mathematical literacy referred to in this study is an individual's ability to formulate, apply, and interpret mathematics in various contexts. The following are indicators of mathematical literacy in this study:
   a) Identify the information needed to solve the problem.
   b) Represent problems mathematically by using appropriate symbols,

diagrams and models.

c) Designing and using strategies in the process of finding solutions.

d) Apply facts, procedures, concepts, and mathematical reasoning in finding solutions.

e) Reinterpret the mathematical results obtained into contextual problems.

f) Explain and provide logical arguments from the mathematical results obtained.

2. The PISA Model Mathematical Problems in this research are contextual questions that contain PISA content and context used to train and find out the description of students' mathematical literacy. The first question is a matter with uncertainty and data content (uncertainty and data) and work context. In this question students are asked to find the lowest and highest percentage of overall damage from the company data presented. The second question is a question with space and shape content and a scientific context. In this question, students are asked to find the length of a ladder and a kite string that is shaped like the slanted side of a triangle.
3. The Cognitive Stylereferred to in this study are the characteristics or habits of a person in obtaining, analyzing, processing, and perceiving information to complete the task. In this study, students were distinguished into reflective and impulsive cognitive styles
4. Students who have a reflective cognitive style referred to in this study are students who carry out tasks more systematically and are careful in making decisions but the answers given are accurate.
5. Students who have an impulsive cognitive style referred to in this study are students who tend to be in a hurry in solving problems so that the results obtained are less accurate.

E. Benefits of research

The research that will be carried out later is expected to provide benefits, namely as follows:

1. As input material for educators regarding mathematical literacy in the teaching and learning process in class, so that it can be used as a consideration for getting to know students according to the cognitive style they have.
2. As a reference for other researchers in conducting research similar to this research in the future.

CHAPTER II

LITERATURE REVIEW

A. Mathematical literacy

Humans will be faced with various problems, in carrying out their activities. Both problems related to his personal life, the surrounding community, the world of work and school life. Many of the problems faced are related to the application of mathematics. These problems include buying and selling land, financial management of housewives, etc. If individuals have good mastery of mathematics, it will be very helpful in solving various problems. Individual ability to use mathematics in solving daily life problems can be referred to as mathematical literacy. Literacy itself is defined as “Literacy is the ability to read and write with understanding a simple statement related to one's daily life” (Unesco, 2004, p. 12-13). This statement means that literacy is the ability to read and write to understand simple statements related to an individual's daily life. Things that are not different were stated by Wardono, et al. (2018) which states that literacy can be interpreted as the ability to read, write, speak, and use language and use all of these abilities in more complex activities. Supporting these two statements literacy is also interpreted as a term that refers to a set of abilities possessed by individuals in reading, writing, speaking, calculating and solving problems at a certain level of expertise needed in everyday life (Wikipedia, 2020). The tendency of the three opinions towards literacy is seen as an individual's ability to read, write, speak, Furthermore, according to the OECD, mathematical literacy is “mathematical literacy: An individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena” (2019a, p. 14-15). This opinion contains the word capacity which means ability, the word refers to the basic abilities possessed by individuals from birth. It's different from ability and capability even though all three have the same meaning, namely ability. Ability refers to the ability that an individual currently has, meaning that this ability is not possessed from birth but individuals can acquire it by practicing. Capability refers to hidden potential abilities that are currently not visible but, may be available to individuals in the future. For example, every individual has the basic ability he was born with (capacity) to read, but the real ability (ability) to be able to read or actually be able to read well must be trained. Individuals have the real ability (ability) to write short stories, if he wants to be successful as a writer then he must have more ability, namely writing novels (which he currently has not mastered, but may have). Based on this, the OCED opinion above means that mathematical literacy is a basic ability possessed by each individual in formulating, applying, and interpreting mathematics in various contexts. This includes mathematical reasoning, the use of mathematical concepts, procedures, facts, and tools to describe,

Madyaratri, et al. put forward a different opinion. (2019) which states that mathematical literacy can be interpreted as a person's ability to formulate, use, and interpret mathematics in various contexts of solving everyday life problems. This opinion is supported by Afriyanti, et al. (2018) which states that mathematical literacy can be interpreted as "an individual's ability to use mathematical concepts, procedures, facts and mathematical tools to describe, explain, and predict phenomena" (p. 609). Third trend this opinion leads to mathematical literacy seen as the ability possessed by individuals in formulating, applying, and interpreting mathematics in various contexts. These abilities include individual abilities in mathematical reasoning, the use of mathematical concepts, procedures, facts, and tools to solve everyday problems.

Complementing the opinion above, Suharta & Suarjana (2018) stated that "Mathematical literacy involves more than a problem-solving procedure. This implies as a knowledge base, competence and confidence to apply this knowledge in the practical world" (p. 414). This statement means that mathematical literacy is not just a problem solving procedure, it involves basic knowledge, competence, and individual confidence to apply the knowledge they have in solving everyday problems. Umbara and Suryadi (2019) stated that mathematical literacy can be interpreted as "Mathematical literacy was interpreted as an individual's ability to solve a situation related to mathematics" (p. 792). This statement means that mathematical literacy is the ability possessed by individuals to solve situations related to mathematics. The tendency of the two opinions towards mathematical literacy is seen as the ability possessed by individuals in applying the knowledge they have to solve mathematical problems.

Abidin, et al. (2018) defines mathematical literacy as "an individual's ability to understand and use mathematics in various contexts to solve problems, as well as being able to explain to others how to use mathematics" (p. 100). The same thing was stated by Kamaliyah, et al. (2013) which states that mathematical literacy can be interpreted as "Mathematical literacy helps one to understand the role or usefulness of mathematics in everyday life as well as uses it to make the right decisions as citizens" (p. 14). This statement means that mathematical literacy helps a person to understand the role and benefits of mathematics in everyday life so that individuals can make informed decisions appropriate. The tendency of the two opinions towards mathematical literacy is seen as an individual's ability to understand the role and benefits of mathematics and can use it to solve problems so that they can make the right decisions.

Based on the opinions stated above, the mathematical literacy referred to in this study is the individual's ability to formulate, apply, and interpret mathematics in various contexts.

B. PISA and Mathematical Literacy Indicators

PISA is defined by the OECD as "PISA is an ongoing program that monitors trends in the knowledge and skills that students around the world, and in demographic subgroups within each country, have acquired." (2019a, p. 11). This statement means that PISA is an ongoing program that monitors the skills of students around the world. Complementing this opinion, Rifai and Wustqa (2017) state that PISA (Program for International Student Assessment) is a study that is held every three years and starts from 2000. Meanwhile Wardono & Kurniasih (2015) defines PISA as an international-level student assessment program that organized by the Organization for Economic Cooperation and Development

(OECD) which assesses mathematical literacy, reading literacy, scientific literacy, and financial literacy.

Based on the opinion above, PISA can be defined as an ongoing international level assessment program organized by the OECD to measure mathematical, scientific, reading and financial literacy. One of the things assessed in PISA is mathematical literacy. Mathematical literacy in PISA consists of three components, namely process, content, and context (OECD, 2019a).

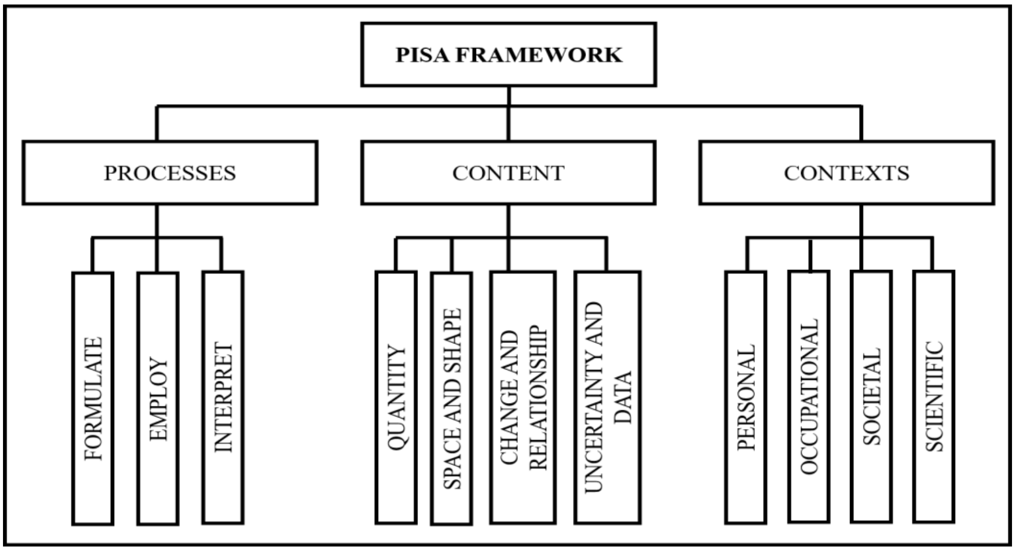


Figure 2.1
Components of Mathematical Literacy

1. **Process**

The process is described by the OECD (2019a) as follows "PISA defines three categories of processes: formulating situations mathematically; employing mathematical concepts, facts, procedures and reasoning; and interpreting, applying and evaluating mathematical outcomes" (p. 15). This statement means that PISA defines processes in mathematical literacy into three categories. First, formulate the problem situation mathematically. Second, applying various concepts, facts, procedures and mathematical reasoning. Third, interpret, apply, and evaluate the mathematical results obtained.

Based on the opinion above, the process in mathematical literacy can be defined as individual steps in solving a problem which includes formulating, applying, and interpreting information so that problems can be resolved. In the process category there are several basic capabilities that underlie successful problem solving.

These capabilities include the following (Abidin, 2017; OECD, 2019a):

a. Communication

   Communication skills are involved in mathematical literacy, both in writing and orally so that individuals can explain how the problem can be solved.

b. Mathematize

   An individual's ability to transform a problem into a mathematical sentence from a real world context or interpret the results of a solution or change a mathematical model into a real world problem can be called a mathematical activity, the ability to mathematize is one of the abilities involved in mathematical literacy.

c. Representation

   Mathematical literacy involves an individual's ability to represent mathematical objects and situations through the activity of selecting, interpreting, translating, and using various forms of representation to present a situation. For example making representations in the form of graphs, tables, diagrams, pictures, equations, formulas, or concrete objects.

d. Reasoning and reasoning

   Individual mathematical abilities derived from the ability to think can be referred to as reasoning and giving reasons, where the ability to reason and give reasons is one of the abilities involved in mathematical literacy.

e. Strategy for solving problems

   The ability possessed by individuals in choosing or using various strategies in applying mathematical knowledge to be able to solve a problem is referred to as the ability to develop strategies. This ability is one of the abilities needed in mathematical literacy.

f. Use of operational and symbolic language, formal language, and technical language. Use of operational and symbolic language, formal language, and technical languageinvolves the ability to understand, interpret, manipulate, Andunderstanding from the use of symbolic expressions in the context of mathematics is needed in mathematical literacy.

g. Use of mathematical tools.

   The use of mathematical tools as an aid or bridge in order to solve a problem. This involves knowledge and skills in using various tools that assist mathematical activities such as the use of measuring devices and calculators.

These components can be involved in mathematical processes so that individuals can be assisted in solving a problem. Process components are defined as individual steps in solving a problem which include formulating, implementing, and interpreting. The following describes the steps and components of the process:

a. Formulate (formulate)

The formulation is explained by the OECD (2016) as follows "The word formulate in the mathematical literacy definition refers to individuals being able to recognize and identify opportunities to use mathematics and then provide a mathematical structure to a problem presented in some contextualized form" (p. 67) . This statement means that in the category of the process of formulating (formulate) in mathematical literacy is an individual's ability to recognize and identify the information provided to solve a mathematical problem and make mathematical formulations presented in a contextual form. Complementing this opinion, formulating according to Sari (2015) includes students' processes in constructing, simplifying, and compiling a mathematical model of a problem obtained. At this stage, students are required to understand information and mathematical concepts that are relevant to the problem. Specifically the process of formulating in PISA includes the following activities (OECD, 2016, p. 67):

1) Identify the mathematical aspects of the situation in real context problems and identify the influencing variables.
2) Recognize mathematical structures such as regularities, relationships, and patterns of a mathematical problem or situation.
3) Simplifying a mathematical situation or problem so that a mathematical analysis can be carried out.
4) Identifying limitations and assumptions in mathematical modeling and simplification of the problem context.
5) Representing or describing a mathematical situation withuse variables, symbols, diagrams and models appropriately.
6) Describe the problem in various ways including organizing it with mathematical concepts and making appropriate assumptions.
7) Understand and explain the relationship between the problem context and mathematical symbols or models.
8) Translate problems into mathematical models.
9) Recognize aspects of a problem that relate to mathematical concepts, facts, or procedures.
10) Using technology to describe the relationship of mathematics to the context of the problem.

This study uses several activities in the formulating process as indicators. Not all formulating indicators were used in this study because there were several formulating indicators which could be classified into one. The indicators used are also adapted to the formulating definitions described above. Indicators that can be classified into one include indicators (1), (2), (3), and (9). These four indicators can be classified into one, namely identifying the information needed to solve the problem. The reason researchers classify the five indicators into one is because the five indicators are indicated to have the same goal, namely to require individuals to recognize and identify the information presented from a problem. Indicators (5), (6), (7), diagrams, and precise modeling. The reason the researcher classifies the four indicators into one is because these indicators are indicated to have the same purpose, namely to make representations. After individuals recognize and identify the information needed, they are required to represent an object or mathematical problem with variables, symbols, diagrams, make assumptions, or the appropriate mathematical model. This indicator is part of the main ability of representation. Indicator (4) will be combined with the indicators in the implementing section. Indicator (10) was not used in this study because the mathematical literacy test questions used in this study were not designed for complex calculations and used mathematical tools such as measuring instruments, calculators, and others.

b. Apply (employ)

Applying is explained by the OECD (2016) as follows "The word employ in mathematical literacy definition refers to an individual being able to apply mathematical concepts, facts, procedures, and reasoning to solve mathematically-formulates problems to obtain mathematical conclusions" (p. 67). This statement means that the process category of applying (employing) in mathematical literacy refers to an individual's ability to apply concepts, facts, procedures, and mathematical reasoning to solve problems so as to get mathematical conclusions. Things that are not different were put forward by Sari (2015) who stated that applying can be interpreted as a process of students using existing mathematical concepts, facts, procedures to obtain a mathematical solution to a problem.

1) Plan and implement strategies to find mathematical solutions.
2) Use math and technology tools to help find the right solution.
3) Apply facts, rules, algorithms, and mathematical structures in finding mathematical solutions.
4) Manipulate numbers, graphics, and data as well as statistical information, algebraic forms, and equations, and geometrical representations
5) Create diagrams, graphs, and mathematical constructs and extract mathematical information from the presentation of these graphs or diagrams.
6) Using several different representations in the process of finding a solution.

7) Make generalizations based on the results of applying mathematical procedures to find solutions.
8) Reflect and explain the mathematical results obtained by giving appropriate reasons.

This study uses several activities in the process of applying as indicators. Not all implementing indicators were used in this study because there were several implementing indicators which could be classified into one. The indicators used are also adapted to the definition of applying described above. Indicators that can be classified into one include indicators (1), (6), and (4) in formulating indicators. These three indicators can be classified into one, namely designing and using strategies in the process of finding solutions. The reason researchers classify the two indicators into one is because these indicators are indicated to have the same goal, namely requiring individuals to identify boundaries and assumptions, choose, plan, and use strategies in applying their mathematical knowledge to find a solution to a problem. This indicator is part of the main ability of the strategy to solve problems. Indicators (3), (4), (5), and (7) can be classified as applying facts, procedures, concepts, and mathematical reasoning in finding solutions. The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language. Indicator (2) was not used in this study because the questions on the mathematical literacy test were This indicator is part of the main ability of the strategy to solve problems. Indicators (3), (4), (5), and (7) can be classified as applying facts, procedures, concepts, and mathematical reasoning in finding solutions. The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language. Indicator (2) was not used in this study because the questions on the mathematical literacy test were This indicator is part of the main ability of the strategy to solve problems. Indicators (3), (4), (5), and (7) can be classified as applying facts, procedures, concepts, and mathematical reasoning in finding solutions. The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language.

Indicator (2) was not used in this study because the questions on the mathematical literacy test were and (7) can be classified as applying facts, procedures, concepts, and mathematical reasoning in finding solutions. The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language. Indicator (2) was not used in this study because the questions on the mathematical literacy test were and (7) can be classified as applying facts, procedures, concepts, and mathematical reasoning in finding solutions. The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language. Indicator (2) was not used in this study because the questions on the mathematical literacy test were The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language. Indicator (2) was not used in this study because the questions on the mathematical literacy test were The reason the researcher classifies the five indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to use and process the information that has been identified to solve a problem. This indicator is part of the main ability to use operational and symbolic language, formal language, and technical language. Indicator (2) was not used in this study because the questions on the mathematical literacy test were used in research are not designed for complex calculations and use mathematical tools such as measuring devices, calculators, and others either as an aid or bridge for students in solving problems. Indicator (8) is almost the same as indicator (2) in the interpreting category so that this indicator will be classified with that indicator.

c. Interpret (interpret)

Interpreting is explained by the OECD (2016) as follows "The word interpret used in the mathematical literacy definition focuses on the abilities of individuals to reflect upon mathematical solutions, results, or conclusions and interpret them in the context of real-life problems" (p. 67). This statement means that the category of interpreting processes in mathematical literacy focuses on the individual's ability to reflect on the solutions, results, and mathematical conclusions obtained and then interpret them contextually. Complementing this opinion, Sari (2015) states that after the process of applying the mathematical solutions obtained are then interpreted in context and validated for truth. Specifically the process of interpreting in PISA includes the following activities (OECD, 2016, p. 68):

1) Reinterpreting mathematical results into contextual problems.
2) Evaluate and provide logical arguments or reasons from the mathematical results obtained.
3) Understand how contextual issues affect outcomes and calculations according to mathematical procedures to make decisions.
4) Explain why the mathematical results or conclusions are appropriate and appropriate to the context of the problem.
5) Understand the extensions and limitations of mathematical concepts and mathematical solutions.
6) Criticize and identify the limitations of the mathematical models used in solving problems.

This study uses several activities in the process of interpreting as indicators. Not all interpreting indicators are used in this study because there are several interpreting indicators that can be classified become one. The indicators used are also adapted to the definition of interpreting that has been described above. Indicators that can be classified into one include indicators (2), (3), (4) in the interpreting category and indicator (8) in the implementing process category. These three indicators can be classified as explaining and providing logical arguments from the mathematical results obtained. The reason the researcher classifies the three indicators into one is because these indicators are indicated to have the same goal, namely to require individuals to provide logical arguments related to their understanding of a problem so that they are able to get these results or interpret the results of solving a problem into real-world contest problems. This indicator is part of the basic skills of communication and giving reasons. Indicator (1), namely reinterpreting the mathematical results obtained into contextual problems is used as an indicator in this study. This indicator is part of the basic ability to mathematize. Indicators (5) and (6) were not used in this study, because the mathematical literacy test questions used in the study were not designed to show individual abilities in these two indicators. So that the indicators of mathematical literacy used in this study based on the description above are as follows: because the mathematical literacy test questions used in this study were not designed to show individual abilities in both of these indicators. So that the indicators of mathematical literacy used in this study based on the description above are as follows: because the mathematical literacy test questions used in this study were not designed to show individual abilities in both of these indicators. So that the indicators of mathematical literacy used in this study based on the description above are as follows:

Table 2.1
Indicators of Mathematical Literacy

Component Process	Indicator
Formulate *(Formulate)*	▪ Identify the information needed to solve the problem. ▪ Represent problems mathematically by using appropriate symbols, diagrams and models.
Apply (employ)	▪ Designing and using strategies in the process of finding solutions.

	▪ Apply facts, procedures, concepts, and reasoning mathematics in finding solutions.
Interpret *(Interpret)*	▪ Reinterpret the mathematical results obtained into contextual problems. ▪ Explain and provide logical arguments from the mathematical results obtained.

2. Content

The content is explained by the OECD (2019a) as follows "These are four ideas (quantity; space and shape; change and relationships; and uncertainty and data) that are related to familiar curricular subjects, such as numbers, algebra and geometry, in overlapping and complex ways" (p. 16). This statement means that there are four aspects of content in mathematical literacy, namely quantity or number, space and shape, change and relationship, uncertainty and data. The following is a description of the content of mathematical literacy in PISA:

a. *Quantity*(quantity or number)

This content is related to number relationships and number patterns such as calculating and understanding the size of objects (OECD, 2016). Rifai & Wustqa (2017) stated that the categories of quantity or numbers are related to number material.

b. *Space and shape*(space and form)

This content relates to the subject matter of geometry. The questions in this content are about space and shape that examine students' abilities in various dimensions and shape representations, as well as recognizing the characteristics of an object (OECD, 2016). Complementing this opinion, Rifai & Wustqa (2017) explained that this category is related to geometric material.

c. *Changes and relationships*(change and relationship)

This content includes describing, modeling, and interpreting changing phenomena through branches of mathematics involving functions and algebra. Related material such as algebraic forms, equations and dissimilarities, tables and graphs (OECD, 2016). Rifai & Wustqa (2017) stated that this category is related to aspects of mathematics content in the Indonesian curriculum, namely algebra.

d. *Uncertainty and data*(uncertainty and data)

This content covers statistical theory and probability. The Uncertainty and data category includes uncertainty and data, as well as opportunities (OECD, 2016a). Rifai & Wustqa (2017) stated that this category includes statistical theory and opportunities used to solve a problem.

3. Context

The context is explained by the OECD (2019a) as follows “These are the settings in a student's world in which the problems are placed. The framework identifies four contexts: personal, educational, societal and scientific” (p.s. 16).This statement means that there are four aspects in the context component, namely personal (personal), occupational (work), societal (social), and scientific (science). Complementing this opinion, Mansur (2018) states that the context component can be interpreted as a situation that is illustrated by a problem presented.

Based on the opinion above, the context in mathematical literacy can be defined as a situation that is illustrated by a mathematical problem consisting of four types, namely personal, work, social, and scientific. The following is an explanation of the four components of the context:

a. *personal*(personal)

Personal or personal context is described by the OECD (2016) as following:

> *Problems classified in the personal context category focus on activities of one's self, one's family or one's peer group. The kinds of contexts that may be considered personal include (but are not limited to) those involving food preparation, shopping, games, personal health, personal transportation, sports, travel, personal scheduling and personal finance*(p. 74).

This statement means that problems that can be classified in the category of personal context focus on individual activities, family or friendship circles. Examples include preparing school supplies, shopping, games, health, transportation, sports, travel, daily schedules, and personal finances. The same thing was stated by Abidin, et al. (2018) which states that problems in the category of personal (personal) context are problems related to students' daily lives, for example health problems and individual travel.

b. *occupational*(work)

The occupational or work context is explained by the OECD (2016) as follows:

> *Problems classified in the occupational context category are centered on the world of work. items categorized as occupational may involve (but are not limited to) such things as measuring, costing and ordering materials for building, payroll/accounting, quality control, scheduling/inventory, design/architecture and job-related decision making*(p. 74).

This statement means that problems that can be classified in the category of work context are focused on the world of work. Such as measuring, calculating costs and ordering building materials, conducting employee payroll, controlling the quality of goods, scheduling or inventory, design or architecture, and making decisions in work. Abidin, et al (2018) stated that problems in the category of occupational (work) contexts are problems related to one's work, for example architects who design buildings and parking attendants who count the number of cars and motorcycles in the parking lot to get maximum profit.

c. *societal*(social)

The societal or social context is explained by the OECD (2016) as follows:

> *Problems classified in the societal context category focus on one's community (whether local, national or global). they may involve (but are not limited to) such things as voting systems, public transport, government, public policies, demographics, advertising, national statistics and economics*(p. 74).

This statement means that problems that can be classified in the category of social context focus on the community that is built by individuals (both local, national or global). Such as voting systems, public transport, government, public policy, demography, advertising, national statistics and the economy. Abidin, et al (2018) stated that problems in the societal (social) context category are problems related to life in society, for example problems related to public transportation and government policies.

d. *scientific*(Science)

The scientific or scientific context is explained by the OECD (2016) as follows:

> *Problems classified in the scientific category relate to the application of mathematics to the natural world and issues and topics related to science and technology. Particular contexts might include (but are not limited to) such areas as weather or climate, ecology, medicine, space science, genetics, measurement and the world of mathematics itself*(p. 74).

This statement means that problems that can be classified in the scientific category are related to the application of mathematics in the world of education, science, and technology. Such as weather, ecology, medicine, aerospace science, genetics, measurement, and mathematics. The same thing was stated by Abidin, et al. (2018) which states that problems in the scientific context category are problems related to mathematics and the use of technological tools. For example related to weather changes and interpreting a graph about the growth of microorganisms.

C. PISA Model Mathematics Problems

The PISA assessment was explained by Kamaliyah, et al. (2013, p. 11) as follows "PISA assessment takes a broad approach to assessing knowledge and skills that reflect the current changes in curricula, moving beyond the school based approach towards the use of knowledge in everyday tasks and challenges". This statement means that the PISA assessment is used to assess students' knowledge and skills, this assessment assesses students' ability to use the knowledge gained to solve everyday problems and challenges. Complementing this opinion, Mansur (2018) states that the compatibility and understanding between mathematical literacy and PISA makes PISA questions can be used to train and assess students' mathematical literacy.

Based on the opinions stated above, the PISA model math questions referred to in this study are contextual questions that contain the process, content, and context of PISA and are used to train and know the description of students' mathematical literacy. The following is an example of the PISA model questions by the OECD (2013) and their solutions based on the indicators formulated above:

1. Content: Uncertainty and Data Context: Occupational

   Tronic and Electric companies make video players and audio players. At the end of each day's production activities, the company's employees will conduct trials on the products produced to make improvements to the products and dispose of the problems. The table below compares the average number of each type of product made per day, and the average percentage of defective products per day for the two companies, namely Tronik and Electrical companies.

Company video players	The average number of made per day	Average number of products broken per day
CompanyTronic	20005	%
Company Electrical	70004	%

Company players	The average number of audio made per day	Average number of products broken per day
CompanyTronic	60003	%
Company Electrical	10002	%

Which company has the lower percentage of overall damage? Show your calculations using the data in the table above. Alternative Solutions

- Students are said to be able to identify the information needed to solve the problem if they are able to determine the variables needed to solve the problem.

  Example

  Is known:

  - Electrical Companyhave broken video players 5%, and 3% broken audio players.
  - Tronik Company has 4% broken video players, and 2% broken audio players

  Asked: Which company has a lower percentage of damage?

- Students are said to be able to represent problems mathematically by using appropriate symbols, diagrams, and modeling if they are able to formulate multiplication, addition, and percentages using known information.

Example

Total and Percentage of damage to the Electric Company

*Video player*5% x 2000

*AudioPlayer*3% x 6000

Total damage = total damage to Video Player + Audio Player

Electric Company damage percentage

$$= \frac{total\ kerusakan}{jumlah\ total\ produksi} \text{ x100}$$

Total and Percentage of Tronic Company damage

*Video player*4% x 7000

*AudioPlayer*2% x 1000

Total damage = total damage to Video Player + Audio Player

Tronic Enterprise damage percentage

$$= \frac{total\ kerusakan}{jumlah\ total\ produksi} \text{ x100}$$

- Students are said to be able to design and use strategies in the process of finding solutions and applying facts, procedures, concepts, and mathematical reasoning in finding solutions if they apply the concepts of multiplication, addition, and percentage to solve the problems that have been formulated.

Example

Total and Percentage of damage to the Electric Company

Video player $\frac{5}{100}$ x 2000 = 100

AudioPlayer $\frac{3}{100}$ x 6000 = 180

Total damage = 100 + 180 = 280 Electric

Company = damage percentage $\frac{280}{8000}$ x 100 = 3.5%

Total and Percentage of Tronic Company damage

Video player $\frac{4}{100}$ x 7000 = 280

AudioPlayer $\frac{2}{100}$ x 1000 = 20

Total damage 280 + 20 = 300 Tronic

Enterprise damage percentage = $\frac{300}{8000}$ x 100 = 3.75%

The company that has the lowest damage percentage is Electric with a damage percentage of 3.5%.

- Students are said to be able to reinterpret the mathematical results obtained into contextual problems if they are able to connect the results obtained, namely 3.5% and 3.75% to find the lowest percentage.

  Example

  The company that has the lowest damage percentage is Electrical.

- Students are said to be able to explain and provide logical arguments from the mathematical results obtained if they provide an explanation why the solutions obtained make sense.

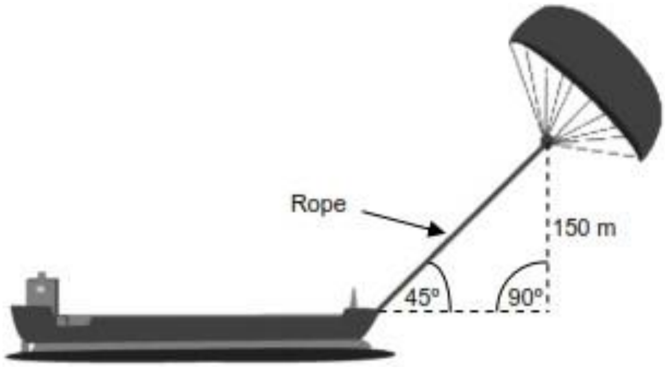
  Example

  The amount of goods produced by the two companies is the same, namely 8000. The total damage to the electricity company is 280

  Total damage to the tronic company 300

  Thus, it makes sense if the lowest damage percentage obtained is an electric company.

2. Content: Shape and Space Context: Scientific



how longkite rope used to tow the ship and forms an angle of 45° and is at a vertical height of 150 m as shown in the picture above!.

A 173 m

B 212m

C 285m

D300m

Alternative Solutions

- Students are said to be able to identify the information needed to solve the problem if they are able to determine the variables needed to solve the problem.

  Example

  Is known:

  The angles that appear in the image are 45°, 90°, 45°, so the triangle is an isosceles right angled triangle. Therefore the base of the triangle is 150 m long.

  Wanted: how long is the kite string (x)?

- Students are said to be able to represent problems mathematically using appropriate symbols, diagrams, and modeling if they are able to formulate the Pythagorean theorem of the problem.

  Example

  $x = \sqrt{1502 + 1502}$

- Students are said to be able to design and use strategies in the process of finding solutions and apply facts, procedures, concepts, and mathematical reasoning in finding solutions if they apply the Pythagorean concept to complete the comparisons that have been formulated. Example

  $\times = \sqrt{1502 + 1502}$

  $\times = \sqrt{22{,}500 + 22{,}500}$

  $\times = \sqrt{45{,}000}$

  $\times = 212.13$

  $\times = 212$

- Students are said to be able to reinterpret the mathematical results obtained into contextual problems if they are able to relate the results obtained, namely 212 as the length of the kite string. Example

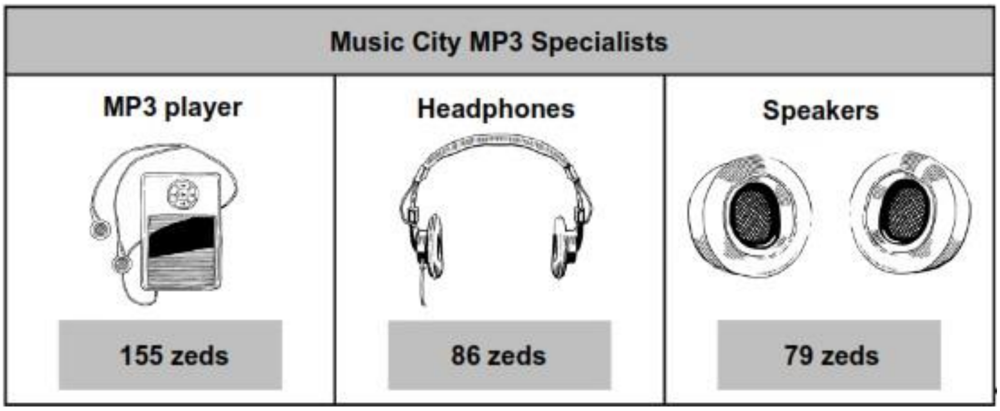
  So the length of the kite string is 212 m (B).

- Students are said to be able to explain and provide logical arguments from the mathematical results obtained if they provide an explanation why the solutions obtained make sense.

Example

For example, the length of the right side of the kite is 150 m, so it is normal if the slanted side or the length of the kite string has a length of more than the length of the right side, which is 212 m.

3. Content: Quantity Context:
   Personal



*MusicCity*is having a sale. If you purchase two or more items during the sale, Music City will provide a 20% discount off the normal selling price of these items. Jason has 200 zeds to spend. During the sale, what items can he buy? Circle “Yes” or “no” for each of the following choices.

Goods	Can Jason buy the item with 200 zeds?
MP3 players and*headphones*	Yes / No
MP3 players and*speaker*	Yes / No
All three of these goods - MP3 *player*, headphones, and speakers	Yes / No

Alternative Solutions

- Students are said to be able to identify the information needed to solve the problem if they are able to determine the variables needed to solve the problem.

  Example

  Is known:

  - If you buy two or more items during a sale, you will get a 20% discount
  - Jason has 20 zeds to spend

  Asked: what items can Jason buy among the three choices above?

- Students are said to be able to represent problems mathematically by using appropriate symbols, diagrams, and modeling if they are able to formulate multiplication, addition, and percentages using known information.

  Example

  - Discount: the price of item x $\frac{20}{100}$
  - Price of goods after discount = initial price - discount

- Students are said to be able to design and use strategies in the process of finding solutions and apply facts, procedures, concepts, and mathematical reasoning in finding solutions if they apply the concepts of addition, multiplication, and percentages to solve the problems that have been formulated.

Example

- First choice:

Discount: 155 x $\frac{20}{100} = 31$

155 zeds – 31= 124 zeds

Discount: 86 x $\frac{20}{100} = 17.2$

155 zeds – 12.2 = 68.8 zeds

Total payout = 124 zeds + 68.8 zeds = 192.8 zeds

Jason can buy both items

- Second choice:

Discount: 155 x $\frac{20}{100} = 31$

155 zeds – 31= 124 zeds

Discount: 79 x $\frac{20}{100} = 15.8$

155 zeds – 15.8 = 63.2 zeds

Total payout = 124 zeds + 63.2 zeds = 187.2 zeds

Jason can buy both items

- Third option:

Discount: 155 x $\frac{20}{100} = 31$

155 zeds – 31= 124 zeds

Discount: 86 x $\frac{20}{100} = 17.2$

155 zeds – 12.2 = 68.8 zeds

Discount: 79 x $\frac{20}{100} = 15.8$

155 zeds – 15.8 = 63.2 zeds

Total payout = 124 zeds + 68.8 zeds + 63.2 zeds = 256 zeds

Jason couldn't afford all three of those things

So, with Jason's 200 zeds and the discounts he can get during the sale, he can buy an MP3 player and headphones or an MP3 player and speakers.

- Students are said to be able to reinterpret the mathematical results obtained into contextual problems if they are able to link the results obtained, namely the first and second choices as choices of items that Jason can buy with the money he has. Example
  So with Jason's 200 zeds and the discounts he can get during the sale, he can buy an MP3 player and headphones or an MP3 player and speakers.
- Students are said to be able to explain and provide logical arguments from the mathematical results obtained if they provide an explanation why the solutions obtained are reasonable and acceptable.
  Example
  If you try to recalculate using the discount from the total purchase of goods, then he will get the same result as follows
  First 155 zeds + 86 zeds = 241
  $$241\text{x}\,\frac{20}{100} = 48.2;\ 241 - 48.2 = 192.8\ \text{zeds}$$
  Both 155 zeds + 79 zeds = 234
  $$234\text{x}\,\frac{20}{100} = 46.8;\ 234 - 48.2 = 187.2\ \text{zeds}$$
  Third 156 zeds + 86 zeds + 79 zeds = 320
  $$320\text{x}\,\frac{20}{100} = 64;\ 320 - 64 = 256\ \text{zeds}$$

4. Content: Change and relationship Context: societal (social)
   Mount Fuji is a famous active volcano in Japan.

The Getomba trail as a hiking trail for Mount Fuji is about 9 km long. Hikers should return from a 18km walk by 8pm. Toshi estimates that he can walk up the mountain at an average of 1.5 km per hour, and descend at twice the speed of the climb. This speed includes the calculation of rest and meal times. Using Toshi's estimated speed, what time is the latest he can start his journey so that he can return at 8 pm?

Alternative Solutions

- Students are said to be able to identify the information needed to solve the problem if they are able to identify the information provided in the problem in the form of distance and speed and then relate it to time.

  Example

  Is known:

  The distance of the hiking
  trail = 9 km The distance of
  the descending path = 9 km

  Toshi's climbing speed = 1.5 km/hour

  Toshi's descending speed = 3 km/hour

  Asked:

  What time is the latest Toshi starts climbing so he can be back by 8pm?

- Students are said to be able to represent problems mathematically by using appropriate symbols, diagrams and modeling if they are able to model the relationship between the start time of climbing and the return time with the length of the trip, the relationship between the length of the trip and the travel time of climbing and descending as well as modeling the distance, speed, time into appropriate formula.

  Example

  Time to climb = $\frac{jarak\ jalur\ mendaki}{kecepatan\ mendaki}$

  Decreased travel time = $\frac{jarakjalur\ menurun}{kecepatan\ menurun}$

  Travel time = climbing travel time + descending travel time
  Climbing time = return time – travel time

- Students are said to be able to design and use strategies in the process of finding solutions. Dan applies facts, procedures, concepts, and mathematical reasoning in finding solutions if he applies the concepts of distance, speed, and time, the concepts of addition and subtraction in units of time. Students use reasoning abilities to choose the right strategy in solving problems.

  Example

  Time to climb = $\frac{jarak\ jalur\ mendaki}{kecepatan\ mendaki}$

  $= \frac{18\ km}{1.5\ km/jam}$

  $= \frac{18\ km}{1.5\ km}$ .O'clock

  = 12 hours

Decreased travel time = $\frac{jarak\ jalur\ menurun}{kecepatan\ menurun}$

$= \frac{18\ km}{3\ km/jam}$

$= \frac{18\ km}{3\ km}$ .O'clock

= 6 hours

Travel time = climbing travel time + descending travel time = 12 hours + 6 hours = 18 hours

Time to start climbing = time to return – travel time = 20.00 – 18.00 = 02.00

- Students are said to be able to reinterpret the mathematical results obtained into contextual problems if they are able to interpret the mathematical solutions obtained 02.00 contextually.

  Example

  Toshi had to start climbing by 2:00 a.m. so he could be back by 8:00 p.m.

- Students are said to be able to explain and provide logical arguments from the mathematical results obtained if they provide an explanation why the solutions obtained make sense.

  Example

  With a speed of 3 km / hour in a day or 24 hours can be reached a distance of 48 km. If at the same speed in 12 hours can be reached a distance of 24 km. So it makes sense that in 18 hours a distance of 36 km can be covered.

In this study, four questions adapted from the 2012 PISA assessment questions will be used which contain all processes, content, and context in PISA. Each question will use different content and context. However, only two questions will be analyzed in this study based on the considerations described in the previous chapter.

D. Cognitive Style

1. Definition of Cognitive Style

The characteristics of students in the learning process and solving math problems have various differences. One of these differences can be influenced by cognitive style. Fadillah, et al. (2019) explained that cognitive style is a pattern that determines how individuals process the information received. The same thing was stated by Hidayat, et al. (2017) who stated cognitive style as a person's way of obtaining and processing information in his brain. The tendency of the two opinions towards cognitive style is seen as a pattern or an individual's way of processing the information he gets.

Completethe opinion above Pagiling (2019, p. 2) explains that "the individual habitual approach in perceiving, processing, organizing, remembering, and representing information to solve problems is called cognitive styles". This statement means that cognitive style, namely individual habits in perceiving, processing, organizing, remembering, and representing information obtained to solve problems. Things that are not different put forward byHendriani, et al. (2017) stated cognitive style as a characteristic of individual behavior in understanding, remembering, and analyzing information in a given cognitive action.The tendency of the two opinions towards cognitive style is seen as an individual characteristic in understanding, remembering, and analyzing the information obtained to solve a problem.

A slightly different opinion was put forward by Engin & Vetschera (2017, p. 2) where cognitive style is seen as "cognitive style can be considered as a factor that influences decisions making performance in a consistent way across several tasks". This statement means that cognitive style is a factor that influences individual decisions in solving various problems. Based on the opinion above, the cognitive style referred to in this study is a person's characteristics or habits in obtaining, analyzing, processing, and perceiving information to solve a problem.

2. Reflective and Impulsive Cognitive Styles

Cognitive style consists of several types, one of which is reflective and impulsive cognitive style. This research will only focus on two characteristics of students, namely students who have a reflective cognitive style and students who have an impulsive cognitive style. The choice of students with reflective and impulsive cognitive styles is due to several reasons, namely (1) Reflective students have higher creativity than impulsive students in geometry material which is one of the content questions tested on students, namely change and relationship. This is in line with the opinion of Shoimah, et al. (2018, p. 1) "reflective students are more creative in solving geometric problems"; (2) Fajriyah, et al (2019) stated that reflective students have very good abilities in the aspects of communication, mathematizing, reasoning and argumentation, as well as devising strategies to solve problems while impulsive students have good abilities in the communication aspect. These aspects are part of the main abilities needed in mathematical literacy (Abidin, et al., 2018); (3) The cognitive style has a large enough frequency in the class. This is in accordance with the opinion "Frequency of reflective-impulsive students in class are generally counted as much as 76.2%." (Satriawan, et al., 2018, p. 2) which means that students with reflective and impulsive cognitive styles in class have a frequency of 76.2%; (4) time efficiency. (3) The cognitive style has a large enough frequency in the class. This is in accordance with the opinion "Frequency of reflective-impulsive students in class are generally counted as much as 76.2%." (Satriawan, et al., 2018, p. 2) which means that students with reflective and impulsive cognitive styles in class have a frequency of 76.2%; (4) time efficiency. (3) The cognitive style has a large enough frequency in the class. This is in accordance with the opinion "Frequency of reflective-impulsive students in class are generally counted as much as 76.2%." (Satriawan, et al., 2018, p. 2) which means that students with reflective and impulsive cognitive styles in class have a frequency of 76.2%; (4) time efficiency.

Reflective and impulsive cognitive styles are defined by Satriawan, et al. (2018) as follows:

> *Reflective students are defined as students who need more time in solving problems, but their solution or answer given is accurate, it is therefore the answer given tends to be correct. Students who need short time to solve problems but give inaccurate and tend to make wrong answers are classified as impulsive students. Impulsivity is a cognitive style in which individuals act before they think*(p. 2).

This statement means that reflective students are students who take a long time to solve problems, but the answers tend to be correct. Meanwhile, impulsive students answered briefly but their answers were inaccurate and tended to be wrong. Impulsive cognitive style can also be said to be a cognitive style in which individuals take actions without thinking first. The same thing was stated by Branch & Shiraz (2014), namely stating reflective and impulsive cognitive styles as follows:

> *Impulsivity and reflectivity are two learning styles in the cognitive domain. An impulsive person, as states, "is a person who tends to make a quick guess at an answer to a problem and a reflective person tends to make a slower, more calclates decision*(p. 1233).

This statement means that impulsive and reflective are two learning styles in the cognitive domain. Impulsive individuals are individuals who tend to make quick guesses at answers and reflective individuals tend to make decisions that take longer and are more calculated. Pagiling (2019) also states that things are no different, namely "reflective students use a long time when solving problems but the solution is precisely written. Impulsive students use a brief time to solve problems but the written answers are less accurate" (p. 5). This statement means that students with a reflective cognitive style take a long time to solve problems but the solutions given are appropriate. Students with an impulsive cognitive style need a short time to solve problems but the answers given are not quite right.

Complementing the opinion described above, Cahyono, et al. (2019) stated that

> *Subjects with a reflective cognitive style capable of making a conclusion by right and give or choose a good excuse to support the conclusion using data, the definition of, axioms, lemma, a relevant theorem factoring (concept, substitute, the equation of equivalence), But on the subjects of impulsive cognitive style is categorized as a less well-off in these things*(p. 6).

This statement means that subjects who have a reflective cognitive style are able to make conclusions correctly and provide appropriate reasons to support conclusions using data, definitions, axioms, lemmas, theorems that are relevant to concepts, but students who have an impulsive cognitive style are lacking in this regard.

Based on the four opinions above, in this study students who have a reflective cognitive style are students who do tasks more systematically and are careful in making decisions so that the answers given are accurate. While students with an impulsive cognitive style are students who tend to be in a hurry in solving problems so that the results obtained are less accurate.

3. Reflective and Impulsive Cognitive Style Measurement

The instrument used to measure reflective and impulsive cognitive styles in this study is the Matching Familiar Figure Test (MFFT). This test is a test that displays a standard image and several image variations that are similar to the standard image. Of the several variations shown, only one image is exactly the same as the standard image. This test requires students to choose an image that is exactly the same as the standard image displayed. This study used the Matching Familiar Figure Test (MFFT) developed by Warli (2010). The instrument was chosen based on the reason that there were similarities in the stages of cognitive thinking of Warli's research subjects and the subjects to be used in the study, namely class X SMA. Warli research subjects were class VII junior high school students who had an age range of 13 to 15 years, while high school students in class X have an age range between 15 to 17 years. According to Piaget's theory of cognitive development, children aged 11 years and over are in the formal operational stage. Thus, the subjects in Warli's study were at the same cognitive stage as the subjects in this study. Supporting this opinion, Galatea (2016) states that the MFFT test developed by Warli is general in nature and can be used for various levels of schools and tertiary institutions.

This instrument consists of 13 items and 2 practice questions. Each item consists of 1 standard image and 8 variation images. The characteristics of the MFFT test developed by Warli are as follows: a) the MFFT test includes standard images and variation images, b) in the variation images, only one image is exactly the same as the standard image, c) the difference between the standard image and the variation image is not striking (only slightly different), d) the standard image is located on a different sheet with the variation image, e) the image is quite clear.

Giving the MFFT test to students will provide data researchers in the form of the first time students use it in answering questions (t) and the frequency of answers until the correct answer is obtained (f). The measurement results of each item for each disabled student are then calculated as the median. The median time of first answering and the median answer frequency are used to determine which students have reflective or impulsive characteristics. This is in line with the opinion of Miatun & Nurafni (2019) that on the cognitive style test the researcher will record the amount of time it takes students to choose an answer the first time and the frequency of choosing until the correct answer is obtained. The time required by the student to obtain the answer for the first time will be recorded. then the time and frequency of answering all students who filled out the MFFT were calculated for the median value. Kenny (2009) stated that the reflective and impulsive cognitive styles were classified as follows: "Impulsivity: respondents who were quicker and therefore whose latency score was below the median; however, with an error rate above the median, Reflective: respondents with a latency score above the median with fewer errors" (p. 154). This statement means that the respondent can be classified in an impulsive cognitive style if the respondent answers the first question quickly so that the time required is less than the median but the error frequency is more than the median. Meanwhile, respondents can be classified in a reflective cognitive style if the respondent takes more time the first time to answer questions than the median with an error frequency of less than the median. Here is a reflective-impulsive image by Kenny (2009).

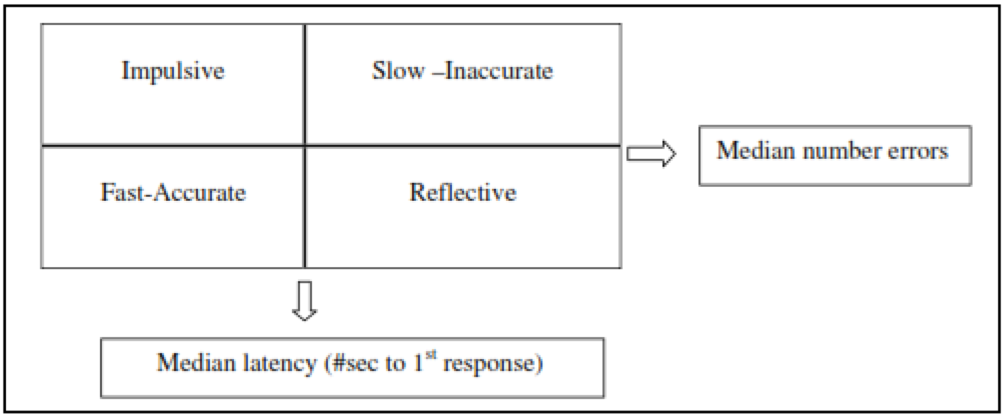


Figure 2.2 Reflective and Impulsive

Source Kenny (2009, p. 53)

Rochika and Cintamulya (2017) also stated that:

> *The measurement of cognitive style is recorded, namely the first time students answer (t) and the number of student answers until they get the correct answer (f)... After the research data is obtained, students can make research plots. The longer it takes students to answer the questions, the position in the plot will be more to the left and if there are more mistakes in answering, the frequency will be higher and vice versa. Then students can be grouped into reflective, impulsive, fast accurate, and slow inaccurate. The grouping is bounded by a red line as the limit of the middle or median value*(p. 154).

The groupings can be seen in the following plots.

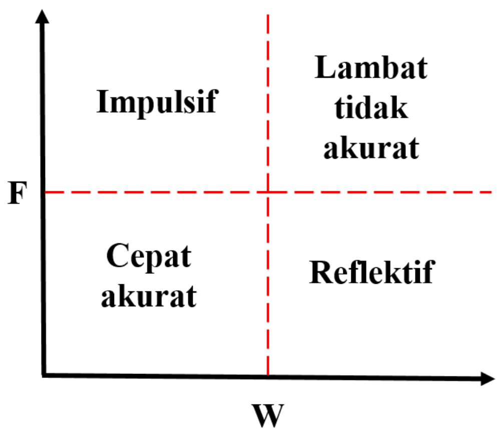


Figure 2.3 Grouping of Cognitive Styles

In the draft MFFT test answer sheet format for researchers designed by Warli, there is a section for writing down data in the form of the first time they answered, the number of students' answers until they were correct, and the average time and average choices. Based on this, in this study students were categorized as having a reflective cognitive style if the average time to answer the first time (t) was more than the median of students in one class and the average frequency of answers

(f) lessof the median of students in one class. Whereas students who are categorized as having an impulsive cognitive style if the average time for the first time answering answers (t) is less than or equal to the median of students in one class and the average frequency of answers (f) is more than or equal to the median in one class. Therefore in this study, if the average time students answer for the first time is likened to □, the median time to first answer for students in one class is likened to □, the average frequency of students' answers is likened to □, and the median frequency of students' answers in one class is likened to

$\bar{y}$ So we can write that students have a reflective cognitive style if □ > □ and □ < □. While students have an impulsive cognitive style if □ ≤ □ and □ ≥ □.

E. Relationship between Mathematical Literacy and Reflective-Impulsive Cognitive Style

Cognitive style is one of the factors that make students give different responses in solving the problems they face. One of these cognitive styles is the reflective and impulsive cognitive style. This difference in cognitive style will make a difference in the way students choose to formulate, apply, and interpret PISA model math problems. Students who have a reflective cognitive style are thought to have a tendency to formulate, apply, and interpret space and shape content or material related to geometry better than students who have an impulsive cognitive style. This suspicion is strengthened by the results of research conducted by Shoimah, et al. (2018, p. 1) "reflective students are more creative in solving geometric problems".

Another opinion was conveyed by Fajriyah, et al (2019) that students with a reflective cognitive style are able to master aspects of communication, mathematizing, reasoning and argumentation, and devising strategies for problem solving. very well. Students with an impulsive cognitive style are able to master aspects of communication very well. These aspects are the abilities needed in mathematical literacy. Abidin, et al. (2018) explains that in mathematical literacy communication or communication and reasoning and argumentation is needed or reasoning and giving reasons both orally and in writing to explain what he knows from the problem, how to solve the problem, and how he provides arguments to defend the answers obtained. This aspect is part of the process components in mathematical literacy, namely formulating, applying, and interpreting. Abidin further explained that mathematical literacy requires the ability to mathematize or mathematize because mathematical literacy involves the ability to change a contextual problem into a sentence or a mathematical model and interpret the results of a mathematical solution that is obtained. This aspect is part of the process component in mathematical literacy, namely formulating and interpreting. Abidin further explained that mathematical literacy requires the ability to mathematize or mathematize because mathematical literacy involves the ability to change a contextual problem into a sentence or a mathematical model and interpret the results of a mathematical solution that is obtained. This aspect is part of the process component in mathematical literacy, namely formulating and interpreting. Abidin further explained that mathematical literacy requires the ability to mathematize or mathematize because mathematical literacy involves the ability to change a contextual problem into a sentence or a mathematical model and interpret the results of a mathematical solution that is obtained. This aspect is part of the process component in mathematical literacy, namely formulating and interpreting.

*Devising strategies for solving problems*or developing strategies to solve problems in mathematical literacy is also required to choose and use various strategies in applying mathematical knowledge to be able to solve a problem. This aspect is part of the components in mathematical literacy, namely applying. This is supported by the opinion of Tasyanti, et al. (2018) that communication (communication), mathematizing (mathematizing), reasoning and argumentation (reasoning and giving reasons), devising strategies for solving problems (designing strategies to solve problems) are an important part of the mathematical literacy component. These important components include, namely (1) communication; (2) mathematization; (3) representation; (4) reasoning and argumentation; (5) plan strategy; (6) using symbol language, formal language, technical language and arithmetic operations, and (7) using mathematical tools.

Based on this, the differences in abilities possessed by students with reflective and impulsive cognitive styles will affect their mathematical literacy achievements. Where reflective students are very good at the aspects of communication (communication), mathematizing (mathematizing), reasoning and argumentation (reasoning and argumentation), as well as devising strategies for problem solving (strategies for solving problems) while impulsive is able to master aspects of communication (communication) very well .

F. Relevant Research

In order to get an overview for consideration, it is necessary to conduct a search of previous studies that are relevant to this research, namely as follows:

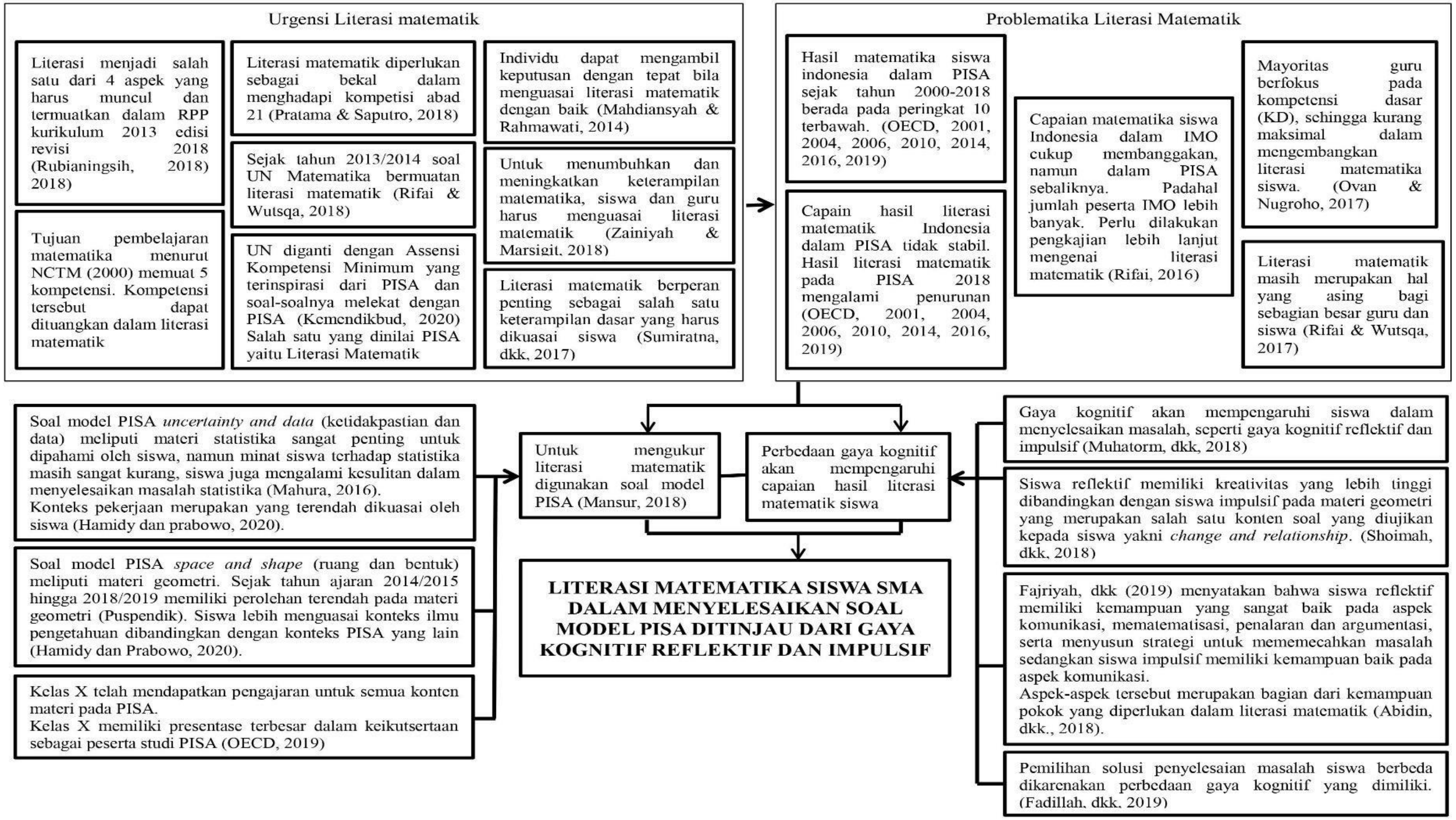
1. Research conducted by Fajriyah, Mulyono, and Asikin (2019, p. 63) entitled Mathematical Literacy Ability Reviews from Cognitive Style of Students on Double Loop Problem Solving Model with RME Approach. In this study, mathematical literacy was described based on aspects of mathematical literacy ability in the research subjects, which consisted of 9 students with different types of cognitive styles. The classification of subjects with different cognitive styles included 2 subjects with inaccurate slow cognitive style, 2 subjects with impulsive cognitive style, 2 subjects with reflective cognitive style, and 1 subject with fast cognitive style which was accurate because only one subject with this cognitive type was found. The relevance to this research is that subjects with a reflective cognitive style are able to master aspects of communication (communication), mathematizing, reasoning and argumentation, and devising strategies for problem solving very well. Subjects with an impulsive cognitive style are able to master aspects of communication (communication)

Very good. These aspects are part of the process aspects of formulating, applying, and interpreting in mathematical literacy. So it can be said that mathematical literacy has a relationship with reflective and impulsive cognitive styles.

2. Research conducted by Nurdianasari, Rochmad, and Hartono (2015, p. 78) entitled Mathematical Literacy Ability of Class VIII Students Based on Cognitive Style. In this study, mathematical literacy abilities were described based on aspects of mathematical literacy abilities in the research subjects which consisted of 9 students with different types of cognitive styles. These different cognitive styles include inaccurate slow cognitive style, impulsive cognitive style, reflective cognitive style, and fast accurate cognitive style. The relevance of this research is that subjects with a reflective cognitive style are classified as very good in the aspect of using mathematics tools which is one part of the application process. Subjects with an impulsive cognitive style have good abilities in the aspect of representation, devising strategies for solving problems, and using mathematics tools which are one part of the process of formulating and implementing. These aspects are part of the process aspects in mathematical literacy. So it can be said that mathematical literacy has a relationship with reflective and impulsive cognitive styles.
3. Research conducted by Warli and Nofitasari (2021, p. 7) entitled Junior High School Students' Mathematical Connection: A Comparative Study of Children Who Have Reflective and Impulsive Cognitive Styles. This study consisted of 2 subjects who had a reflective cognitive style and 2 subjects who had an impulsive cognitive style. The relevance of this research is that there are several aspects in common that are assessed by mathematical literacy. These aspects such as mathematizing, representing, and strategizing to solve problems. Subjects who have a reflective cognitive style can identify the information obtained and need to be sought from something

problems, create mathematical models, and connect problems with related material. Subjects who have an impulsive cognitive style can identify information that is obtained and need to be sought from a problem, but are less able to make mathematical models, and are less able to connect problems with related material. The aspects in these findings are in accordance with the indicators of mathematical literacy to be tested in the research. So it can be said that reflective and impulsive cognitive styles will influence and have a relationship with mathematical literacy.

G. Research Framework



CHAPTER III

RESEARCH METHOD

A. Research design

The research that was conducted had the aim of obtaining a description related to the mathematical literacy of class X high school students in solving PISA model math problems. The research conducted is a type of descriptive research with a qualitative approach. The following are the stages of the research carried out:

1. Preparation phase

   The steps taken by the researcher in the preparation stage are as follows:

   a. Conducting theoretical studies related to students' mathematical literacy insolve PISA model problems.

   b. Develop research instruments related to mathematical ability tests (TKM), mathematical literacy tests (TLM), and interview guidelines.

   c. Perform research instrument validation.

   d. Coordinate the place where the research is carried out. The procedures performed include:

      1) Make a permit to collect research data

      2) Discuss the time of the research with the supporting teacher (grade X IPA 5 SMAN 12 Surabaya).

2. Implementation Stage

   The steps taken by the researcher at the implementation stage are as follows:

   a. Determination of research subjects

      1) Class X IPA 5 SMAN 12 Surabaya

      2) Carrying out the TGK MFFT test in one class to obtain data on students who have reflective and impulsive cognitive styles.

3) After obtaining data related to students' reflective and impulsive cognitive styles, they are given a mathematical ability test (TKM) to obtain equivalent mathematical ability data, namely the range of scores obtained by students is not more than 5% of the total score or 5 points because the total score in TKM is 100 .

b. Data collection

1) One subject who has a reflective cognitive style and one subject who has an impulsive cognitive style with equivalent mathematical ability is given a Mathematical Literacy Test (TLM 1) and continued with TLM 1-based interviews.
2) Test and interview basedTLM 2 is used as data triangulation. If TLM 1 and TLM 2 are not valid, then TLM 3 is given to students until valid data is obtained.

3. Data Analysis Stages

The steps taken by the researcher at the data analysis stage are as follows:

a. Analyze the data that has been obtained.
b. Make conclusions from the results of the data that has been analyzed.

4. Report Writing Stage

At the report writing stage, the steps taken by the researcher were compiling a research report with reference to the results of the previous stage's analysis so that the presentation of the mathematical literacy of class X high school students in solving PISA model problems could be known.

B. Research subject

This research was conducted on students of class X IPA 5 SMAN 12 Surabaya. Based on OECD data (2019b), 49.2% of high school students in class X take part in the PISA study. This percentage is the largest for students who participating in the PISA study when compared to other classes. Subject selection was carried out by giving cognitive style tests and math ability tests in one class. The researcher gave MFFT (matching familiar figure test) to find out each student's cognitive style. Through MFFT obtained groups of students who have a cognitive reflective style and groups of impulsive students. Mathematical ability test (TKM) is given after the cognitive style test. TKM is used to determine the mathematical ability of each student. The mathematical literacy test (TLM) made in this study is a PISA model mathematics problem that fulfills the process, content, and context components in PISA.

Through cognitive style tests, students are grouped into two, namely the reflective group and the impulsive group. After that, one student who has a reflective cognitive style and one impulsive student is selected. The criterion for a reflective student is if he uses the first time he answers (t) more than the median of students in one class and the frequency of answers (f) is less than the median of students in one class. The criteria for an impulsive student are if he uses the time to answer the first time he answers (t) less than the median of students in one class and the frequency of answers (f) is more than the median in one class. The selection also takes into account that the selected subjects can represent each cognitive style and have equivalent mathematical abilities, namely the range of scores obtained by students does not exceed 5% of the total score or 5 points because the total score used in TKM is 100 and students have different genders. The same. The selection of research subjects can be seen in Figure 3.1.

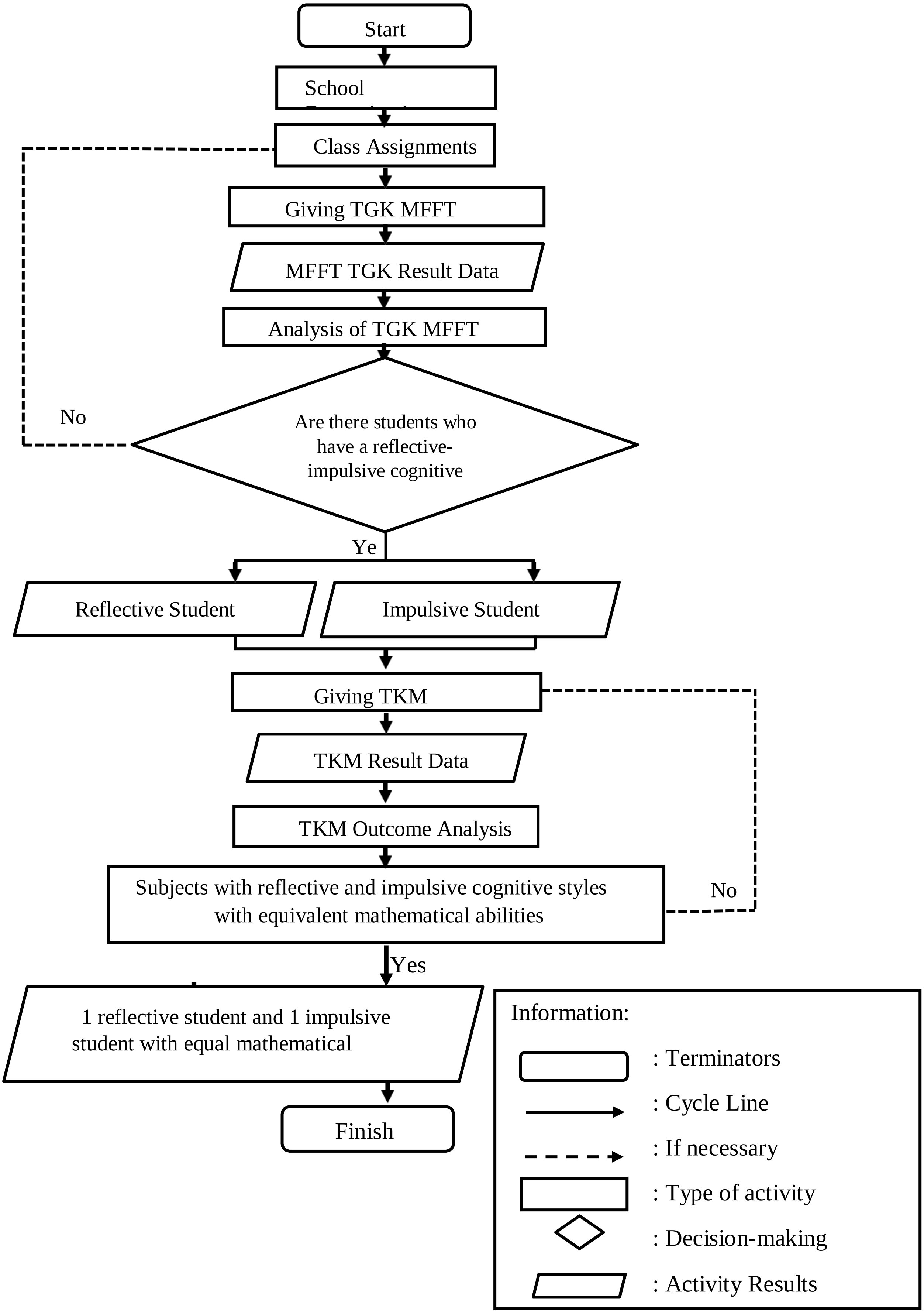


Figure 3.1 Flow of Research Subject Selection

C. Data Collection Techniques and Research Instruments

Data collection techniques in this study consisted of written tests and test-based interviews, while the research instruments consisted of main instruments and supporting instruments.

1. Data collection technique
   a. Written test

      The written test used to collect data in this study is the Mathematical Literacy Test (TLM). Mathematical literacy tests were given after the research subjects were obtained, namely students with reflective cognitive styles and students with impulsive cognitive styles who had equivalent mathematical abilities. TLM includes TLM 1 and TLM 2. Mathematical literacy test 1 (TLM 1) is given to obtain data related to the mathematical literacy of class X IPA 5 students in solving PISA model questions. Then the mathematical literacy test 2 (TLM 2) is used with the aim of data triangulation. The questions in TLM 1 and TLM 2 consist of different questions but have an equivalent level of difficulty because the questions are designed for the needs of triangulation of students' mathematical literacy data in solving PISA model questions. Giving TLM 1 and TLM 2 one week apart.

   b. Test Based Interview

      In this study, researchers conducted semi-structured interviews. The questions asked referred to the interview guidelines, then developed according to the answers given by students on the Mathematical Literacy Test (TLM). The interviews were conducted after the students completed the Mathematical Literacy Test (TLM). This activity is to reveal more about the mathematical literacy of class X IPA 5 students in solving PISA model questions. The results obtained from the interviews were used by researchers as a comparison with the results of student work. Interviews were recorded using Camtasia Studio 7 so that the data obtained was accurate and no information was missed.

      Interviews were conducted in this study twice, namely the first interview based on TLM 1 and the second based on TLM

TLM 2. To test the correctness of the data, researchers used time triangulation. Triangulation according to Bachri (2010, p. 56) is "the technique of checking the validity of data by utilizing something other than the data itself, for checking purposes or as a comparison of the data". This study used time triangulation which was carried out with a mathematical literacy test 2 and the same subject and different times, namely one week apart. Student research data can be said to be valid if there is consistency or many similarities (tend to be the same) between TLM 1 data and TLM 1 based interviews with TLM 2 data and TLM 2 based interviews. Data is said to be consistent or have similarities if each result of oral or written questions shows aspects of the research on the TLM 1 data and TLM 1 based interviews that have the same meaning as the results of TLM 2 and TLM 2 based interviews. If the data is invalid or inconsistent then it will be Repeat TLM to research subjects until valid and consistent data is obtained. The steps of the data collection technique can be seen in Figure 3.2.

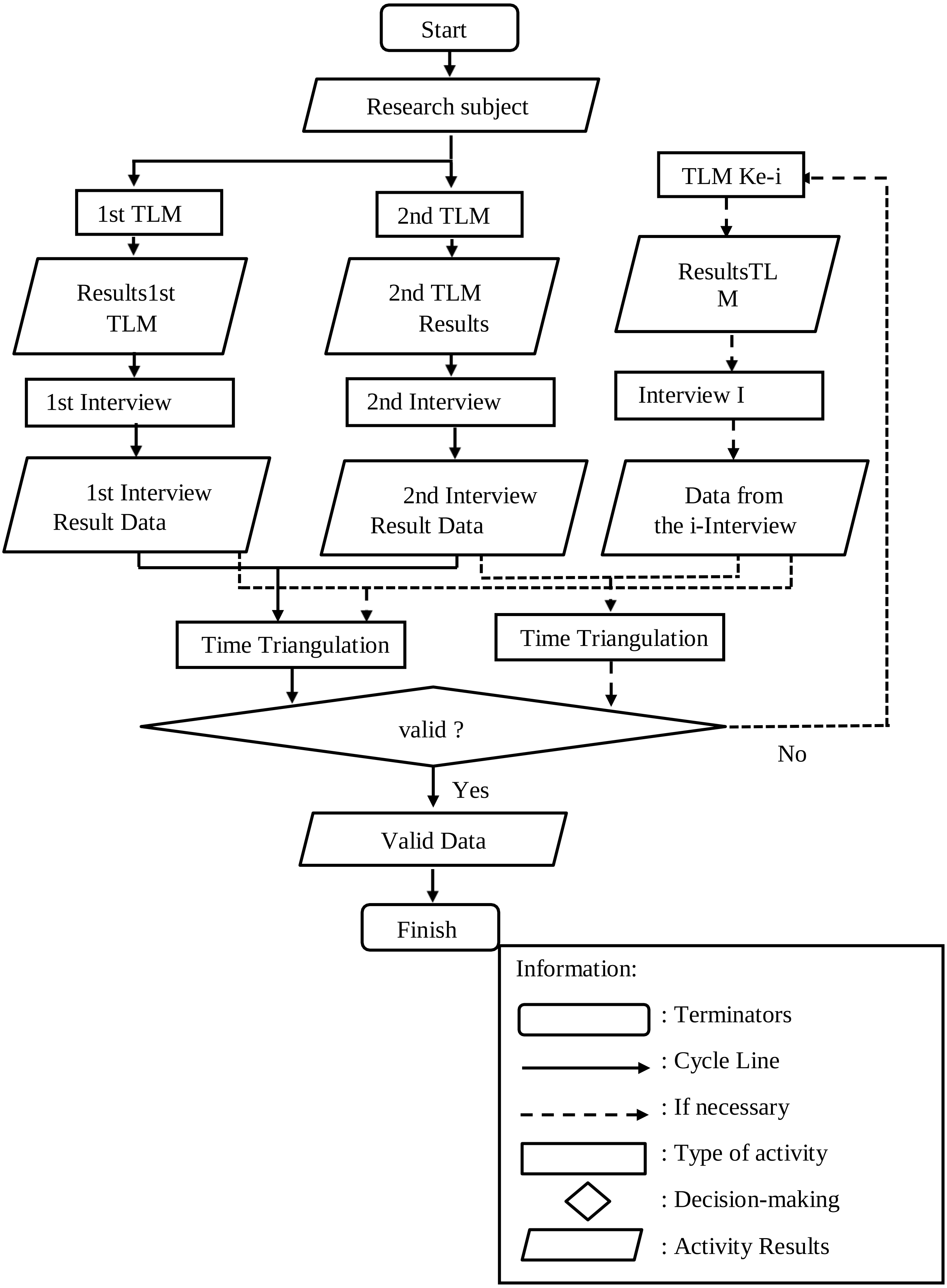


Figure 3.2 Flow of Data Collection

2. Research Instruments

a. Main Instruments

In this study, the main instrument was the researcher himself. Because the researchers conducted interviews themselves to dig up in-depth information regarding the mathematical literacy of class X SMA students in terms of reflective and impulsive cognitive styles that cannot be represented by others. Both during the planning process, conducting research and during data analysis.

b. Supporting Instruments

The supporting instruments used in this study consisted of:

1) Cognitive Style Test Matching Familiar Figure Test (TGK MFFT)

This test is an instrument that tests students' cognitive styles. This instrument is used to determine research subjects who have reflective and impulsive cognitive styles. The MFFT TGK was adopted from a cognitive style test developed by Warli (2010) which has been tested for its validity. This test consists of 13 questions. For each item there is one standard image and eight variation images. In the TGK MFFT implementation, students were asked to choose one of eight variation images that match the standard images. The time used by students in solving problems is also considered by researchers.

2) Mathematical Ability Test (TKM)

This test is a test used to determine students' mathematical abilities. The test was given after the cognitive style test was carried out and it was found that students had reflective and impulsive cognitive styles. The TKM questions used are questions in the form of descriptions. This test consists of 5 questions. The selected questions represent each question content on PISA. The first question is a matter of change and relationship which is taken from algebraic forms. The second question is a matter of uncertainty and data (uncertainty and data) taken from statistical material.

The third question is a matter of space and shape (space and shape) which is taken from the material of flat sided spaces. The fourth question is a matter of quantity (quantity or number) which is taken from the matter of exponentials and root forms. The fifth question is about change and relationship (change and relationship) taken from comparative material. TKM questions in this study were to determine students' equivalent mathematical ability. The selected criteria for mathematical ability are students who have a range of scores not exceeding 5 points. TKM questions are consulted in advance with the supervising lecturer. Then it was validated by experts consisting of two mathematics education lecturers at Surabaya State University and one math teacher teaching class X at SMAN 12 Surabaya.

3) Mathematical Literacy Test (TLM)

The mathematical literacy test is a test to describe the mathematical literacy of class X high school students in solving PISA model questions. TLM was given after it was found that students who had reflective and impulsive cognitive styles had equivalent mathematical abilities. This instrument consists of four questions in the form of descriptions. The questions made are contextual questions and adapted to the components in mathematical literacy, namely content and context components. Following are the details of questions that will be used in TLM.

Table 3.2
Details of TLM Questions

No Question	Content	Context
1.	*Uncertainty and Data* (Uncertainty and Data)	*Occupational*(Work)
2.	*Space and Shape*(space and form)	*Scientific*(Science)

No Problem	Content	Context
3.	*Quantity*(Quantity or Number)	*personal*(Personal)
4.	*Change and Relationships* (Change and Relationship)	*Societal*(Social)

In this study, TLM 1 and TLM 2 had different questions, but had the same level of difficulty because the questions were designed for the triangulation needs of students' mathematical literacy data in solving PISA model questions. The following shows examples of TLM 1 and TLM 2 questions.

Table 3.3
Example of TLM Questions

Example of a TLM Question1	Example TLM 2 problem
Amanah and Berkah manufactures standing fans, wall fans, ceiling fans and portable fans. At the end of production per day, the company's employees will carry out trials on the products produced to make repairs and dispose of problems. The table below compares the average number of each type of product made per day, and the average percentage of defective products per day for both	The Mawar and Melati Company manufactures one-burner gas stoves, two-burner gas stoves, four-burner gas stoves and portable gas stoves. At the end of production per day, the company's employees will carry out trials on the products produced to make repairs and dispose of problems. The table below compares the average number of each type of product made per day, and the average percentage of defective products per day for the two companies, namely Mawar and Melati companies.

Example of a TLM Question1Example TLM 2 problem

company, namely company Trust and Blessing.

Perusahaan	Jumlah rata-rata kipas angin berdiri (*standing fan*) yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Amanah	250	8%
Perusahaan Berkah	200	4%

Perusahaan	Jumlah rata-rata kipas angin dinding (*wall fan*) yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Amanah	200	2%
Perusahaan Berkah	250	6%

Perusahaan	Jumlah rata-rata kipas angin meja (*portable fan*) yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Amanah	150	4%
Perusahaan Berkah	100	2%

Perusahaan	Jumlah rata-rata kipas angin gantung (*ceiling fan*) yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Amanah	200	4%
Perusahaan Berkah	250	6%

Which company has the lower percentage of overall damage? Show your calculations using the data in the table above!.

Perusahaan	Jumlah rata-rata kompor 1 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	300	6%
Perusahaan Melati	250	4%

Perusahaan	Jumlah rata-rata kompor 2 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	350	7%
Perusahaan Melati	350	5%

Perusahaan	Jumlah rata-rata kompor 4 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	100	4%
Perusahaan Melati	200	2%

Perusahaan	Jumlah rata-rata kompor *portable* yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	250	5%
Perusahaan Melati	200	8%

Which company has the lower percentage of overall damage? Show your calculations using the data in the table above!.

In order to obtain a valid instrument, TLM is consulted first with the supervisor. Then it was validated by experts consisting of two mathematics education lecturers at Surabaya State University and one mathematics teacher who teaches class X at SMAN 12 Surabaya. The following is the flow of preparing the mathematical literacy test.

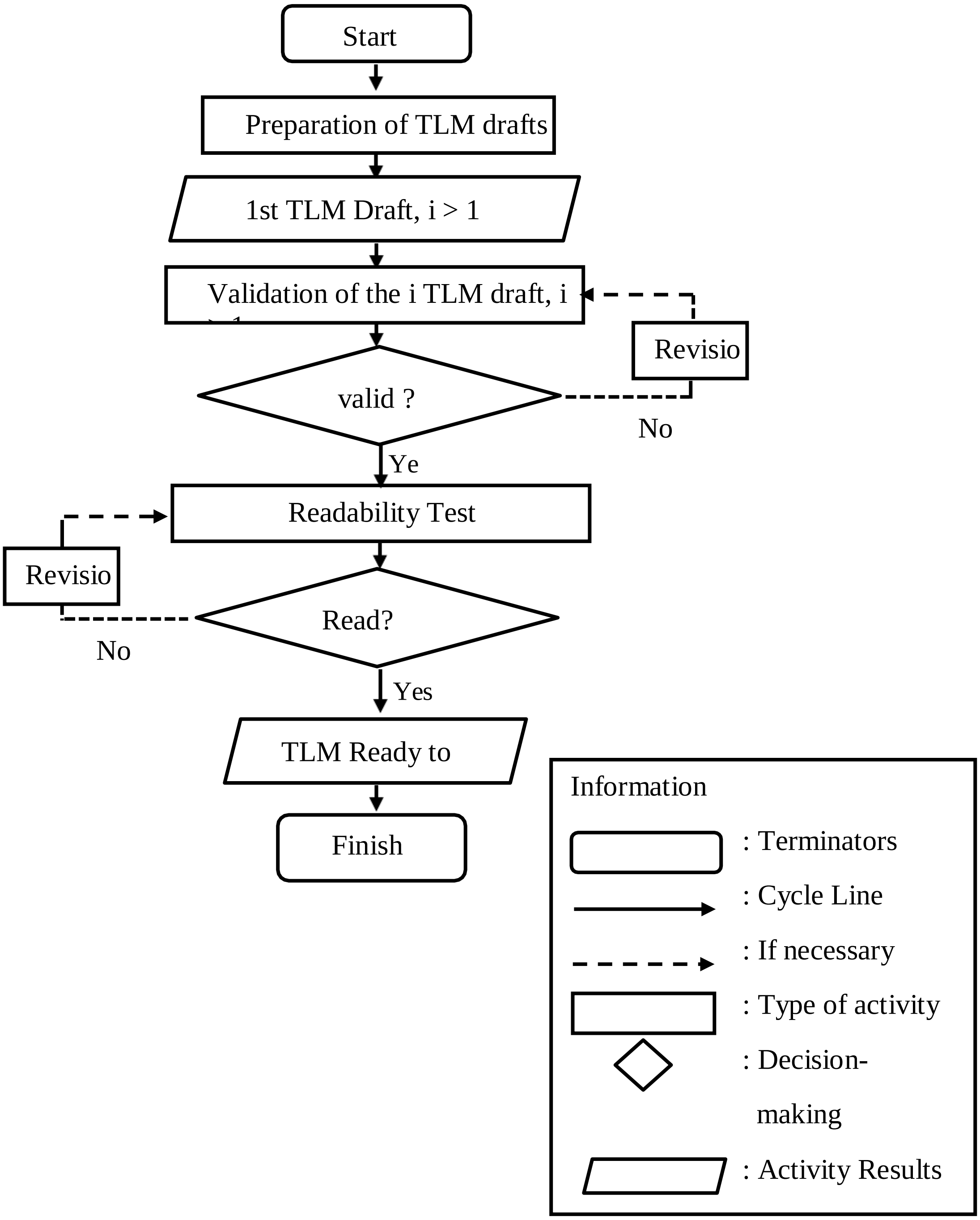


Figure 3.3 The flow of preparing the Mathematical Literacy Test

4) Interview guidelines

Interview guidelines are used by researchers as a guide when conducting interviews with students, so that interviews can be well-directed. This interview guide was used when conducting interviews after the subject worked on the mathematical literacy test (TLM). Interviews were conducted to confirm the TLM results that students worked on and to clarify students' mathematical literacy in reflective and impulsive cognitive styles. Interview guidelines are consulted in advance with the supervisor. Then it was validated by experts consisting of two mathematics education lecturers at Surabaya State University and one mathematics teacher who teaches class X at SMAN 12 Surabaya. The flow of preparing the interview guide instrument validation can be seen in Figure 3.4.

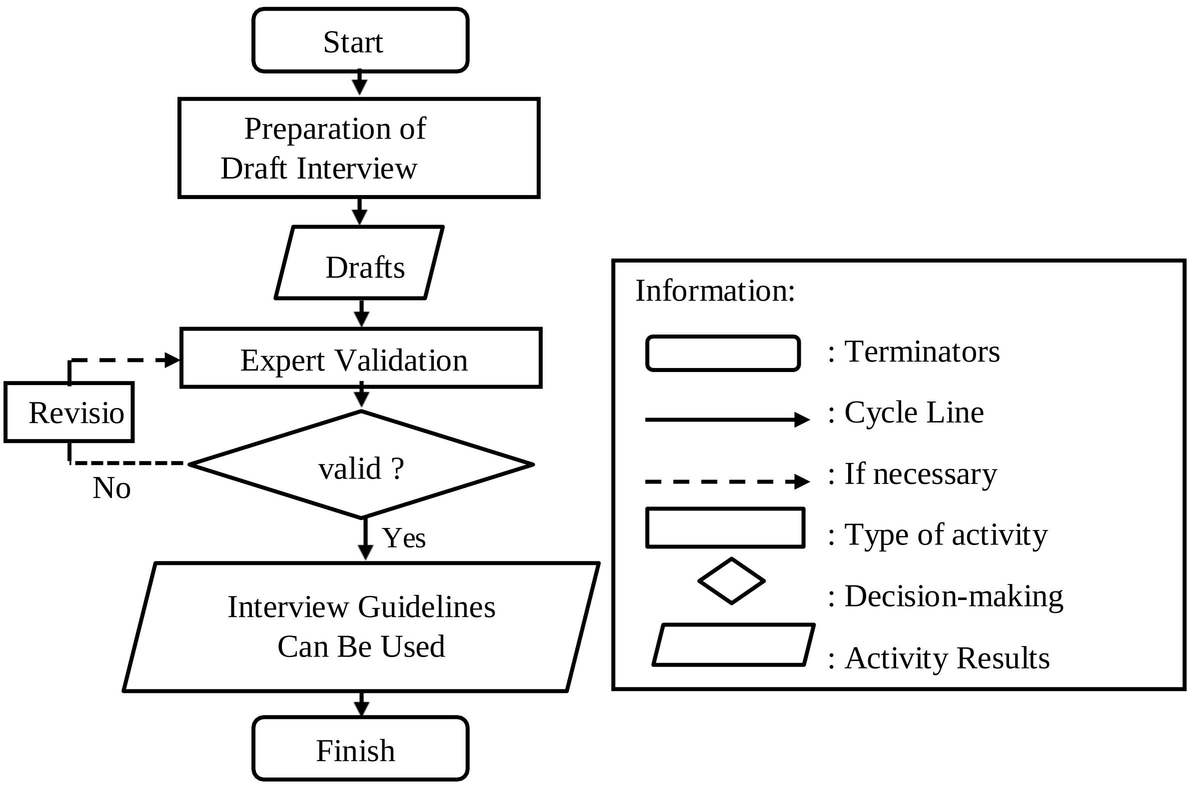


Figure 3.4 Flowchart for Preparation of Interview Guidelines

D. Data analysis technique

The data analysis techniques used in this study were data analysis on the mathematical literacy test 1 (TLM 1), the mathematical literacy test 2 (TLM 2), and test-based interviews. The steps taken during the analysis of the mathematical literacy test data (TLM 1) along with the triangulation data (TLM 2) are as follows:

1. Data reduction

   In this study, the interview results were reduced by selecting data that supports how the mathematical literacy of class X IPA 5 SMAN 12 Surabaya solves the PISA model questions with the following steps:

   a. Summarize and select important data.
   b. Focusing and categorizing the data obtained.
   c. Discard unused data.

2. Data Presentation

   The presentation of the data carried out in this study examined the interview data after being reduced. Researchers use five-digit labels in conversations with research subjects to make it easier to understand short descriptions. The following describes the description of the five digits:

   a. The first two digits are the initials of the research subject, for example SR for research subjects who have a reflective cognitive style and SI for research subjects who have an impulsive cognitive style.
   b. The third digit represents the question number.
   c. The last two digits are the order in which the interviews were conducted. For example SR301, the answer was given by the research subject with a reflective cognitive style for question number 3 in the 1st interview. The capital letter P is used as a label for the conversation conducted by the researcher. For example P501, the interview given by the researcher for question number 5 is in 1st order.

3. Conclusion withdrawal

   Based on the results of the presentation of the data obtained, conclusions were drawn about students' mathematical literacy in solving PISA model questions.

CHAPTER IV

RESEARCH RESULTS

The research results are the results obtained from the implementation of research related to high school students' mathematical literacy in solving PISA model questions which include: results of research supporting instrument development, research subject selection, and research data on students' mathematical literacy in solving PISA model questions in terms of reflective cognitive style and impulsive.

A. Research Support Instrument Development Results

Research support instruments consisted of a cognitive style test Matching Familiar Figure Test (MFFT), math ability test, Mathematical Literacy Test 1, Mathematical Literacy Test 2, and an interview guide. Before being used in research, the instrument was consulted with the supervising lecturer first and then validated by experts. The following describes the process of compiling and validating the instruments used in this study.

1. Reflective and Impulsive Cognitive Style Test (MFFT)

Reflective and impulsive cognitive style tests are used to determine research subjects who have reflective and impulsive cognitive styles. The research subject was one student who had a reflective cognitive style and one student who had an impulsive cognitive style. The TGK MFFT used in this study is a cognitive style test developed by Warli (2010). This instrument has been tested for validity so that it is directly used by researchers.

2. Mathematical Ability Test (TKM)

Mathematical ability tests in this study were used to determine the mathematical abilities of prospective subject students. The research subject was one student who had a reflective cognitive style and one student who had an impulsive cognitive style with equivalent mathematical abilities, namely

the value obtained from TKM is not more than 5 points. TKM consists of five questions in the form of descriptions. The TKM questions were chosen to represent each question content on PISA. The following provides details about TKM.

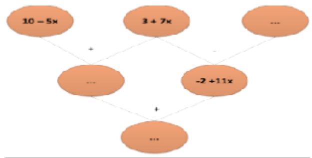
Table 4.1
Details of TKM Questions

No Question	Content OnPISAMaterial	
	changes and relationships (change and relationship)	Algebraic form
1.	*uncertainty and data* (uncertainty and data)	Statistics
2.	*space and shape*(space and form)	Build a flat side room
3.	*quantity*(quantity or number)	Roots and forms
4.	*changes and relationships* (change and relationship)	Comparison

5. Draft TKM questions, first consulted with the lecturer mentor. ResultsTKM consultation with supervisors is a matter of TKM that is considered appropriate for use in research. The TKM questions were then validated by 3 validators consisting of 2 Surabaya State University lecturers who teach school mathematics courses and/or assessment of learning processes and outcomes, as well as a class X math teacher at SMAN 12 Surabaya. The results of the validation carried out were two validators in the study stating that TKM was suitable for use with improvements and one validator stated that TKM was suitable for use in research. In the following, TKM improvements are presented based on suggestions from the validator.

Table 4.2

Improvements to the Mathematical Ability

TestRemarks	Before	After
Instruction	Useblack pen or 2B pencil to fill in the answer sheet.	Use a black pen for answer questions.
	-	Time to work on question 60minute.
Problem No. 1	If the integers x and y divided by 8, there is a remainder of 6. If the number x - 3y is divided by 8, what remains?	Complete the algebraic form missing on every circle below. 
QuestionNo. 4	Known $a+b$ =10 and ab =24. Calculate the value of □2 + $b2$.	It is known that the sum of two numbers is 10 and the product is 24. Calculate the number of numbers, after the two numbers are squared.

Note: The underline marks an improvement in the TKM draft

After the improvements were made, the researcher carried out a legibility test on the math ability test. The readability test was used to find out whether the TKM instruments used in the research could be understood by students. The readability test was carried out on January 19, 2021 on two class X students who were not research subjects. The result of the readability test is that students are able to understand each sentence or question order, so that no revisions need to be made to the TKM. Based on these results, it can be concluded that the mathematical ability test is feasible to use to collect data on students' mathematical abilities.

3. Mathematical Literacy Test Instrument 1 (TLM 1)

Mathematical literacy test 1 is used to reveal high school students' mathematical literacy in solving PISA model questions in terms of reflective and impulsive cognitive styles. TLM 1 questions contain questions adapted from PISA and chosen to represent each PISA content and context. The following shows the selection of questions.

Table 4.3
Details of TLM Questions 1

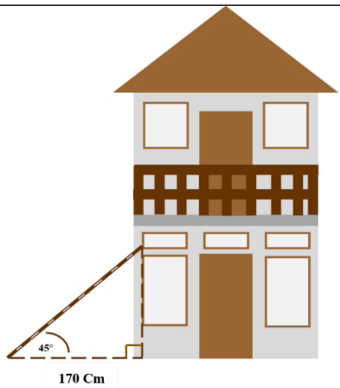
No Question	Content	Context
1.	*Uncertainty and Data* (Uncertainty and Data)	*Occupational*(Work)
2.	*Space and Shape*(space and form)	*Scientific*(Science)
3.	*Quantity*(Quantity or Number)	*personal*(Personal)
4.	*Change and Relationships* (Change and Relationship)	*Societal*(Social)

The draft of TLM 1 questions, first consulted with the supervisor. The results of the TLM 1 consultation with the supervisor were that the TLM 1 questions were considered appropriate for use in research. The TLM 1 questions were then validated by 3 validators consisting of 2 Surabaya State University lecturers who teach school mathematics courses and/or assessment of learning processes and outcomes, as well as a class X math teacher at SMAN 12 Surabaya. The results of the validation carried out were two validators in the study stating that TLM 1 was feasible to use with improvements and a validator stated that TLM 1 was feasible to use in research. In the following, TLM 1 improvements are presented based on suggestions from the validator.

Table 4.4

Improvement of Mathematical Literacy

Test 1	Remarks Before	After
Instructions	Use black pen or 2B pencil to fill in the answer sheet.	Use a black pen to answer questions.
	-	Time to do questions 60 minutes.
Problem No 2	Estimate the length the ladder used to fix the window that forms an angle of 45° and has a horizontal distance of 170 cm as shown in the image below!. 	Mr. Andi will replace one of the windows his existing house cracked. Because the position of the cracked window is too high, Mr. Andiuse the stairs to replace the glass that window. After ladder laid, the ladder forms an angle of 45° and has a horizontal distance of 170 cm as illustrated in the following figure. Try to estimate the length of the ladder used by Mr. Andi.

Description	Before	After
		
Problem No. 3	Mrs. Mimi has money IDR 2,700,000.00 to spend. During the sale, what items can Mrs. Mimi buy with the money? Specify “Yes” or “No” for each of the following options. Give your reasons!.	Miss Mimi has money IDR 2,700,000.00 to spend. During the sale, what items can Mrs. Mimi buy with the money? Specify “Yes” or “No” for each of the following options. Give your reasons on the answer sheet!
Problem No. 4	Mount Ijen is active volcano located in Banyuwangi Regency, East Java, Indonesia. On this mountain there is a phenomenon of blue fire or blue fire which can only be found here. Because of this, Andika was interested in climbing Mount Ijen.	Mount Ijen is an active volcano located in Banyuwangi Regency, East Java, Indonesia. On this mountain there is a phenomenon of blue fire or blue fire which can only be found here. Because of this, Andika was interested in climbing Mount Ijen.

Description	Before	After
	Andika doclimbing throughPaltideng and the cliffs of the Caldera with a distance of about 10 km. Hikers are expected to cover a total of 20 km for the ascent and descent and must return by the hour 19.00. Andika estimated that he could climb the mountain at an average speed 2 km per hour, and descending at twotime climbing.That speed alreadyincluding withCalculation of rest and meal times. By using estimation speedAndika, what time is he the latest?start journeyso can come back at 19.00?	Andika did climbing through paltideng and caldera cliffs with a distance of about 10 km. Hikers are expected to travel a total of 20 km for climbing and descending. Andika estimates that he can climb the mountain at an average speed of 2 km per hour, and descend at twice the ascent. That speed alreadyincluding withCalculation of rest and meal times. By using speed estimate Andika, what time should he start climbing at the latest so that he can return to the starting point at 19.00?

Note: The underline marks an improvement in the TLM 1 draft

After the improvements were made, the researcher carried out a legibility test on the math literacy test questions 1. The readability test was used to find out whether the TLM 1 instrument used in the study could be understood by students. The readability test was carried out on January 19, 2021 on two class X students who were not research subjects. The result of the readability test is that students are able to understand each sentence or question order, so there is no revision that needs to be made to TLM 1. Based on these results, it can be concluded that the mathematical literacy test 1 is feasible to use to collect students' mathematical literacy data.

4. Mathematical Literacy Test Instrument 2 (TLM 2)

Mathematical literacy test 2 is used as a triangulation of high school students' mathematical literacy in solving PISA model questions in terms of reflective and impulsive cognitive styles. TLM 2 questions contain questions adapted from PISA and chosen to represent each PISA content and context. The following shows the selection of questions.

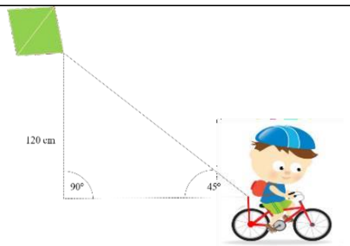
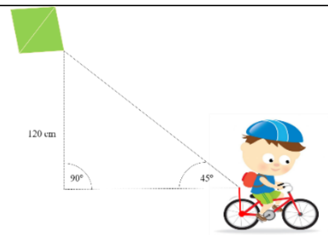
Table 4.5
Details of TLM 2 Questions

No Question	Content	Context
1.	*Uncertainty and Data* (Uncertainty and Data)	*Occupational*(Work)
2.	*Space and Shape*(space and form)	*Scientific*(Science)
3.	*Quantity*(Quantity or Number)	*personal*(Personal)
4.	*Change and Relationships* (Change and Relationship)	*Societal*(Social)

The draft of TLM 2 questions must first be consulted with the lecturer mentor. The results of the TLM 2 consultation with the supervisor were that the TLM 2 questions were considered appropriate for use in research. TLM 2 problem then validated by 3 validators consisting of 2 Surabaya State University lecturers who teach school mathematics courses and or assessment of learning processes and outcomes, as well as a class X math teacher at SMAN 12 Surabaya. The results of the validation carried out were two validators in the study stating that TLM 2 was feasible to use with improvements and one validator stated that TLM 2 was feasible to use in research. In the following, TLM 2 improvements are presented based on suggestions from the validator.

Table 4.6

Improvement of Mathematical Literacy

Test 2Remarks	Before	After
Instructions	Use black pen or 2B pencil to fill in the answer sheet.	Use a black pen to answer questions.
	-	Time to do questions 60 minutes.
Question	 Estimate the length of the kite string that is pulled by the moon and forms an angle of 45° and is at a vertical height of 120 cm as shown in the picture above!.	 Since the Covid-19 pandemic epidemic, Malik decide dilige nt exercise to keep his health. That afternoon, Malik was in the middle cycling on the field near his house. He tie a kite his favorite part

Description	Before	After
		<u>behind the bike. Because the wind blows,</u> <u>kite that was tied earlier</u> <u>started to rise in the air</u> and forms a 45° angle and is at a vertical height of 120 cm as illustrated in the image above. Try to estimate the length of Malik's kite string.
Question	 2019. Silvan is very happy because he was able to buy a new car after working for 4 years. Silvan wants to share the cake with 40 neighbors around his house. Harby cake shop provides a special year-end discount of 20% for each type of bread. Silvan has	 2019. Silvan is very happy because he was able to buy a new car after working for 4 years. Silvan wants to share the cake with 40 neighbors around his house. Harby cake shop provides a special year-end discount of 20% for each type of bread. Silvan has

<table>
<tr><th>Description</th><th>Before</th><th>After</th></tr>
<tr><td></td><td>IDR 500,000.00 for bought 40 boxes of cookies. When the special year-end discount takes place, what cake choices can Silvan buy with that money? Determine “Yes or “No” for each of the following choices and provide your explanation.
<table>
<tr><th>Jumlah pembelian</th><th>Kue</th><th>Bisakah Silvan membeli kue tersebut dengan uang Rp500.00,00?</th></tr>
<tr><td>40 kotak</td><td>read bean bun dan peanut chunk</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>read bean bun dan anpan</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>read bean bun dan sosis mix mayo</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>peanut chunk dan anpan</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>peanut chunk dan matcha twist bun</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>anpan dan sosis mix mayo</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>sosis mix mayo dan read bean bun</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>matcha twist bun dan read bean bun</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>choco ovaltine bun dan anpan</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>choco ovaltine bun dan peanut chunk</td><td>Ya/Tidak</td></tr>
</table></td><td>IDR 500,000.00 for bought 40 boxes of cookies<u>Which Contains 2 cakes per box.</u> When special year-end discounts are taking place, what cake choices can Silvan buy with that money? Determine "Yes or "No" for each of the following choices and provide your explanation on the answer sheet.
<table>
<tr><th>Jumlah pembelian</th><th>Kue</th><th>Bisakah Silvan membeli kue tersebut dengan uang Rp500.00,00?</th></tr>
<tr><td>40 kotak</td><td>roti kacang merah dan roti kacang</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti kacang merah dan roti salju</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti kacang merah dan roti sosis mayo</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti kacang dan roti salju</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti kacang dan roti matcha</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>Roti salju dan roti sosis mayo</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti sosis mayo dan roti coklat</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti matcha dan roti kacang merah</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti coklat dan roti salju</td><td>Ya/Tidak</td></tr>
<tr><td></td><td>roti coklat dan roti kacang</td><td>Ya/Tidak</td></tr>
</table></td></tr>
<tr><td>Question No. 4</td><td>Mountain Rinjani is one of the active volcanoes located in Jambi. Mount Rinjani has a caldera that forms a lake, also known as Lake Segara Anak (Children of the Sea) because of its beautiful blue color, which is as enchanting as the ocean. It was because of this that Kiki was interested in climbing to</td><td>Mount Rinjani is one of the active volcanoes located in Jambi. Mount Rinjani has a caldera that forms a lake, also known as Lake Segara Anak (child of the sea) because of its beautiful blue color, which is as enchanting as the ocean. This is what made Kiki interested in climbing</td></tr>
</table>

Description	Before	After
	Mount Rinjai. Kikido climbing through the Senaru routewith a distance of about 12 km. Hikers are expected to travel a total of 24 km for the ascent and descent and must return at 19.00	Mount Rinjani. Kikido the hike through the Senaru route with a distance of about 12 km. Climberestimated take the total trip for climbing and descend about 24 km.
	Kiki estimatethat he can climb a mountain at an average speed of 1.5 km per hour, and descend at twice the ascent speed. This speed includes the calculation of rest and meal times. Using Kiki's estimated speed, what time is the latest for her to start her journey so that she can be back at 20:00?	Kiki estimatethat he can climb a mountain at an average speed of 1.5 km per hour, and descend at twice the ascent speed. This speed includes the calculation of rest and meal times. Using Kiki's estimated speed, what time should she start climbing at the latest so that she can return to the starting point at 20.00?

Note: The underline marks an improvement in the TLM 2 draft

After the improvements were made, the researcher carried out a readability test on the mathematical literacy test questions 2. The readability test was used to find out whether the TLM 2 instrument used in the study can be understood by students. The readability test was carried out on January 20, 2021 on two class X students who were not research subjects. The result of the readability test was that students were able to understand each sentence or question order, so that no revisions needed to be made to TLM 2. Based on these results, it can be concluded that the mathematical literacy test 2 is feasible to use to collect students' mathematical literacy data.

5. **Interview guidelines**

Interview guidelines in this study were used as a guide for researchers when conducting interviews with research subjects. The interview guidelines were first consulted with the supervising lecturer. The results of consulting the interview guidelines with the supervisor were that the interview guidelines were considered appropriate for use in research. The interview guide was then validated by 3 validators consisting of 2 Surabaya State University lecturers who teach school mathematics courses and/or assessment of learning processes and outcomes, as well as a class X math teacher at SMAN 12 Surabaya. The results of the validation carried out were two validators in the study stating that the interview guideline was feasible to use with improvement and one validator stated that the interview guideline was appropriate for use in research.

Table 4.7

Improved Interview Guidelines

IndicatorLiteracy math	Before after	
Represent the problem mathematically by using	What is Youdo based on	What concept/material associated with about this?

Literacy Indicator mathvariable,	Before after	
symbol , diagram, An dproper modelling.	information Whi chobtained from questions?	
	How would you turn this problem into its proper mathematical representation?	What if the problem changed inside variables/symbol/mo d el math that in accordance?
Apply facts, procedures, concepts, and mathematical reasoning in finding solutions.	How do you use facts,procedure, An dmathematical reasoning in finding a solution?	Rumusapa Whichyou use infinish problem This?Why formula the?.
Reinterpreting the mathematical results obtained into contextual problems.	Describe the results you got	What is your answer already answered which problem asked?. How do you Certain?.

Note: The underline marks the revised interview guide

B. Selection of Research Subjects

The selection of research subjects was carried out based on the provisions mentioned in the previous chapter, namely chapter III. Prospective research subjects consisted of 36 students of class X IPA 5 SMA Negeri 12 Surabaya consisting of 15 male students and 21 female students. SMA 12 Surabaya was chosen based on the consideration of the results of the 2019 National Examination. There is something unique, namely out of 23 public high schools in Surabaya, SMAN 12 Surabaya was ranked 2nd 21 or the lowest 3 with an average value of 58.56. Class X IPA 5 was selected based on the advice of the math teacher for class X. Class X IPA 5 had better math skills than other class X students. Two male students did not participate in learning activities on the day of the research, so the data collected included 34 potential research subjects. Prospective subjects were first collected in a google meet and briefed regarding TGK MFFT and TKM. The test will be held on January 21, 2021. TGK MFFT is given via Google form and TKM questions through class groups. There are two assessments that need to be considered from the MFFT cognitive style test, namely the time students answer for the first time and the frequency of student answers until they get the correct answer. Students are given 2 links to work on the TGK MFFT. In the first link, students are asked to work on questions and fill in the duration of time they answered TGK MFFT so that data will be obtained when students answer the first time and student answers. Students are then asked to work on the TGK MFFT on the second link if they have not got the correct answers for the thirteen items presented. The researcher then counted the number of student answers. Based on the results of the TGK MFFT, the cognitive style data of class X IPA 5 SMA Negeri 12 Surabaya were obtained as follows. The researcher then counted the number of student answers. Based on the results of the TGK MFFT, the cognitive style data of class X IPA 5 SMA Negeri 12 Surabaya were obtained as follows. The researcher then counted the number of student answers. Based on the results of the TGK MFFT, the cognitive style data of class X IPA 5 SMA Negeri 12 Surabaya were obtained as follows.

Table 4.8

Description of Cognitive Style of Students X IPA 5 SMAN 12 Surabaya

Class X IPA 5	StyleCognitiveAmount				whole participant educate
	reflective	Impulsiveno	Fast Accurate	Slow accurate	
Amount	7	12	5	10	34

Based on table 4.8, it was found that of the 34 students who attended the MFFT TGK, there were 20.59% of students who had a reflective cognitive style, 35.29% were impulsive, 14.71% were fast accurate, and 29.41% were slow inaccurate. subject in this study are subjects who have a cognitive style of reflective and impulsive. After the researcher knows the cognitive style of each student, the next step is to see the value of students' mathematical ability. Research subjects were selected based on equivalent mathematical ability. Equivalent mathematical abilities, namely students who have an TKM score of no more than 5 points. The last criterion for research subjects is to choose research subjects based on their gender. Female gender was chosen as a subject in this study based on advice from a mathematics teacher in class X IPA 5 SMA Negeri 12 Surabaya, that female students in the class communicate better than male students. Good communication is needed for the smooth running of the research process. Apart from this,

Based on these criteria, 2 female research subjects were selected who had equivalent mathematical abilities. The following presents the data of the selected research subjects in Table 4.9.

Table 4.9

Research Subject Data

No	Name	Type Sex	Mark TKM	Style cognitive	Code subject
1	JNA	P	97	reflective	RJ
2	SS	P	93	Impulsiv	IS

C. Schedule of Research Activities

Researchers collected data on students' mathematical literacy by giving math literacy test questions 1 and 2 to each research subject. The interviews were conducted after giving the math literacy test questions and carried out based on the results of each subject's work. The details of the activities carried out in this study are presented in the following table.

Table 4.10

Schedule of Research Activities

Date	Activity	Place
12 December 2020 – January 18, 2021	Validate	SMAN 12 Surabaya
04-18 January 2021	Licensing	SMAN 12 Surabaya
19-20 January 2021	Test readability	SMAN 12 Surabaya
January 21, 2021	MFFT cognitive style test	Google meet SMAN 12 Surabaya
January 21, 2021	Test Mathematical Ability	Google meet SMAN 12 Surabaya
28-29 January 2021	TLM 1 and interviews	Google meet SMAN 12 Surabaya
04-05 February 2021	TLM 2 and interviews	Google meet SMAN 12 Surabaya

D. Student Mathematical Literacy Data in Solving PISA Model Problems

There are two types of data in this study, namely data on the results of giving mathematical literacy tests (written) and data from interviews with research subjects. The data collection process includes two stages, namely the administration of a mathematical literacy test 1 and a mathematical literacy test 2 followed by conducting interviews after administering a mathematical literacy test. The interview activities were conducted using Google Meet and recorded with the Camtasia Studio 7 application. The interview results were then transcribed and numbered. To simplify the analysis process, interviews are numbered using 2 letters and 3 numbers. The explanation regarding the numbering is as follows:

1. The first letter states the initials of the research subjects (R and I). The letter R is for a reflective subject and I is for an impulsive subject.

2. The second letter states the initials of the research subjects. RJ is a reflective subject with the first initial J. IS is an impulsive subject with the first initial S.
3. The third digit represents the question number
4. The last two digits are the sequence of interviews conducted with research subjects. For example RJ301, then the answer is given by the reflective subject for question number 3 in interview 1.
5. The capital letter P is used as a conversational label by the researcher. For example P301, the question was given by the researcher for question number 3 in interview 1.

Code indicators for students' mathematical literacy in solving PISA model questions are presented in table 4.11 below.

Table 4.11

Student Mathematical Literacy Indicator Code in Solving Problems the PISA model

Component Process	Indicator	Code
Formulate (Formulate)	Identify the required information in solving problems.	F1
	Represents the problem mathematically using symbols, diagrams, And proper modelling.	F2
Apply (Employ)	Design and use the strategy in process of finding solutions.	E1
	Apply facts, procedures, concepts, and mathematical reasoning in finding solutions.	E2
Interpret(Interpret)	Reinterpreting mathematical results obtained into contextual problems.	I1
	Explain and provide arguments logical from the mathematical results obtained.	I2

This study discusses only the first and second questions of mathematical literacy. The third and fourth questions are not discussed based on the reasons described in the previous chapter.

E. RJ's Mathematical Literacy Research Data in Solving PISA Model Problems

1. Exposure, validation, and inference of data about RJ's mathematical literacy in solving PISA uncertainty and data model questions

a. RJ data exposure on TLM 1

The results of the RJ subject's mathematical literacy test on the PISA Uncertainty and Data model questions can be seen in Figure 4.2 and Table 4.12 of the interview transcript as follows.

Perusahaan Amanah dan Berkah membuat kipas angin berdiri (*standing fan*), kipas angin dinding (*wall fan*), kipas angin gantung (*ceiling* fan), dan kipas angin meja (*portable fan*). Pada akhir produksi perharinya, para pegawai perusahaan akan melakukan uji coba pada produk yang dihasilkan untuk melakukan perbaikan dan membuang yang bermasalah. Tabel di bawah ini membandingkan jumlah rata-rata dari setiap jenis produk yang dibuat perhari, dan persentase rata-rata produk yang rusak per-hari untuk kedua perusahaan yaitu perusahaan Amanah dan Berkah.

Perusahaan	**Jumlah rata-rata kipas angin berdiri (*standing fan*) yang dibuat perhari**	**Jumlah rata-rata produk yang gagal perhari**
Perusahaan Amanah	250	8%
Perusahaan Berkah	200	4%

Perusahaan	**Jumlah rata-rata kipas angin dinding (*wall fan*) yang dibuat perhari**	**Jumlah rata-rata produk yang gagal perhari**
Perusahaan Amanah	200	2%
Perusahaan Berkah	250	6%

Perusahaan	**Jumlah rata-rata kipas angin meja (*portable fan*) yang dibuat perhari**	**Jumlah rata-rata produk yang gagal perhari**
Perusahaan Amanah	150	4%
Perusahaan Berkah	100	2%

Perusahaan	**Jumlah rata-rata kipas angin gantung (*ceiling fan*) yang dibuat perhari**	**Jumlah rata-rata produk yang gagal perhari**
Perusahaan Amanah	200	4%
Perusahaan Berkah	250	6%

Perusahaan manakah yang memiliki persentase keseluruhan kerusakan lebih rendah? Tunjukkan perhitungan Anda menggunakan data dalam tabel di atas!.

Figure 4.1

Items on the PISA Uncertainty and Data TLM model 1

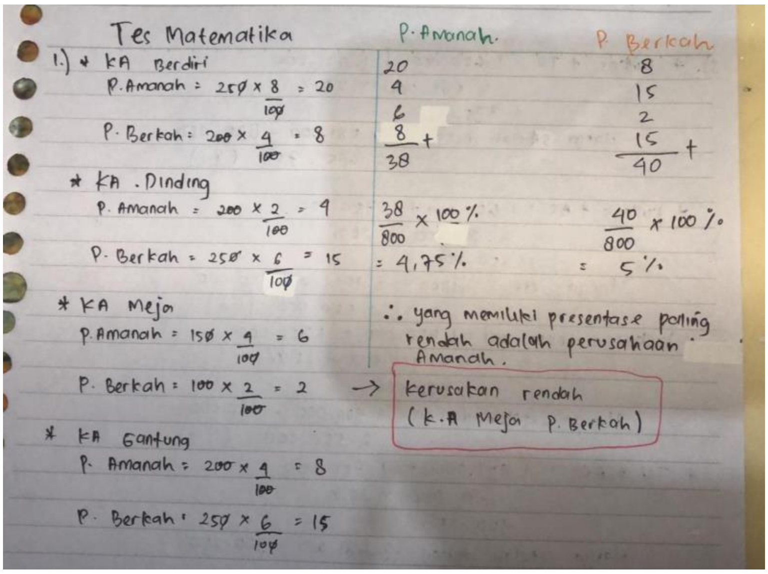


Figure 4.2

The results of the RJ subject's mathematical literacy test on the PISA model questions

Uncertainty and Data

Table 4.12

Interview transcript based on TLM 1 subject RJ on the PISA

Uncertainty and Data model questions

Label	Interview Transcript	Code
P101	What information did you get from the questions?	
RJ101	The problem is that it's about the same trustworthy company Blessing company makes every fan every day there is an average percentage that fails	F1
P102	So what should we look for from this problem?	
RJ102	What you're looking for is the percentage of total damage the lowest	F1
Q103 What concept or material is related to this problem?		
RJ103Comparison,		
average	F2	
P104	How do you solve this first problem based on the information you have obtained?	

Label	Transcip	Interview	Code
	Look for a broken fan first, then fix it		
RJ104	add them up. After that, look for the percentage the damage		E1
P105	Try to explain the solution you used in this saol.		
RJ105	So that's a standing fan company trust company the number is 250 multiplied the damage $\frac{8}{100}$ the result is 20, the company is a blessing 200 timesthe damage $\frac{4}{100}$ the result is 8 Trustworthy wall fan 200 times 2 $\frac{}{100}$ result 4, company blessing 250 times 5$\frac{}{100}$ result15. Trustworthy table fan 150 times 4 $\frac{}{100}$ result 6, blessing company 250 times 2$\frac{}{100}$ result 2. Trustworthy hanging fan 200 multiplied by 4 $\frac{}{100}$ result 8, company blessing 250 times 6$\frac{}{100}$ the result is 15. Continue to add the trustworthy, the result is 38 blessings 40.		E2
P106	So?		
RJ106	Keep looking for the percentage 38 $\frac{}{800}$ x 100% result 4.75%, $\frac{40}{800}$ x 100% returns 5%. So the lowest is a trusted company.		E2
P107	What formula are you using it to mean?		
RJ107	percentage formula		E2
P108	Does your answer answer the question asked? If yes, what is your reason?		

Label	Transcip Interview	Code
RJ108	Yes, the problem is what was asked has the lowest percentage	I1
P109	Okay, try to explain why your results are logical and acceptable?	
RJ109	The problem is that the company is blessed with a percentage the damage is greater ma'am.	I2

From the results of the mathematical literacy test and interview transcripts, it can be stated that RJ did the following.

1) Subject RJ identified the information needed to solve the problem in the form of information he obtained from the problem, namely the number of fans produced and the percentage of products that failed per day from the two companies using his own words and implied from the results of the TLM work (RJ101, Figure 4.9).
2) Subject RJ identified the information that needed to be sought from the problem, namely the lowest percentage of total damage between the two companies using their own words and implied from the results of the TLM work (RJ102, Figure 4.9).
3) The RJ subject represents the questions into concepts/materials related to the questions, namely comparative or average concepts/materials (RK103).
4) The RJ subject represents a matter of using the right symbols or mathematical models in finding the damage to each type of fan for the two companies, the total damage experienced by the two companies, and the total percentage of damage for the two companies (Figure 4.9).
5) Subject RJ designs and uses strategies by solving these problems using the concepts of addition and multiplication (RJ104, Figure 4.9).

6) RJ's subject applies facts, procedures, concepts, and mathematical reasoning in finding solutions by applying the concepts of addition and multiplication to solve the problem. Subject RJ used multiplication to find the damaged fans of each type and the percentage of total damage. Subject RJ used summation to find the total fan damage in both companies (RJ105, RJ106, RJ107, Figure 4.9).
7) Subject RJ reinterpreted the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem. Subject RJ stated and wrote that those with the lowest percentage were trusted companies (RJ108, Figure 4.9).
8) RJ's subject explained and gave logical arguments from the mathematical results obtained that other companies (berkah) had a higher percentage compared to trustworthy companies, namely 5% (RJ109).

b. Exposure of RJ data on TLM 2

The results of the mathematical literacy test for 2 RJ subjects on the PISA Uncertainty and Data model questions can be seen in Figure 4.4 and table 4.13 of the interview transcript as follows.

Perusahaan Mawar dan Melati membuat kompor gas satu tungku, kompor gas dua tungku, kompor gas empat tungku, dan kompor gas *portable*. Pada akhir produksi perharinya, para pegawai perusahaan akan melakukan uji coba pada produk yang dihasilkan untuk melakukan perbaikan dan membuang yang bermasalah. Tabel di bawah ini membandingkan jumlah rata-rata dari setiap jenis produk yang dibuat perhari, dan persentase rata-rata produk yang rusak per-hari untuk kedua perusahaan yaitu perusahaan Mawar dan Melati.

Perusahaan	Jumlah rata-rata kompor 1 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	300	6%
Perusahaan Melati	250	4%

Perusahaan	Jumlah rata-rata kompor 2 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	350	4%
Perusahaan Melati	350	4%

Perusahaan	Jumlah rata-rata kompor 4 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	150	4%
Perusahaan Melati	200	2%

Perusahaan	Jumlah rata-rata kompor 4 tungku yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	150	4%
Perusahaan Melati	200	2%

Perusahaan	Jumlah rata-rata kompor *portable* yang dibuat perhari	Jumlah rata-rata produk yang gagal perhari
Perusahaan Mawar	200	5%
Perusahaan Melati	200	8%

Perusahaan manakah yang memiliki persentase keseluruhan kerusakan lebih tinggi? Tunjukkan perhitungan Anda menggunakan data dalam tabel di atas!.

Figure 4.3

Items on the PISA Uncertainty and Data model

TLM 2

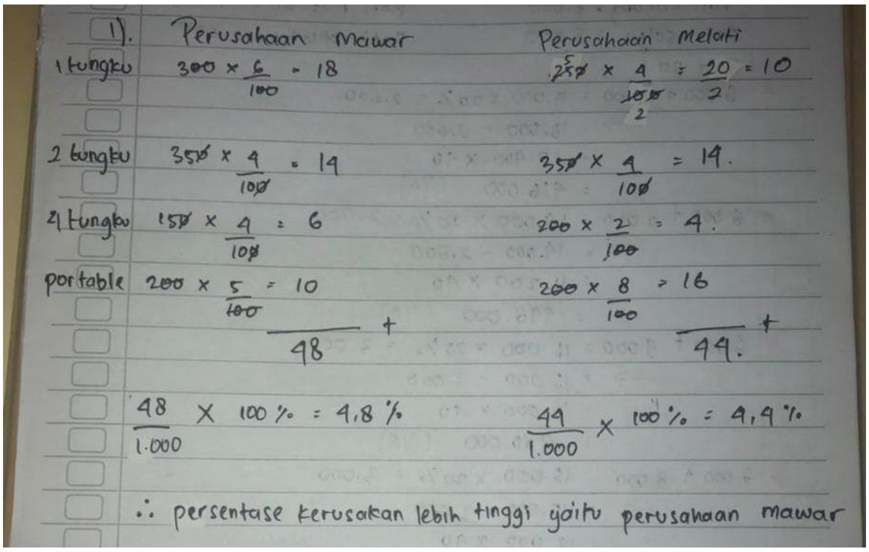


Figure 4.4

The results of the RJ 2 subject's mathematical literacy test on the PISA model questions

Uncertainty and Data

Table 4.13

Interview transcripts based on TLM 2 subject RJ on the PISA Uncertainty and Data model questions

Label	Interview Transcript	Code
P101	What information did you get from the questions?	
RJ101	The number one is making a stove every day gas one burner, two burners, four burners alikegas stove *portable*.Persist percentage daily damage. At the end of every production employees find the average damage.	F1
P102	Any other?	
RJ102	No	F1
P103	Then what needs to be sought from the problem of the first item?	
RJ103	Looking for a company with a percentage of damage higher	F1

Label	Transcip	Interview	Code
P104	In your opinion, what concepts/materials are related with this first question?		
RJ104	Average, percentage		F2
P105	How do you solve this question based on the information you have obtained from the question?		
RJ105	First, look for a broken gas stove with one burner, two burners, four burners and the same*portable* keep looking for the percentage		E1
P106	Try to provide an explanation of the solution You are.		
RJ106	The rose company has one stove 300 equals a failure of 6%, then multiplied by 18. Two 350 furnaces fail 4% the result is 14. Four furnaces 150 fail 4% the result is 6. *Portable*200 failures 5% the result is 10. So all in all, there are 48. Then look for the percentage of 48 per 1000 times 100% the result is 4.8. The jasmine is also the same way.		E2
P107	What formula are you using?		
RJ107	Percent mom		E2
P108	Are you sure your answer is already answered problem asked?		
RJ108	Already ma'am		I1
P109	Why?		
RJ109	The problem is that what is being asked is a percentage more damagehigh, well the highest it's rose company 4.8%		I1

LabelTranscip	InterviewCode	
P110	Okay, try to explain why the results are Do you find this logical and acceptable?	
RJ110	Yes, that wasMa'am, the problem is that the company is jasmine That's a lower percentage, ma'am, only 4.4%.	I2

From the results of the mathematical literacy test and interview transcripts, it can be stated that RJ did the following.

1) Subject RJ identified the information needed to solve the problem in the form of information he obtained from the problem, namely the number of stoves produced and the percentage of total products that failed per day by the two companies using his own words and implied from the results of the TLM work (RJ101, Figure 4.10).
2) RJ's subject identified the information that needed to be sought from the problem, namely the highest percentage of damage between the two companies using their own words and implied from the results of the TLM work (RJ102, Figure 4.10).
3) The RJ subject represents the questions into the concepts/materials related to the questions, namely the average concept/matter or percentage (RJ104).
4) The RJ subject represents a matter of using the right symbols or mathematical models in finding the damage to each type of fan for the two companies, the total damage experienced by the two companies, and the total percentage of damage for the two companies (Figure 4.10).
5) Subject RJ designs and uses strategies by solving these problems using the concepts of addition and multiplication (RJ105, Figure 4.10).
6) RJ's subject applies facts, procedures, concepts, and mathematical reasoning in finding solutions by applying the concepts of addition and multiplication to solve the problem.

Subject RJ used multiplication or percentage to find damaged stoves for each type and the percentage of total damage. Subject RJ used the sum to find the total damage to the stoves in the two companies (RJ106, RJ107, Figure 4.19).

7) Subject RJ reinterpreted the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem. Subject RJ stated and wrote that the rose company had the highest percentage with a percentage of 4.8% (RJ109, Figure 4.19).
8) Subject RJ explained and gave logical arguments from the mathematical results obtained that other companies (jasmine) had a lower percentage compared to rose companies, namely 4.4% (RJ110).

c. Validation of RJ's mathematical literacy data in solving TLM 1 and TLM 2 questions on the PISA Uncertainty and Data model

Triangulation in this study was to test the validity of the RJ subject's mathematical literacy data in solving the PISA Uncertainty and Data model questions in TLM 1 and TLM 2. Triangulation was carried out by comparing data to look for suitability or consistency of data from test results and interviews based on TLM 1 with test results data. and TLM-based interviews of 2 RJ subjects. The triangulation used in this research is time triangulation. The distance between giving and interviewing based on TLM 1 and TLM 2 is one week. The following presents the RJ subject triangulation in table 4.14.

Table 4.14

Triangulation of RJ's Mathematical Literacy Data in Solving PISA Uncertainty and Data Model Problems

Indicator Code	TLM data1Data	TLM 2
F1	Identify the information needed in solving the problem in the form of information that he gets from the problem, namely the number of fans produced and the percentage of failed products per day from both company uses own words and implied from the results of TLM	Identifying informationrequired in solve the problem in the form of information hegetfromquestions ienumber of stoves Whichproduced and the percentage of total products that failedper day by both the
	work. Identifying informationthat need to be searched fromproblem thei.e. the lowest percentage of total damageuse sentenceitself and	company uses its own words and is implied from the results of TLM work. Identifying informationthat need to be searched from these problems i.e. the percentage of total damage
F2	implied from the results of TLM's work. Representing the problem into a concept/material is related to the question Thisis concept/material	is the highestuse sentences itself and implied from the results of TLM's work. Representing the problem into a concept/materialrelated to this question is the average concept/material or percentage.

Indicator Code	TLM data1Data	TLM 2
	comparisonoraverage-flat.	
	Represent the problem using the right symbol or mathematical model.	Represent the problem using the right symbol or mathematical model.
E1Designing	Anduse strategy by completingproblem the use the concept of addition and multiplication or percentage	Designing Anduse strategy by completingproblem the use concept addition and multiplication or percentageapply facts,
E2Apply	fact,procedures, concepts, and mathematical reasoning in finding solutions withapply draftaddition and multiplicationFor finishthe problem. RJ's subject used multiplication to find damaged fans of each type and the percentage of total damage. RJ's subject usessum Forfind the total damage	procedures, concepts, and deep mathematical reasoningfind a solution with apply concept addition and multiplicationFor finishthe problem. RJ's subject uses multiplicationto find a stove damaged of every kindand total percentage damage. SubjectRJ usesumto

Indicator Code	TLM data1Data	TLM 2
	fan on both companies	find the total damage to the stove in both
I1	Reinterpret the mathematical results obtained into the problemcontextual An d state thatthe answer he gotAlready answerpr oblem. RJ's subject stated that those with the lowest percentage were trusted companies	companies Reinterpret the mathematical results obtained into the problemcontextual An d States that the answer he gotAlready answerpr oblem. RJ's subject stated that the rose company had the highest percentage with a percentage of 4.8%.
I2	Explain An dprovides a logical argument from the mathematical results obtained that other companies or blessings have a higher percentage when compared to trustworthy companies, namely 5%.	Explain Andprov ide a logical argument from the mathematical results obtained that the other company(jasmine) owna lower percentage when compared to rose companies, namely 4.4%.

Based on table 4.20, it can be seen that the things expressed by the reflective subject (RJ) tend to be the same and consistent. Thus, it can be stated that the subject's mathematical literacy is reflective

(RJ) in solving PISA uncertainty and data model questions is valid.

d. Conclusion of RJ's mathematical literacy data in solving PISA Uncertainty and Data model questions

Based on exposure to data that has been tested for validity, researchers obtain reflective subject mathematical literacy (RJ) data on aspects of formulating, applying, and interpreting PISA uncertainty and data model questions. RJ carried out all indicators of mathematical literacy (table 4.11), RJ used addition and multiplication in solving problems. Thus, the researcher concludes these findings as follows.

1) Applying, in this aspect the things RJ subjects did were:
   a) Identify the information needed to solve the problem using their own sentences and implied from the results of the TLM work.
   b) Representing questions into related concepts/materials, namely the average concepts/materials and changing the problems presented in the form of appropriate mathematical symbols and models.
2) Formulating, in this aspect the things RJ subjects did were:
   a) Designing and using strategies in solving problems using addition and multiplication.
   b) Apply facts, procedures, concepts, and mathematical reasoning using the information he has obtained and then apply it to addition and multiplication.
3) Interpreting, in this aspect the things RJ subjects did were:
   a) Interpret the results obtained into contextual problems and state that the answers obtained have answered the questions asked.

b) Explain and provide arguments why the answers given are logical and acceptable.

2. Exposure, validation, and inference of data about RJ's mathematical literacy in solving space and shape problems

a. RJ data exposure on TLM 1

The results of the RJ subject's mathematical literacy test on the PISA space and shape model questions can be seen in Figure 4.5 and table interview transcripts

4.15 as follows.

Pak Andi akan mengganti salah satu kaca jendela rumahnya yang sudah retak. Karena posisi jendela yang retak terlalu tinggi, Pak Andi menggunakan tangga untuk mengganti kaca jendela tersebut. Setelah tangga diletakkan, tangga tersebut membentuk sudut 45° serta memiliki jarak horisontal 170 cm seperti ilustrasi pada gambar berikut. Coba perkirakan panjang tangga yang digunakan oleh Pak Andi.

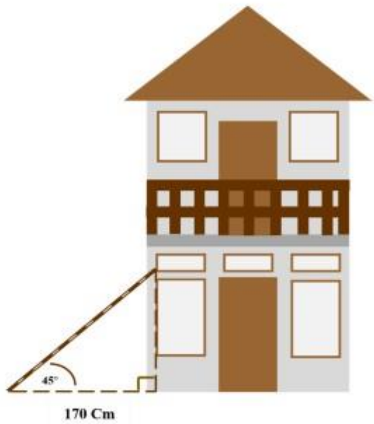


Figure 4.5

Items about the PISA space and shape TLM model 1

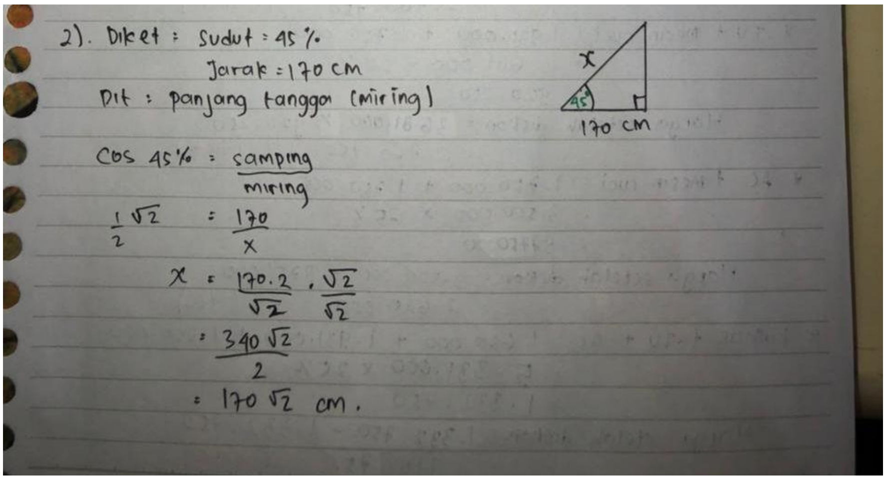


Figure 4.6

The results of the RJ subject's mathematical literacy test on the PISA model questions

space and shape

Table 4.15

Interview transcript based on TLM 1 subject RJ on the PISA space and shape model questions

LabelTranscip	InterviewCode	
P201	What information do you get from the questions these two?	
RJ201	The sides or the horizontal distance of 170 cm are the same the angle is 45 degrees	F1
P202What	what to look for in this question?	
RJ202 Searching		
	the length of the steps or sidescrooked	F1
P203	What do you think this is related to the concept/material of the question? This?	
RJ203	Trigonometry Mrs	F2
P204	How do you solve this problem?	
RJ204	Using trigonometry	E1
P205	Try to explain about the solution you are using	
RJ205Kan	that ladderoblique	E2

LabelTranscip	InterviewCode	
	then the side is 170 cm long and what we are looking for is the slanted part of the ladder so the most appropriate is to use the cos. The formula is sideways for slanted ma'am	
P206	What's your answer already answered problem asked?	
RJ206Yes		buI1
P207 What	the reason?	
RJ207	The problem is that what is asked is the length of the stairs, length $170\sqrt{2}$ –	I1
P208Try Explain why your results are acceptable? Yes,		
RJ208	that was not what the side knew at an angle of 45 so it's appropriate to usecos, I2 The formula is side divided by oblique.	

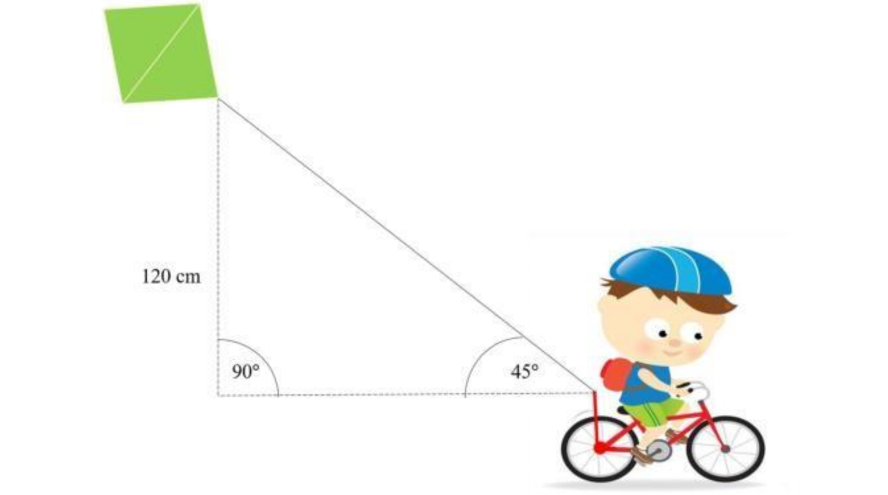
From the results of the mathematical literacy test and interview transcripts, it can be stated that RJ did the following.

1) Subject RJ identified the information needed in solving the problem in the form of information he obtained from the problem, namely the known angle is 45° and the side length is 170 cm using his own sentence (RJ201, Figure 4.11).
2) Subject RJ identified the information that needed to be sought from the problem, namely the length of the ladder or the slanted side using his own sentence (RJ202, Figure 4.11).
3) The subject of RJ represents the problem into the concept/material related to the problem, namely the concept/matter of trigonometry (RJ203).
4) Subject RJ represents a problem using the right mathematical symbol or model in finding the length of the ladder (Figure 4.11)

5) Subject RJ designs and uses strategies in solving problems by choosing to use the concept of trogonometry (RJ204, Figure 4.11).
6) RJ's subject applies facts, procedures, concepts, and mathematical reasoning in finding solutions by applying trigonometry concepts to solve the problem. Subject RJ used the cos α formula to determine the length of the ladder (RJ205, Figure 4.11).
7) Subject RJ reinterpreted the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem. Subject RJ stated that the length of the ladder was $170\sqrt{2}$ (RJ207).
8) RJ's subject explains and gives logical arguments from the mathematical results obtained. RJ stated that based on the information obtained it was appropriate to use the cos formula to find the slanted side or length of the ladder (RJ208).

b. Exposure of RJ data on TLM 2

The results of the mathematical literacy test for 2 RJ subjects on the PISA space and shape model questions can be seen in Figure 4.8 and table interview transcripts 4.16 as follows.



Sejak pandemi Covid-19 mewabah, Malik memutuskan rajin berolahraga untuk menjaga kesehatannya. Sore itu, Malik tengah bersepeda di lapangan dekat rumahnya. Ia mengikatkan layangan kesukaanya ke bagian belakang sepeda. Karena angin bertiup kencang, layangan yang diikat tadi mulai naik ke udara dan membentuk sudut 45° serta berada pada ketinggian vertikal 120 cm seperti ilustrasi pada gambar di atas. Coba perkirakan panjang tali layang-layang Malik.

Figure 4.7

Items about the PISA space and shape TLM 2 model

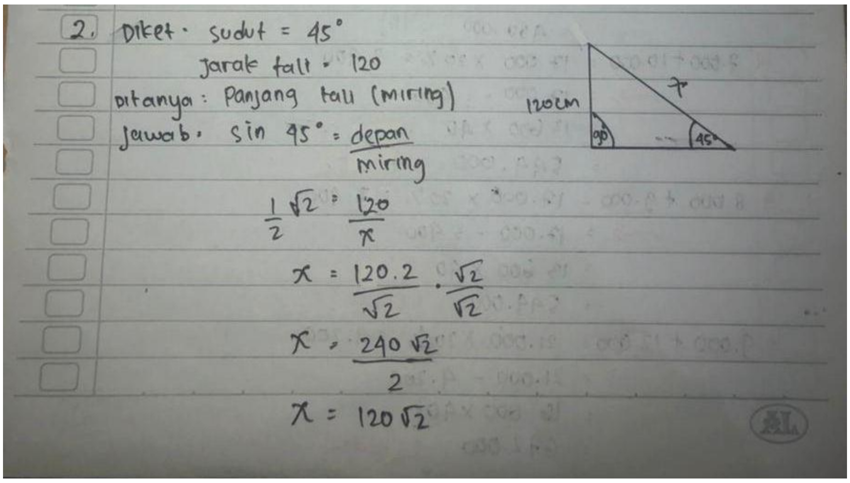


Figure 4.8

The results of the RJ 2 subject's mathematical literacy test on the PISA model questions

space and shape

Table 4.16

Interview transcript based on TLM 2 subject RJ on space and shape questions

Label	Interview Transcript	Code
P201	What information did you get from the questions?	
RJ201	From the problem it is known that the height distance rop e the kite is 120 cm, keep the angle 45 degrees	F1
P202	What to look for in this matter?	
RJ202	What to look forthe length of the kite's string or side oblique triangle	F1
P203	Okay, you think this is the same problem What concept/material?	
RJ203	Trigonometry	F2
P204	How do you solve this problem?	
RJ204	Using trigonometry, look for the hypotenuse	E1
P205	Try to explain how the solution you used in this problem	
RJ205	It's a triangle shape Then the vertical side runs out one hundred and 120 cm Then the 45° angle to the slanted side is unknown We are told to find the length of the rope or the side crooked. So we use the sin formula, the formula is in front of the slant	E2
P206	Does this mean you are using this sinful strategy or formula? Why do you use this formula?	
RJ206	Let it's easy bu	E2

Label	Transcip Interview	Code
P207	So you think this is the easiest way yes?	
RJ207	Yes	E2
P208	Try to explain if your answer is already answer the questions asked?	
RJ208	Already, ma'am, the question is long the rope, length $120\sqrt{2}$	I1
P209	Okay, try to explain why the results you get are acceptable?	
RJ209	The problem is that it is the most appropriate to use the formula which is sin bu because it's what is knownside perpendicular to the same angle Mrs	I2

From the results of the mathematical literacy test and interview transcripts, it can be stated that RJ did the following.

1) Subject RJ identified the information needed in solving the problem in the form of information he obtained from the problem, namely the known angle is 45° and the side length is 120 cm using his own sentence (RJ201, Figure 4.12).
2) Subject RJ identified the information that needed to be sought from the problem, namely the length of the kite string or the slanted side using his own sentence (RJ202, Figure 4.12).
3) The subject of RJ represents the problem into the concept/material related to the problem, namely the concept/matter of trigonometry (RJ203).
4) Subject RJ represents a problem using the right mathematical symbol or model in finding the length of a kite string or the slanted side (Figure 4.12)
5) Subject RJ designs and uses strategies by solving these problems by choosing the concept of trigonometry (RJ204, Figure 4.12).

6) RJ's subject applies facts, procedures, concepts, and mathematical reasoning in finding solutions by applying trigonometry concepts to solve the problem. Subject RJ used the sin α formula to determine the length of the kite string (RJ205, RJ206, RJ207, Figure 4.12).
7) Subject RJ reinterpreted the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem. RJ subject

   states that the length of the kite string is $120\sqrt{2}$ (RJ2$\overline{0}$8, Figure 4.12).
8) Subject RJ explained and gave logical arguments from the mathematical results obtained. RJ stated that based on the information obtained it was appropriate to use the sin formula to find the length of the kite string (RJ209).

c. Validation of RJ's mathematical literacy data in solving TLM 1 and TLM 2 questions on the PISA space and shape model

Triangulation in this study was to test the validity of the RJ subject's mathematical literacy data in solving the PISA model questions space and shape items in TLM 1 and TLM 2. Triangulation was carried out by comparing data to look for suitability or consistency of data from test results and interviews based on TLM 1 with the results data test and interview based on TLM 2 subjects RJ. The triangulation used in this research is time triangulation. The distance between giving and interviewing based on TLM 1 and TLM 2 is one week. The following presents the RJ subject triangulation in table 4.17.

Table 4.17

Triangulation of RJ's Mathematical Literacy Data in Solving PISA Space and Shape Model Problems

Indicator Code	TLM data1Data	TLM 2
F1 alone	Identify the information needed in solving the problem in the form of information that he gets from the problem, namely the known angle is 45° and the side length is 170 cm using sentences and implied by the results of TLM's work.	Identifying informationrequired in solve the problem in the form of information hegetfromquestions ieknown angle is 45° and side length is 120 cmuse sentences Aloneand implied
	Identifying informationthat need to be searched fromproblem thenamely the length of the ladder or the slanted side using its own sentence.	from the results of TLM work. Identifying informationthat need to be searched from problem theis the length of the kite stringkite or side crookeduse sentences Alone.
F2	Representing the problem into the concept/material related to the problem, namely concept/material trigonometry.represent	Representing the problem into the concept/material related to the problem, namely trigonometry concept/material. Representsquestion use
	questionuse the symbol or	the symbol or

Indicator Code	TLM data1Data	TLM 2
	proper mathematical model.	proper mathematical model.
E1	Designing Anduse strategy by completingproblem the using the concept of trigonometry	Designing Anduse strategy by completingproblem the using the concept of trigonometry
E2	Apply fact,procedures, concepts, and mathematical reasoning in finding solutions withapply draft trigonometry Forsolve the problem. RJ subject uses the cos α formula to determine the length of the ladder	apply facts, procedures, concepts, and mathematical reasoning in finding solutions withapply draft trigonometryto solve the problem the. Subject RJusing the formula sin α to determine the length of the kite string. Reinterpret the
I1	Reinterpret the mathematical results obtained into the problemcontextual And state thatthe answer he gotAlready answerproblem. RJ subject	mathematical results obtainedinto trouble contextual And States that the answer he gotAlready answerproblem. RJ subjectstate that

Indicator Code	TLM data1Data	TLM 2
	state thatladder length 170√2	kite string length 120√2
I2Explained	An provide logical arguments from the mathematical results obtained. RJstate that based on the information obtained it is appropriate to use the cos formula to find the length of the ladder.	Explainand provide logical arguments from the mathematical results obtained. RJStates that based on the information obtained it is appropriate to use the sin formula to find the length of the kite string.

Based on table 4.23, it can be seen that the things expressed by the reflective subject (RJ) tend to be the same and consistent. Thus, it can be stated that reflective subject mathematical literacy (RJ) in solving PISA space and shape model problems is valid.

d. Conclusion of RJ's mathematical literacy data in solving the PISA space and shape model problems

Based on the exposure of the data that has been tested for validity, the researcher obtained reflective subject mathematical literacy (RJ) data on the aspects of formulating, applying, and interpreting the PISA space and shape model questions. RJ carries out all indicators of mathematical literacy (table 4.11), RJ uses trigonometry in solving problems. Thus, the researcher concludes these findings as follows.

1) Applying, in this aspect the things RJ subjects did were:
   a) Identify the information needed to solve the problem using their own sentences.

b) Representing questions into related concepts/materials, namely trigonometry concepts/materials and changing the problems presented in the form of appropriate mathematical symbols and models.

2) Formulating, in this aspect the things RJ subjects did were:

a) Designing and using strategies in solving problems using trigonometry.

b) Applying facts, procedures, concepts, and mathematical reasoning using the information he obtained and then applying it to cos α and sin α trigonometry.

3) Interpreting, in this aspect the things RJ subjects did were:

a) Interpret the results obtained into contextual problems and conclude that the answers obtained have answered the questions asked.

b) Explain and provide arguments why the answers given are logical and acceptable.

F. IS Mathematical Literacy Research Data in Solving PISA Model Problems

1. Exposure, validation, and inference of data about IS mathematical literacy in solving uncertainty and data PISA model questions

a. IS data exposure on TLM 1

The results of the IS subject's mathematical literacy test on the PISA uncertainty and data model questions can be seen in Figure 4.9 and Table 4.18 of the interview transcript as follows.

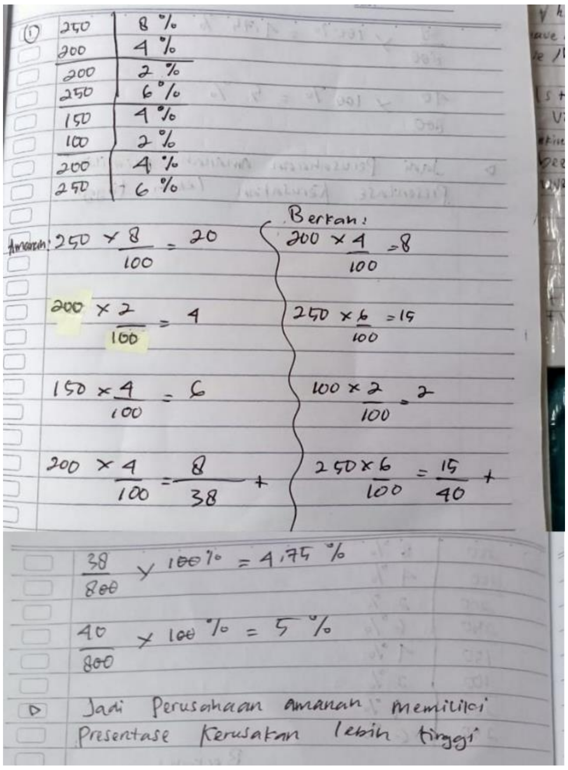


Figure 4.9

The results of the IS subject's mathematical literacy test on the PISA model questions

uncertainty and data

Table 4.18

Interview transcripts based on TLM 1 IS subject on the PISA uncertainty and data model questions

LabelTranscip		
Interview	CodeP101Information what	
did you get from the questions?		
IS101Percentage	which productfail	F1
P102	Then, what needs to be looked for from the problem the?	
IS102	Find the percentage of the total damage that higher	F1
Q103 What concept or material is related to this problem?		
IS103Material		
comparison orstatistics ma'am		F2

Label	Transcip	Interview	Code
P104	How do you solve this question based on the information you have obtained earlier?		
IS104	Look for damage like 250 multiplied by $\frac{8}{100}$ that's 20		E1
P105	Try to explain about the solution you used in the problem		
IS105	Trusted company 250 multiplied by $\frac{8}{100}$ that's 20 200 multiplied by $\frac{2}{100}$ it's 4 150 multiplied by $\frac{4}{100}$ it's 6 200 multiplied by $\frac{4}{100}$ it's 8 Plus 20 + 4 + 6 + 8 = 38 $\frac{38}{800}$ times 100% is 4.75%. The blessing is 200 multiplied by $\frac{4}{100}$ it's 8 250 multiplied by $\frac{6}{100}$ it's 15 100 multiplied by $\frac{2}{100}$ it's 2 250 multiplied by $\frac{6}{100}$ it's 15 Plus 8+15+2+15 = 40 $\frac{40}{800}$ times 100% is 5%.		E2
P106	Wear what formula do you think this is?		
IS106	Multiplication		E2
P107	Try to explain why your answer is already answer the questions asked		
IS107	What is asked is the company that owns higher damage percentage		I1
P108	More high or low?		

IS108 Oh yes low	buI1

LabelTranscip	
Interview	CodeP109 Yes continue
IS109A lower companytrust I1	
P110	Try to explain why your results work accepted?
IS110See	the

only one with a higher percentagehigh buI2

From the results of the mathematical literacy test and interview transcripts, it can be stated that IS did the following things.

1) The IS subject identified the information needed to solve the problem in the form of information that he obtained from the problem, namely the number of fans produced and the percentage of failed products per day by the two companies which were also implied from the results of the TLM work (IS101, Figure 4.15).
2) The IS subject identified the information that needed to be sought from the problem, namely the percentage of overall damage was the lowest between the two companies (IS108).
3) IS subjects represent questions into concepts/materials related to the questions, namely comparative or statistical concepts/materials (IS103).
4) IS subject representsa question of using the right symbol or mathematical model in finding the damage to each type of fan for the two companies, the total damage experienced by the two companies, and the percentage of total damage for the two companies (Figure 4.15).
5) IS subjects design and use strategies by solving these problems using the concepts of addition and multiplication (IS104, Figure 4.15).
6) IS subjects apply facts, procedures, concepts, and mathematical reasoning in finding solutions by applying the concepts of addition and multiplication to solve the problem. The IS subject used multiplication to find the damaged fan for each type and the percentage of the total damage.

IS subjects used summation to find the total fan damage in the two companies (IS105, IS106, Figure 4.15).

7) The IS subject reinterpreted the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem. IS subjects stated that those with the lowest percentage were trusted companies (IS109).
8) The IS subject explained and gave logical arguments from the mathematical results obtained that other companies (berkah) had a higher percentage (IS110).

b. IS data exposure on TLM 2

The results of the mathematical literacy test for 2 IS subjects on questions of uncertainty and data can be seen in Figure 4.10 and Table 4.19 of the interview transcript as follows.

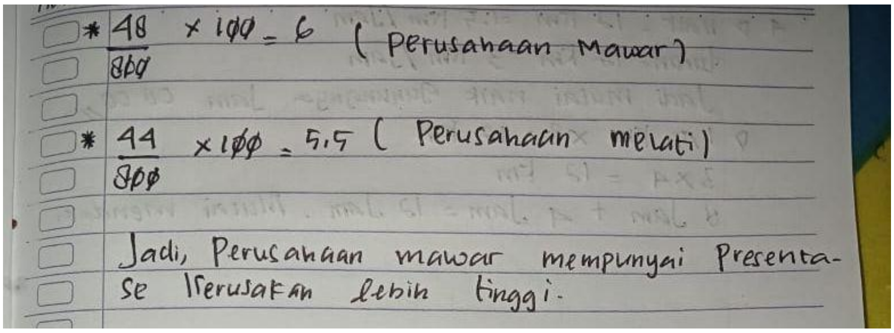


Figure 4.10

Mathematical literacy test results for 2 IS subjects on uncertainty and data questions

Table 4.19

TLM-based interview transcript 2 IS subject on the question

uncertainty and data

Label	Interview Transcript	Code
P101	What information did you get from the questions?	
IS101	Comparison	F1
P102	Comparison of what?	
IS102	rose company and jasmine company regarding failed products is higher	F1
P103What	what to look for from this problem? Find	
IS103F1	the percentage of the total damage that higher	
P104	What concept or material is related to the problem This?	
IS104Material		statisticsBuF2
P105	What is the mathematical model/form of the problem this number 1?	
IS105 Meaning		
P106	HowMa'am? What this means is in the form of a story, nah try to explain how you change this story problem to doneso you can get that answer	F2
IS106	It's not like the rose company 300x $\frac{6}{100}$ the result is 18 then if it's 350 x $\frac{4}{100}$ That's the result 14 150 x $\frac{4}{100}$ result 6 200 x $\frac{5}{100}$ the result is 10 So the results will add up to 48P107	F2
OK		

Label	Transcip	Interview	Code
IS107	Then jasmine company 250 x four $4 \frac{}{100}$ result 10 350 x $\frac{4}{100}$ the result is 14 200 x $\frac{2}{100}$ the result is 200 x $\frac{8}{100}$ four the result is 16 The total is 44 bu		F2
P108	So how do you solve this problem based on the information you've got?		
IS108	Look for the damage, later the amount can be found total damage percentage		E1
P109	Okay, try to explain earlier, right? You already got a company of 48 damaged roses, 44 jasmine, what's your next solution?		
IS109	The company rose 48 divided by 800 total total all the fans multiplied by 100 the result 6%, jasmine company 44 divided by 800 times 100 yield 5.5%		E2
P110	What formula do you use for this?		
IS110	Multiplication		E2
P111	Does your answer answer the question asked? If so, how can you be sure?		
IS111	The problem is in the questions asked which has a higher percentage of damage, rightcompany rose mom		I1
P112	Try to explain why your results are acceptable?		

Label	Transcip Interview	Code
IS112	The problem is that the jasmine company is the percentage lower bu 5,5%	I2

From the results of the mathematical literacy test and interview transcripts, it can be stated that IS did the following things.

1) The IS subject identified the information needed to solve the problem in the form of information that he obtained from the problem, namely the number of stoves produced and the percentage of products that failed per day by the two companies which were also implied from the results of the TLM work (IS101, IS102, Figure 4.16).
2) The IS subject identified the information that needed to be sought from the problem, namely the percentage of overall damage was the highest between the two companies (IS103, Figure 4.16).
3) IS subjects represent questions into related concepts/materials, namely statistical concepts/materials (IS104).
4) The IS subject represents a matter of using the right mathematical symbol or model in finding damage to each type of stove for the two companies, the total damage experienced by the two companies, and the total percentage of damage for the two companies (IS106, IS107)
5) IS subjects design and use strategies by solving these problems using the concepts of addition and multiplication (IS016, IS017, Figure 4.16).
6) IS subjects apply facts, procedures, concepts, and mathematical reasoning in finding solutions by applying the concepts of addition and multiplication to solve the problem. The IS subject used multiplication to find the damaged stoves for each type and the percentage of the total damage. IS subjects used summation to find the total damage to stoves in both companies (IS106, IS107, IS108, IS109, IS110, Figure 4.16).

7) The IS subject reinterprets the mathematical results obtained into contextual problems and believes that the answers he gets already answer the problems. IS subjects stated that rose companies had the highest percentage (IS111, Figure 4.16).
8) IS subjects explained and gave logical arguments from the mathematical results obtained that other companies (Melati) had a lower percentage of 5.5% (IS112).

c. Validation of IS mathematical literacy data in solving TLM 1 and TLM 2 questions on the PISA uncertainty and data model

Triangulation in this study was to test the validity of IS subjects' mathematical literacy data in solving PISA uncertainty and data model questions at TLM 1 and TLM 2. Triangulation was carried out by comparing data to look for suitability or consistency of data from test results and interviews based on TLM 1 with test results data. and TLM-based interviews of 2 IS subjects. The triangulation used in this research is time triangulation. The distance between giving and interviewing based on TLM 1 and TLM 2 is one week. The following presents the IS subject triangulation in table 4.20.

Table 4.20

Triangulation of IS Mathematical Literacy Data in Solving PISA Model Problems uncertainty and data

Code Indicator	TLM data1Data	TLM 2
F1	identifyinformation required infinish problem in the form of information he getfromquestions ienumber of fans Which	Identify the information needed in solving the problem in the form of information he gets from the problem, namely the number of stoves used

Indicator Code	TLM data1Data	TLM 2
	produced and the percentage of failed products per day by the two companies.	produced and the percentage of failed products per day by the two companies.
	Identifying informationthat need to be searched fromproblem theie the percentage of overall	Identifying informationthat need to be searched from these problems i.e. the percentage of overall damage is the highest
F2	damage is the lowest between the two companies. Representing the questions into concepts/materials related to the questions, namely concepts/materials comparison or statistics	between the two companies. Representing the questions into concepts/materials related to the questions, namely statistical concepts/materials
E1Designing	Represent the problem using the right symbol or mathematical model.	Represent the problem using the right symbol or mathematical model. Designing
	Anduse strategy by completingproblem the use the concepts of addition and multiplication	Anduse strategy by completingproblem the use the concepts of addition and
E2Apply	fact,p rocedures, concepts, and	multiplicationapply facts, procedures, concepts, and

Indicator Code	TLM data1Data	TLM 2
	deep mathematical reasoninglooking for a solution withapply draftaddition and multiplicationFor finishthe problem. The IS subject uses multiplication to find each type of broken fan andpercentage wholedamage. Subject ISusesum Forsearchtotal damagefan on secondcompany	deep mathematical reasoningfind a solution with apply concept addition and multiplicationFor finishthe problem. The IS subject uses multiplicationto find a stove damaged each type and the overall percentagedamage. Subject ISusesumto looking for total damage second stove company Reinterpret the
I1	Reinterprets the mathematical results obtained into contextual problems and states that the answers he gets have answered the problem. The IS subject stated that those with the lowest percentage were trusted companies	mathematical results obtained into the problemcontextual An d States that the answer he gotAlready answerpr oblem. IS subjectmention Andwrite down that which has the most percentage

Indicator Code	TLM data1Data	TLM 2
		high is the company of roses
I2Explain		Explain
	Andprovide a logical argument from the mathematical results obtained that the other company(blessing) ownhigher percentage	Andprovide a logical argument from the mathematical results obtained that the other company(jasmine) owna lower percentage of 5.5%

Based on table 4.32, it can be seen that things expressed by impulsive subjects (IS) tend to be the same and consistent. Thus, it can be stated that the impulsive subject mathematical literacy (IS) in solving PISA uncertainty and data model problems is valid.

d. Conclusion of IS mathematical literacy data in solving PISA uncertainty and data model questions

Based on the presentation of the data that has been tested for validity, the researcher obtained data on the subject's impulsive mathematical literacy (IS) on the aspects of formulating, applying, and interpreting uncertainty and data PISA model questions. IS carries out all indicators of mathematical literacy (table 4.11), IS uses addition and multiplication in solving problems. Thus, the researcher concludes these findings as follows.

1) Applying, in this aspect what IS subjects do, namely:
   a) Identify the information needed to solve the problem.
   b) Representing questions into related concepts/materials, namely statistical concepts/materials and changing existing problems

presented in the form of appropriate symbols and mathematical models.

2) Formulating, in this aspect the things that the IS subject does are:
   a) Designing and using strategies in solving problems using addition and multiplication.
   b) Apply facts, procedures, concepts, and mathematical reasoning using the information he has obtained and then apply it to addition and multiplication.
3) Interpreting, in this aspect the things RJ subjects did were:
   a) Interpret the results obtained into contextual problems and believe that the answers obtained have answered the questions asked.
   b) Explain and provide arguments why the answers given are logical and acceptable.

2. Exposure, validation, and inference of data about IS mathematical literacy in solving PISA space and shape model problems

a. IS data exposure on TLM 1

The results of the mathematical literacy test for 1 IS subject on the PISA space and shape model questions can be seen in the interview transcript in table 4.21 as follows.

Table 4.21

Interview transcript based on TLM 1 IS subject on the PISA space and shape model questions

LabelTranscip	
Interview	CodeP201This
what's your answer?	
IS201A	what number ma'am?
P202 The second item is about stairs	No, I did number
IS202	one, three, and four just

Label	Transcip	Interview	Code
P203	Take a look at the problem, then please state What information can you get from the questions and what should you look for?		
IS203	Pak Andi replaced the cracked window. The stairs form a corner 45 ° as well as having a distance horizontally 170cm. What you are looking for is an approximate length the ladder used by Mr. Andi		F1
P204	Okay. What material is this?		
IS204	Confused		buF2
P205	That's the same staircase as a triangular house. What material? What is the geometric shape, algebra, SPLDV, Pythagoras, Trigonometry, statistics or what do you think?		
IS205	Wake up		roombuF2
P206	What?		
IS206	Pythagoras		
richmom			
F2P207	So what, what next?		
IS207	Confused		ma'am,don't knowE1

From the results of the mathematical literacy test and interview transcripts, it can be stated that IS did the following things.

1) The IS subject identified the information needed in solving the problem in the form of information that he obtained from the problem, namely the angle formed by the ladder is 45° and has a horizontal distance of 170cm (IS203).
2) The IS subject identifies the information that needs to be sought from the problem, namely the length of the ladder (IS203).
3) IS subjects represent questions into related concepts/materials, namely Pythagorean concepts/materials (IS206).

4) The IS subject does not represent questions using symbols or the right mathematical model in finding the length of the ladder (IS207)
5) IS subjects do not design and use strategies to solve these problems (IS207).
6) IS subject does not apply facts, procedures, concepts, and mathematical reasoning in solving problems (IS207)
7) The IS subject did not complete the problem so he did not interpret the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem.
8) The IS subject did not complete the problem so he did not explain and provide logical arguments from the mathematical results obtained.

b. IS data exposure on TLM 2

The results of the mathematical literacy test for 2 IS subjects on the PISA space and shape model questions can be seen in table 4.22 of the interview transcript as follows.

Table 4.22

Interview transcripts based on TLM 2 IS subjects on the PISA space and shape model questions

LabelTranscip		
Interview	CodeP201Number	you
didn't finish these two, did you? IS201Yes		Mom, I forgot howdo
itE1 P202	From that question, what information can you get? get?	
IS202	The kite forms a 45° angle vertical 120 cm	F1
P203 If	what to look for?	
IS203Length		
kite stringMalik		
	F1P202 Approx	

What material is this related to?

Label	Interview Transcript	Code
IS202	Build a room ma'am	F2
P203	Why are you building space?	
IS203	The problem is there is a triangle, ma'am	F2
P204	So what if it's a triangle? Is a triangle geometry?	
IS204	Pythagorean huh?	F2
P205	If Pythagoras continues, what should he do?	
IS205	Forget mom	E1
From the results	mathematical literacy test and interview transcript,	can

it is stated that for the aspect of implementing the subject of IS do the following things.

1) The IS subject identified the information needed in solving the problem in the form of information he obtained from the problem, namely the angle formed by a 45° kite and is at a vertical height of 120cm (IS202).
2) The IS subject identifies the information that needs to be sought from the problem, namely the length of the kite string (IS203).
3) The IS subject represents a related concept/material, namely the Pythagorean concept/material (IS204).
4) The IS subject does not represent questions using symbols or the right mathematical model in finding the length of a kite string (IS205).
5) IS subjects do not design and use strategies to solve these problems (IS205).
6) IS subjects do not apply facts, procedures, concepts, and mathematical reasoning in solving problems (IS205).
7) The IS subject did not solve the problem so he did not interpret the mathematical results obtained into the problem

contextual and stated that the answer he got had answered the problem.

8) The IS subject did not complete the problem so he did not explain and provide logical arguments from the mathematical results obtained.

c. Validation of IS mathematical literacy data in solving TLM 1 and TLM 2 questions of both space and shape

Triangulation in this study was to test the validity of the IS subject's mathematical literacy data in solving the PISA space and shape model questions in TLM 1 and TLM 2. Triangulation was carried out by comparing data to look for suitability or consistency of data from test results and interviews based on TLM 1 with test results data. and TLM-based interviews of 2 IS subjects. The triangulation used in this research is time triangulation. The distance between giving and interviewing based on TLM 1 and TLM 2 is one week. The following presents the IS subject triangulation in table 4.23.

Table 4.23

Triangulation of IS Mathematical Literacy Data in Solving PISA Space and Shape Model Problems

Code Indicator	TLM data1Data	TLM 2
F1	identifyinformation needed to solve the problem in the form of information he get from the question ie The angle formed by the ladder is 45° and has a horizontal distance of 170 cm.	Identify the information needed in solving the problem in the form of information that he gets from the problem, namely the angle formed by the ladder is 45° and has a horizontal distance of 120 cm.

Indicator Code	TLM data1Data	TLM 2
	Identify the information that needs to be sought from these problems, namely the length of the ladder.	Identify the information that needs to be sought from these problems, namely the length of the kite string. Representing questions
F2	Representing questions into related concepts/materials, namely concepts/materials pythagoras.	into related concepts/materials, namely concepts/materials pythagoras.
	Does not represent the problem using proper mathematical symbols or models.	Does not represent the problem using proper mathematical symbols or models.
E1	Does not design and use a strategy to solve the problem	Does not design and use a strategy to solve the problem
E2	Does not apply facts, procedures, concepts, and mathematical reasoning in finding a solution for the length of a ladder	Does not apply facts, procedures, concepts, and mathematical reasoning in finding solutions to the length of the kite string
I1	Did not solve the problem so he did notinterpret resu ltsthe mathematics obtained into the problemcontextual And	Didn't solve the problem so he didn'tinterpret results the mathematics obtained into the problemcontextual And

Indicator Code	TLM data1Data	TLM 2
	state thatthe answer he gotAlready answerproblem	state thatthe answer he gotAlready answerproblem
I2	Did not solve the problem so he did notexplain Andprovide logical arguments from the mathematical results obtained.	Didn't solve the problem so he didn'texplain Andprovide logical arguments from the mathematical results obtained.

Based on table 4.35, it can be seen that things expressed by impulsive subjects (IS) tend to be the same and consistent. Thus, it can be stated that impulsive subject literacy (IS) in solving PISA space and shape model questions is valid.

d. Conclusion of IS mathematical literacy data in solving PISA space and shape model problems

Based on the exposure of the data that has been tested for validity, the researcher obtained data on the subject's impulsive mathematical literacy (IS) on the PISA space and shape model questions. IS does not solve problems so it only implements several indicators of mathematical literacy (table 4.11. Thus, the researcher concludes these findings as follows.

1) Applying, in this aspect what IS subjects do, namely:
   a) Identify the information needed to solve the problem.
   b) Representing questions in related concepts/materials, namely Pythagorean concepts/materials but not representing problems in the form of symbols and mathematical models.

2) Formulating, in this aspect the things that the IS subject does are:
    a) Does not design and use strategies in solving problems
    b) Does not apply facts, procedures, concepts, and mathematical reasoning using the information he gets.
3) Interpreting, in this aspect the IS subject does, namely:
    a) Did not solve the problem so that he did not interpret the mathematical results obtained into contextual problems and stated that the answers he obtained had answered the problem
    b) Did not solve the problem so that he did not explain and provide logical arguments from the mathematical results obtained.

CHAPTER V

DISCUSSION

This study aims to describe high school students' mathematical literacy in solving PISA model questions in terms of reflective and impulsive cognitive styles. Mathematical literacy in this study is seen from the three processes described by PISA, namely formulating, applying, and interpreting. This chapter will discuss the findings related to reflective and impulsive students' mathematical literacy, the differences and similarities of reflective and impulsive students' mathematical literacy as well as research limitations.

A. Student Mathematical LiteracyReflective (RJ) in Solving PISA Model Problems

1. RJ's Mathematical Literacy on PISA Uncertainty and Data Model Questions

Reflective subject (RJ) in the aspect of formulating (formulating) problems with indicators identifying the information needed to solve the problem, doing the following (1) identifying the information obtained from the two questions in more detail and using their own sentences and implied from the results of the test;

(2) identify what to look for from the two questions using their own sentences. This finding is supported by Warli & Nofitasari's research (2021), namely "reflective cognitive style can recognize ideas by writing down what is known and what is asked in solving problems" (p. 7). This opinion states that students who have a reflective cognitive style can recognize information obtained from a problem by writing down what is known and asked in solving a problem. The findings in this study are also supported by research results which state that reflective students can express the information asked and known from the questions using their own words appropriately (Ramadhan, et al, 2019; Aini, et al, 2019).

In the aspect of formulating with indicators representing problems mathematically using appropriate symbols, diagrams and modeling, the reflective subject (RJ) does the following (1) Mentions concepts or material related to the problem, namely the average concept or material. The average is intended to find damage to each type of goods in the company and then the amount and percentage of the total damage can be found; (2) Changing the questions into appropriate symbols or mathematical models including mathematical models for damage to each type of goods, total damage to each company per day, and finding the total percentage of damage to each company. This finding is supported by the results of Warli & Nofitasari's research (2021), namely "reflective students are able to use ideas to make mathematical models in solving problems well. It was also found that reflective students were able to interpret real-life problems into mathematical models" (p. 7). This opinion states that students who have a reflective cognitive style are able to make mathematical models in solving a problem well. Reflective students are also able to interpret contextual problems into mathematical models appropriately. Fajriyah, et al (2019) stated that "The analysis of mathematical literacy abilities reviewed from students' cognitive style showed that students with reflective cognitive style were able to ... mathematize ... very well" (p. 63). This opinion means that subjects who have a very good reflective cognitive style in the aspect of mathematizing,

Reflective subject (RJ) in employing (implementing) aspects of problems with indicators of designing and using strategies in the process of finding solutions, reflective subjects (RJ) solve these problems by applying strategies to identify information known from the problem first then apply it to in addition and multiplication. This finding is supported by Warli & Nofitasari's research (2021), namely "reflective students can recognize and use the relationship between ideas in mathematics better than impulsive students" (p. 1). This opinion means that students who have a reflective cognitive style are able to recognize and use existing information from a problem so that they are able to develop appropriate strategies in finding solutions to problems. Fajriyah et al (2019) stated that "The analysis of mathematical literacy abilities reviewed from students' cognitive style showed that students with reflective cognitive style were able to ... devising strategies for solving problems very well" (p. 63).

In the application aspect with indicators applying facts, procedures, concepts, and mathematical reasoning in finding solutions, the reflective subject (RJ) uses multiplication to find damage to each type of goods of the two companies. RJ uses the sum to determine the total damage to the two companies' goods. RJ uses multiplication to convert the total item damage into a percentage. This finding is supported by the results of Azhil's research (2017), namely "The subject of reflective cognitive style ... carry out all settlement plans as a whole and coherent, and provide settlement solutions at the end of time" (p. 60). This opinion means that the reflective subject can carry out all the plans and strategies he thinks of to solve the problem as a whole and provide a solution to a problem. Salido, et al (2020) expressed a different thing, namely "students in the reflective group have characteristics: ... using expert strategies, concluding answers, and solving difficult problems in accordance with logic..." (p.7). This opinion means that reflective students have the characteristics of using strategies, concluding answers, and solving difficult problems with the logic and experiments performed. This finding is in accordance with the discussion in chapter 2, namely reflective students tend to give the correct answers and the correct solutions to the problems given.

The reflective subject (RJ) on the interprete aspect of the problem with indicators reinterprets the mathematical results obtained into contextual problems, states the correctness of the answers they get and provides supporting arguments. In the aspect of interpreting with indicators explaining and providing logical arguments from the mathematical results obtained, the reflective subject explains why the results of his work are logical and acceptable with supporting arguments. This finding is supported by the research results of Fajriyah, et al (2019), namely "The analysis of mathematical literacy abilities reviewed from the students' cognitive style showed that students with reflective cognitive style were able to master communication ... reasoning and argumentation ... very well ”(p. 63). This opinion states that students who have a reflective cognitive style are able to communicate and provide arguments for the answers they get very well. This finding is in accordance with the discussion in chapter 2, namely reflective students are able to make conclusions and provide appropriate reasons to support these conclusions.

2. RJ's mathematical literacy on the PISA Change and Relationship Model Questions

Reflective subject (RJ) on the aspect of formulating (formulating) problems with indicators identifying the information needed to solve the problem, doing the following (1) identifying the information obtained from the two questions in more detail and using the sentences; (2) identify what to look for from the two questions using their own sentences. This finding is supported by Warli & Nofitasari's research (2021), namely "reflective cognitive style can recognize ideas by writing down what is known and what is asked in *solving problems*" (p. 7). This opinion states that students who have a reflective cognitive style can recognize information obtained from a problem by writing down what is known and asked in solving a problem. The findings in this study are also supported by research results which state that reflective students can express the information asked and known from the questions using their own words appropriately (Ramadhan, et al, 2019; Aini, et al, 2019).

In the aspect of formulating with indicators representing problems mathematically by using appropriate symbols, diagrams, and modeling, the reflective subject (RJ) does the following (1) states concepts or material related to the problem, namely trigonometry concepts or material. Trigonometry is meant to find the side length of a triangle where one side and one angle are known; (2) Changing the questions into appropriate mathematical symbols or models including the mathematical model for the length of the ladder. This finding is supported by the results of Warli & Nofitasari's research (2021), namely "reflective students are able to use ideas to make mathematical models in solving problems well. It was also found that reflective students were able to interpret real-life problems into mathematical models" (p. 7). This opinion states that students who have a reflective cognitive style are able to make mathematical models in solving a problem well. Reflective students are also able to interpret contextual problems into mathematical models appropriately. Fajriyah, et al (2019) stated that "The analysis of mathematical literacy abilities reviewed from students' cognitive style showed that students with reflective cognitive style were able to ... mathematize ... very well" (p. 63). This opinion means that subjects who have a reflective cognitive style are very good in the aspect of mathematizing, we have discussed this aspect in the previous chapter which includes the ability to Reflective students are also able to interpret contextual problems into mathematical models appropriately. Fajriyah, et al (2019) stated that "The analysis of mathematical literacy abilities reviewed from students' cognitive style showed that students with reflective cognitive style were able to ... mathematize ... very well" (p. 63). This opinion means that subjects who have a reflective cognitive style are very good in the aspect of mathematizing, we have discussed this aspect in the previous chapter which includes the ability to Reflective students are also able to interpret contextual problems into mathematical models appropriately. Fajriyah, et al (2019) stated that "The analysis of mathematical literacy abilities reviewed from students' cognitive style showed that students with reflective cognitive style were able to ... mathematize ... very well" (p. 63). This opinion means that subjects who have a reflective cognitive style are very good in the aspect of mathematizing, we have discussed this aspect in the previous chapter which includes the ability to mathematizing ... very well" (p. 63). This opinion means that subjects who have a reflective cognitive style are very good in the aspect of mathematizing, we have discussed this aspect in the previous chapter which includes the ability to mathematizing ... very well" (p. 63). This opinion means that subjects who have a reflective cognitive style are very good in the aspect of mathematizing, we have discussed this aspect in the previous chapter which includes the ability to change contextual problems into sentences or mathematical models.

Reflective subject (RJ) on employing (implementing) aspects of problems with indicators of designing and using strategies in the process of finding solutions, solving these problems by applying strategies to identify information known from the problem first then applying it to trigonometry concepts/material. This finding is supported by Warli & Nofitasari's research (2021), namely "reflective students can recognize and use the relationship between ideas in mathematics better than impulsive students" (p. 1). This opinion means that students who have a reflective cognitive style are able to recognize and use existing information from a problem so that they are able to develop appropriate strategies in finding solutions to problems. Fajriyah et al (2019) stated that "The analysis of mathematical literacy abilities reviewed from students' cognitive style showed that students with reflective cognitive style were able to ... devising strategies for solving problems very well" (p. 63). This opinion states that students who have a reflective cognitive style are able to develop strategies to solve a problem very well.

In the aspect of applying with indicators applying facts, procedures, concepts, and mathematical reasoning in finding solutions, reflective subjects (RJ) use trigonometry concepts/materials to solve problems. RJ uses the formula cos α to determine the length of the ladder. RJ uses the formula sin α to determine the length of the ladder and kite string. RJ uses trigonometry because he thinks this method is the easiest. This finding is supported by the results of Azhil's research (2017), namely "The subject of reflective cognitive style ... carry out all settlement plans as a whole and coherent, and provide settlement solutions at the end of time" (p. 60). opinion means that the reflective subject can carry out all the plans and strategies he thinks about to solve the problem as a whole and provide a solution to a problem. Salido, et al (2020) expressed a different thing, namely "students in the reflective group have characteristics: ... using expert strategies, concluding answers, and solving difficult problems in accordance with logic..." (p.7). This opinion means that reflective students have the characteristics of using strategies, concluding answers, and solving difficult problems with logic and experiments carried out. This finding is in accordance with the discussion in chapter 2, namely reflective students tend to give the correct answers and the correct solutions to the problems given.

The reflective subject (RJ) on the interprete aspect of the problem with indicators reinterprets the mathematical results obtained into contextual problems, states the correctness of the answers they get and provides supporting arguments. In the aspect of interpreting with indicators explaining and providing logical arguments from the mathematical results obtained, the reflective subject explains why the results of his work are logical and acceptable with supporting arguments. This finding is supported by the research results of Fajriyah, et al (2019), namely "The analysis of mathematical literacy abilities reviewed from the students' cognitive style showed that students with reflective cognitive style were able to master communication ... reasoning and argumentation ... very well ”(p. 63). This opinion states that students who have a reflective cognitive style are able to communicate and provide arguments for the answers they get very well. This finding is in accordance with the discussion in chapter 2, namely reflective students are able to make conclusions and provide appropriate reasons to support these conclusions.

B. Impulsive Student Mathematical Literacy (IS) in Solving PISA Model Problems

1. Mathematical Literacy IS PISA Uncertainty and Data Model Question Items

Impulsive subjects (IS) in the aspect of formulating (formulating) problems with indicators identifying information needed to solve problems, do the following (1) Identify information obtained from questions and implied from the results of the test; (2) Identify what needs to be looked for from the two questions and is implied from the results of the test. The findings are supported by the results of Warli & Nofitasari's research (2021), namely "students who have impulsive cognitive styles can recognize ideas by writing down what is known and what is asked in solving problems" (p. 7). This opinion states that students who have an impulsive cognitive style can recognize information that is known and asked from a problem. IS had made a mistake in writing down the information asked in the question, however in the interview he realized the mistake and understood what the real question was asking. This is in accordance with the discussion in chapter 2, that impulsive students tend to be less careful in solving a problem.

In the aspect of formulating with indicators representing problems mathematically by using appropriate symbols, diagrams and modeling, impulsive subjects (IS) do the following (1) represent concepts or material related to the problem, namely statistical concepts or material. Statistics intended to find the mean or average damage of each type of goods in the company and then find the amount and percentage of total damage; (2) Changing the questions into appropriate symbols or mathematical models including mathematical models for damage to each type of goods, total damage to each company per day, and finding the percentage of total damage to each company. This finding is supported by the research results of Nurdianasari, et al (2015), namely that students are impulsive good ability in the aspect of representation, the aspect of representation can include representing problems or situations mathematically by using appropriate formulas, variables or modeling.

Impulsive subject (IS) in the aspect of employing (implementing) problems with indicators of designing and using strategies in the process of finding solutions, solving problems using the concepts of addition and multiplication or percentages. In the aspect of applying with indicators applying facts, procedures, concepts, and mathematical reasoning in finding solutions, using multiplication to find damage to each type of goods of the two companies. IS uses the sum to determine the total damage to the goods of the two companies. IS uses multiplication to convert total item damage into percentages. This finding is in accordance with the opinion of Nurdianasari, et al (2015), namely that impulsive students have abilities that are classified as very good in the aspect of devising for problem solving (p. 81).

The impulsive subject (IS) on the interprete aspect of the problem with indicators reinterprets the mathematical results obtained into contextual problems, states the correctness of the answers they get and provides supporting arguments. In the aspect of interpreting with indicators explaining and providing logical arguments from the mathematical results obtained, the subject is impulsive explaining why his work results are logical and acceptable with supporting arguments. This finding is in accordance with the opinion of Fajriyah, et al (2019) "Students with impulsive cognitive style were able to master communication very well" (p. 63). This opinion states that students who have an impulsive cognitive style are able to master aspects of communication very well so that they can explain problems and give arguments well.

2. IS Mathematical Literacy on PISA Space and Shape Model Problems

Impulsive subjects (IS) in the aspect of formulating (formulating) problems with indicators identifying information needed to solve problems, do the following (1) Identify information obtained from questions; (2) Identify what needs to be sought from the two questions. The findings are supported by the results of Warli & Nofitasari's research (2021), namely "students who have impulsive cognitive styles can recognize ideas by writing down what is known and what is asked in solving problems" (p. 7). This opinion states that students who have an impulsive cognitive style can recognize information by writing down what is known and asked about a problem.

In the aspect of formulating with indicators representing problems mathematically by using appropriate symbols, diagrams and modeling, the impulsive subject (IS) does the following (1) Represents concepts or material related to the problem, namely Pythagoras, but he tends to guess and does not understand how Use Pythagoras to solve the problem. This finding is in accordance with the opinion of Warli & Nofitasari (2021), namely "Impulsive students are less able to make connections between one concept and another concept in solving problems" (P. 7). This opinion means that impulsive students are less able to connect concepts in mathematics to solve a problem. (2) Do not change the questions into symbols or mathematical models that are appropriate in finding the length of the slanted side or the length of the ladder and kite string. This finding is supported by Warli & Nifitasari, namely "Students who have impulsive cognitive are less able to use ideas to make mathematical models in solving problems (inaccurate). It was also found that impulsive students were less able to interpret real-life problems into mathematical models" (p. 7). opinion states that students who have an impulsive cognitive style are less able to make mathematical models in solving problems or are inaccurate. Impulsive students are less able to correctly interpret a contextual problem into a mathematical model.Subject Impulsivity (IS) on the aspect *employ* (applying) problems with indicators of designing and using strategies in the process of finding solutions, difficulties in identifying related materials or concepts and choosing suitable strategies to use in solving problems so that they fail to solve these problems. In the aspect of applying with indicators applying facts, procedures, concepts, and mathematical reasoning in finding solutions, impulsive subjects do not apply their facts, procedures, concepts, and mathematical reasoning in solving problems. This finding is in accordance with the opinion of Warli and Nofitasari (2017), namely "Impulsive students are less able to make connections between one concept and another concept in solving problems." (p. 7). This opinion states that impulsive students are lacking in identifying a concept or material related to the problem so that it is difficult to determine the right strategy to solve the problem. Ramadan, et al (2019) stated that in solving problems, impulsive subjects are less able to explain and carry outthe steps taken to solve the problem,

Whichresult in not getting the desired result by the problem. This opinion is also supported by Salido, et al (2020), namely "impulsive groups have characteristics not completing answers, and give up easily in the face of a difficult task" (p. 7). This opinion means that students in the impulsive group tend not to complete an answer problems and easily give up in the face of difficult tasks.Subject Impulsivity (IS) on the aspect *interprete* (interpret) problems with indicators reinterpreting the mathematical results obtained into contextual problems, not solving problems so that he does not interpret the mathematical results obtained into contextual problems and believes that the answers he gets already answer the problems. In the aspect of interpreting with indicators explaining and providing logical arguments from the mathematical results obtained, the impulsive subject did not solve the problem so he did not explain and provide logical arguments from the mathematical results obtained. The difference in solving the problems of impulsive students in the first and second items, it can be seen that the impulsive students did not solve the second problem which contained change and relationship. In chapter 2 we have discussed that this content is related to geometry material. The findings show that impulsive students fail to solve questions that contain the content. This finding is supported by the opinion of Shoimah, et. al (2018) namely reflective students are more creative than impulsive students in solving geometric problems. Reflective students are able to provide many alternative answers and different ways. He also understands the problem very well compared to impulsive students. Thus, this finding is in accordance with Shoimah's research that impulsive students in the subject matter of geometry are lacking in understanding, looking for alternative solutions, and solving a problem.

C. The Similarities and Differences of Reflective and Impulsive Subject Mathematical Literacy in Solving PISA Model Problems

The results of the research described in the previous chapter show that the mathematical literacy of reflective and impulsive subjects has similarities and differences. The following is information about the similarities and differences in mathematical literacy of reflective and impulsive subjects in solving PISA model problems.

Table 5.1

The similarities and differences in the mathematical literacy of high school students in terms of reflective and impulsive cognitive styles

IndicatorMathematical Literacy	High school students' mathematical literacy in solving items on the Uncertainty and Data PISA Model Questions		High school students' mathematical literacy in solving items on the PISA Change and Relationship Model Questions	
	Similarities	Differences	Similarities	Differences
identifyinformation Whichneeded insolve the problem.	Reflective subject (RJ)danimpulsive (IS)identifyinformation that Heget from the question.	reflective subject (RJ)identify the information he obtainedthan about more detailswhen answerquestion interviewandimpliedfrom resultsTLM work.	RJ too	reflective subject (RJ)danimpulsive (IS)identifyinformation that Heget from the question.

RJ's reflective subject identifies and writes	down the information he gets from the questions	in more detail andwritten from results of TLM work.	RJ too

Indicator Mathematical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
	Reflective subject	use their own words. While the subjectimpulsive (IS) identify some of the information, but implicitly the subject is impulsive knowing what information is obtained from the questions seen in the results of the TLM work.	reflective subject	use their own words. reflective subject (RJ)identifynece
	(RJ)andimpulsive (IS)identify the information that needs to be searched problem.	reflective subject (RJ)identifyinformation that needlooking for problemsthe use	(RJ)danimpulsive (IS)identify the information that needs to be searched problem.	ssary information looking for problemsthe use

IndicatorMathematical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
representquestion	Reflective subject	sentence Alone. While impulsive (IS) answers tend to be the same as the sentences in the questions.	Reflective (RJ) and	own sentence. RJ also wrote down the information that needed to be sought in the results of the TLM work.
in a mannermathematical withusesymbol, diagram,And modelingright.	(RJ)andimpulsive (IS)represent the problem in the conceptor material Whichrelated	Reflective subject (RJ) represents the concept or material related to the problem is the average concept or material. The impulsive subject (IS) stated that the concept or material related to the problem was a statistical concept or material.	impulsive (IS) subjects represent questions by mentioning concepts or material related to the questions	The reflective subject (RJ) represents the concept or material related to the problem, namely the trigonometry concept or material. subjectimpulsive (IS) represent the problem into a concept or materialPythagoras, however

IndicatorMathematical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
				tend to guess that.
	Reflective subject (RJ) and impulsive subject (IS) represent the problem mathematicallywith change problem served inappropriate form of symbols and mathematical models.			Reflective subject (RJ) represent the problem mathematically by changing the problem presented in the form of appropriate mathematical symbols and models. Impulsive subject (IS) does not represent problems mathematically by changing the problems presented in the form

IndicatorMathem atical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
				symboland modelappropr iate math.
Designing An d usestrategy in process look forsolution.	Reflective subject (RJ) and the impulsive subject (IS) devise and use strategies by solvingproblem theuse conceptsum And multiplication orp ercentage			Reflective subject (RJ) designing and use strategy by completingproblem theusin g the concept of trigonometry. Impulsive subject (IS) is notdesigning and use strategies to solve the problem

IndicatorMathem atical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
Apply facts, procedures, concepts,And reasoning mathematics in finding solutions.	Reflective subject (RJ) and impulsive subject (IS) usemultiplication or percentage ForLook for damaged goods of every kindAnd percentag eoverall damage. Subjects (RJ and IS) usesum Forlook for total goods damage			The reflective subject (RJ) uses the trigonometry formula, namely sin α and cos α. RJ stated that this is the easiest formula to solve the problemthe. Whereasi mpulsive subject (IS) is notapply fact,proce dures, concepts, and mathematical reasoning in solving problemsso that fail

IndicatorMathematical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
	on second company			solve the problem.reflective subject
Interpretreturn resultsmathematics Whichobtained into contextual problems.	Reflective subject (RJ)andimpulsive (IS)reinterpret mathematical resultsobtained inproblem contextualAnd statethat answer thathe earned Alreadyanswer problems.			(RJ)Reinterpret math results Whichobtainedin contextual problem and believes that the answer he gets already answers the problem.Impulsive subject (IS)Didn't solve the problem so he didn'tinterpret results mathematics

IndicatorMathematical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
				obtained into contextual problems and believes that the answers he gets have answered the problem
Explain And provide logical argumentsfrom results mathematics Whichobtained	Reflective subject (RJ) and impulsivity (IS) explain why the results obtained are logical and can beaccepted with argument Whichsupport.			Reflective subject (RJ) explain why the results obtained are logical and acceptableargument Whichsupport. While the impulsive subject (IS) is notsolve the problem such that he does notexplain And

IndicatorMathematical Literacy	Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Uncertainty and Data*		Mathematics literacy of high school students in complete the Items on the PISA Model Problem *Change and Relationships*	
	Similarities	Differences	Similarities	Differences
				provide a logical argument from the resultsmathematics Whichobtained.

Based on the results of the analysis of similarities and differences in the table above, it appears that the two subjects have similarities and differences in solving PISA model questions. In addition to this, there are differences and similarities in each subject in solving PISA uncertainty and data model questions as well as space and shape. The similarities and differences are explained as follows.

1. Reflective Subject (RJ) in solving PISA uncertainty and data model questions as well as space and shape

   a. Equality

      RJ's subject carried out all the indicators of mathematical literacy on the uncertainty and data PISA model questions as well as space and shape.

   b. Difference

      In the first indicator, namely identifying the information needed to solve the problem, RJ wrote down the information he obtained and needed to find from the PISA space and shape model questions, but not for uncertainty and data. Even so, RJ continued to implicitly identify information from the results of the test and stated the information needed.

2. Impulsive Subject (IS) in solving PISA uncertainty and data model questions as well as space and shape

   a. Equality

      1) IS subjects are able to carry out indicators to identify the information needed to solve problems in the PISA uncertainty and data model questions as well as space and shape.

      2) The IS subject is able to represent the questions in concepts or material related to the PISA uncertainty and data model questions as well as space and shape.

   b. Difference

      1) The IS subject carried out all the indicators of mathematical literacy in the PISA uncertainty and data model questions, but only carried out some of the indicators in the PISA space and shape model questions.

2) The IS subject completed and got answers from the PISA uncertainty and data model questions, while he failed to complete and gave up on space and shape questions which he considered difficult.

D. Research limitations

This research has limitations in its implementation.

These limitations include the following.

1. Researchers only analyzed two of the four questions presented. These questions are questions with content of uncertainty and data (uncertainty and data) as well as change and relationships. Several similarities and differences were found between reflective and impulsive students in the results of the tests and interviews for the two questions. It is possible that these differences and similarities also occur in questions with other content and contexts. Thus, researchers who raise similar topics are advised to be able to analyze students' mathematical literacy with more diverse content and contexts.
2. The study in this study was still limited to students' mathematical literacy in solving PISA model questions in terms of reflective and impulsive cognitive styles taking into account students' mathematical abilities that were equivalent and did not specifically cover high, medium, and low abilities.
3. The provision of mathematical literacy test questions and interviews was not carried out simultaneously because it adjusted to the schedule of appointments with students outside of school hours. This allows students to ask other friends about the test.

CHAPTE

R VI

CLOSING

A. Conclusion

Based on the results of the research described in the previous chapter and referring to the research questions, it can be concluded that several things related to reflective and impulsive students' mathematical literacy are as follows.

1. Reflective Student Mathematical Literacy (RJ) Class X in Solving PISA Model Problems

a) PISA Uncertainty and Data Model Problems

In the aspect of formulating problems, reflective students (RJ) identify the information needed in solving problems in the form of information obtained and sought from more detailed questions and using their own sentences as well as implied from the results of the test. RJ represents the problem into the concept or material related to the problem, namely the average concept or material and transforms the problem into the appropriate mathematical symbol or model.

In the aspect of applying problems, reflective students (RJ) design and use strategies in the process of finding solutions using addition and multiplication. Apply facts, procedures, concepts and mathematical reasoning to find solutions using addition and multiplication. In the aspect of interpreting, reflective students (RJ) reinterpret the mathematical results obtained into contextual problems and state the correctness of their answers by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

b) PISA Change and Relationship Model Question Items

In the aspect of formulating problems, reflective students (RJ) identify the information needed in solving problems in the form of information obtained and searched for from questions using their own sentences and written from the results of the test. RJ represents the problem into concepts or material related to the problem, namely trigonometry concepts or material and transforms the problem into the appropriate mathematical symbol or model.

In the aspect of applying problems, reflective students (RJ) design and use strategies in the process of finding solutions using trigonometry. Apply facts, procedures, concepts, and mathematical reasoning to find solutions using the trigonometry formulas sin α and cos α. In the aspect of interpreting, reflective students (RJ) reinterpret the mathematical results obtained into contextual problems and state the correctness of their answers by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

2. Impulsive Student Mathematical Literacy (IS) Class X in Solving PISA Model Problems

a) Uncertainty and Data PISA Model Question Items

In the aspect of formulating problems, impulsive students (IS) identify the information needed to solve problems in the form of information obtained and sought from questions. IL represents questions into concepts or material related to the questions, namely statistical concepts or materials and transforms questions into appropriate mathematical symbols or models.

In the aspect of applying problems, impulsive students (IS) design and use strategies in the process of finding solutions using addition and multiplication. Apply facts, procedures, concepts and mathematical reasoning to find solutions using addition and multiplication. In the interpreting aspect, the impulsive student (IS) reinterprets the mathematical results obtained into a contextual problem and states the correctness of the answer by providing supporting arguments. Explain and provide logical arguments why the mathematical results obtained are acceptable.

b) PISA Change and Relationship Model Question Items

In the aspect of formulating problems, impulsive students (IS) identify the information needed to solve problems in the form of information obtained and sought from questions. IS represents the problem into the concept or material related to the problem, namely the Pythagorean concept or material, but IS tends to guess that. IS does not change the problem into the appropriate mathematical symbols or models.

On the aspectapplying problems, impulsive students (IS) do not design and use strategies in the process of finding solutions. Does not apply facts, procedures, concepts, and mathematical reasoning to find solutions. In the interpreting aspect, the impulsive student (IS) did not solve the problem so he did not reinterpret the mathematical results obtained into a contextual problem and stated the correctness of the answer with supporting arguments. Does not explain and provide logical arguments why the mathematical results obtained are acceptable.

B. Suggestion

1. The results showed that impulsive students, on the PISA change and relationship model questions, failed to solve the questions and gave up on questions they considered difficult. Therefore, teachers are expected to be able to provide motivation and teaching encouragement that can improve students' abilities in questions related to the material.
2. It is necessary to carry out further research and discussion with the four contents. This needs to be done considering that there are differences in the results of impulsive student tests in the content of uncertainty and data and change and relationships. Impulsive students were able to solve uncertainty and data questions but failed to solve change and relationship questions. This difference is possible in other content with different variations of questions. Therefore, these findings and suggestions are expected to be taken into consideration for similar research in the future.

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