

MATHEMATICAL BELIEFS IN SOLVING STATISTICS PROBLEMS: A CASE STUDY OF INTROVERTED STUDENTS AT A STATE ISLAMIC SENIOR HIGH SCHOOL

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Abstract

This study aims to describe the mathematical beliefs of an introverted student in solving statistics problems. The research was conducted at a State Islamic Senior High School in Palu City using a qualitative descriptive approach. The subject was a male student with an introverted personality and high mathematical ability, identified through the Eysenck Personality Inventory (EPI) and categorized as high-ability based on Arikunto's classification. Data were collected through a statistics problem solving test and semi-structured interviews, then analyzed using the Miles and Huberman model, which includes data condensation, data display, and conclusion drawing. The findings, analyzed through five aspects of mathematical belief, indicate that the introverted student demonstrated positive mathematical beliefs throughout the statistical problem-solving process. He was able to understand problems thoroughly, plan steps systematically, carry out solutions independently and carefully, and review his answers reflectively. These five aspects were reflected in his beliefs about the importance of understanding problem, following solution steps, facing difficult problems, interpreting word problems, and persevering in effort. He relied more on independent thinking than social interaction, preferred structured and logical approaches, and was diligent in verifying his answers.

Keywords: mathematical belief, problem solving, statistics, personality, introvert

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan mathematical belief siswa introvert dalam memecahkan masalah statistika. Penelitian dilakukan di salah satu MAN Kota Palu dengan menggunakan pendekatan deskriptif kualitatif. Subjek penelitian adalah seorang siswa laki-laki dengan tipe kepribadian introvert dan kemampuan matematika tinggi yang ditentukan melalui angket Eysenck Personality Inventory (EPI) serta kategori kemampuan tinggi berdasarkan klasifikasi Arikunto. Data dikumpulkan melalui tes tertulis pada materi statistika dan wawancara semi terstruktur, kemudian dianalisis dengan model Miles dan Huberman yang meliputi kondensasi data, penyajian data, serta penarikan kesimpulan. Hasil penelitian yang dianalisis menggunakan lima aspek mathematical belief menunjukkan bahwa siswa introvert memiliki mathematical belief positif dalam proses pemecahan masalah statistika. Siswa mampu memahami masalah secara teliti, merencanakan langkah-langkah secara sistematis, melaksanakan penyelesaian dengan mandiri dan hati-hati, serta memeriksa kembali jawabannya secara reflektif. Kelima aspek mathematical belief tampak melalui keyakinan siswa terhadap pentingnya memahami masalah, mengikuti langkah penyelesaian, menghadapi soal sulit, menafsirkan soal cerita, dan berusaha dengan tekun. Ia lebih mengandalkan pemikiran mandiri dibandingkan interaksi sosial, menyukai pendekatan yang terstruktur dan logis, serta tekun dalam memverifikasi jawaban.

Kata kunci: keyakinan matematis, pemecahan masalah, statistika, kepribadian, introvert

INTRODUCTION

The success of mathematics learning is not solely determined by mastery of concepts and procedural skills, but also by affective factors such as students' beliefs, attitudes, and self-confidence toward mathematics. Belief is a crucial element in the cognitive and affective development of students during mathematics learning. One highly influential affective aspect is mathematical belief, which refers to an individual's belief in their own ability to understand

and solve mathematical problems (Hidayanto & Ibad, 2023). Students' beliefs influence how they interpret problems, select strategies, and regulate their cognitive processes (Wang et al., 2022). According to Muhtarom et al. (2024), mathematical belief plays a significant role in shaping students' thinking patterns, behavior, and decision-making when faced with mathematical tasks. Students with positive mathematical beliefs tend to be more confident, persistent, and strategic in problem-solving compared to those with negative beliefs (Asare et al., 2025; Komara et al., 2024). High self-confidence can enhance students' mathematical creativity through problem-solving activities, as they trust their own thinking abilities (Raudhatunnur & Dewanti, 2025). This aligns with the findings of Kusuma et al. (2024), which show that emotional regulation plays an important role in maintaining consistency of thought and perseverance when solving mathematical problems.

Studies have shown that students with strong mathematical beliefs tend to possess better problem-solving abilities compared to those with weaker beliefs. Conversely, students with low mathematical beliefs often struggle to develop effective problem-solving strategies and lack confidence when answering mathematical questions (Hidayatullah & Csíkos, 2022; Komara et al., 2024; Mukarromah et al., 2024). Therefore, it can be concluded that mathematical belief plays a crucial role in the process of mathematical problem solving. One area of mathematics that frequently demands strong problem-solving skills is statistics.

Statistics is a crucial topic in school mathematics problem solving, aimed at fostering students' confidence, critical thinking, and mathematical communication skills (Khairunnissa et al., 2024). In the context of statistics learning, which demands analytical skills and precision in interpreting data, mathematical belief is one of the key factors influencing student success. Various observations in classrooms show that many students still face difficulties in understanding grouped data, constructing frequency distribution tables, determining measures of central tendency, and interpreting word problems. These difficulties are consistent with previous findings that students often struggle to extract relevant information and select appropriate strategies in solving a problem such as statistical problem (Khairunnissa et al., 2024; Nur'ain et al., 2024).

Research on mathematical beliefs has been widely conducted across various educational contexts. For instance, a study by Dianita (2022) revealed that positive mathematical beliefs contribute to improved learning outcomes and increased student

confidence in facing mathematical problems. In general, students' mathematical beliefs encompass three main aspects: (1) beliefs about mathematics education, (2) beliefs about oneself, and (3) beliefs about social norms (Leder et al., 2002). Among these, the present study focuses on beliefs about mathematics education, particularly the sub-aspects of beliefs about mathematics learning and problem solving. This focus was chosen in alignment with the field of mathematics education, where the learning process and problem-solving ability are central to the development of students' mathematical beliefs.

Mathematical belief in the context of mathematics learning and problem solving encompasses two main dimensions: beliefs about learning mathematics, which relate to how students perceive mathematics, the learning process, and the teacher's role, and beliefs about mathematical problem solving, which concern how students perceive their own ability to understand, plan, and solve problems (Leder et al., 2002). Leder et al., 2002). Kloosterman & Stage (1992) identified five key aspects that represent mathematical belief: (1) Difficult Problems, the belief that solving challenging problems is important and worthwhile to learn; (2) Understanding, the belief in the importance of understanding concepts rather than merely memorizing formulas; (3) Steps, the belief that following systematic steps helps achieve accurate solutions; (4) Word Problems, the belief in one's ability to translate word problems into mathematical form; and (5) Effort, the belief that success in mathematics is achieved through persistence and continuous effort.

In addition to affective factors, differences in students' characteristics and learning approaches can also be explained through personality types. Personality is the result of the interaction between behavior, environment, and personal factors, which include beliefs, expectations, and self-perception. Personality plays an important role in social dynamics, as explained by Rudianti et al. (2021), who classified personality into introvert and extrovert types. Personality is not a static trait but can develop through learning experiences. In the educational context, understanding differences in personality such as introversion and extroversion helps teachers design more personalized learning approaches (Jach et al., 2023).

Individuals with introverted personalities tend to experience higher levels of anxiety and self-reflection compared to extroverts (Li et al., 2025). These characteristics may make them more cautious and analytical in their thinking, but can also affect their level of self-confidence in social learning situations. This aligns with the findings of (Qadry et al., 2024),

which revealed that students with introverted personality types tend to have more structured and reflective thinking when solving mathematical problems, yet their confidence is more influenced by internal motivation rather than social factors. Introverted students tend to be reflective, structured, careful, and more dependent on internal thought processes rather than social interaction (Rudianti et al., 2021; Selpiana & Munawir, 2024). Previous studies have shown that reflective or introverted students often demonstrate deeper understanding and greater accuracy when following systematic problem-solving procedures (Puspita Hermin et al., 2025; Putri et al., 2025). These characteristics suggest that introverted learners may exhibit a unique pattern of mathematical belief during problem solving.

Although research related to mathematical beliefs is widely available, no studies have specifically described how introverted students display the five aspects of mathematical belief which is difficult problems, understanding, steps, word problems, and effort within the stages of solving statistical problems emerge in each stage of the problem-solving process. Existing studies either focus solely on cognitive aspects, compare personality types in general, or examine mathematical belief without analyzing how these beliefs appear throughout the actual problem-solving process. Therefore, a clear research gap remains in understanding how introverted students express these five belief aspects during each stage of Polya's problem-solving stages.

To address this gap, the present study aims to describe how introverted students' mathematical beliefs are reflected through the five belief aspects when solving statistical problems, based on Polya's problem solving stages. The findings are expected to offer both theoretical contributions to the study of mathematical beliefs and practical implications for teachers in designing learning strategies that accommodate students' personality characteristics, particularly those who rely on reflective and independent thinking.

METHODS

Research Design and Procedures

This research employed a qualitative descriptive approach with a case study design, as the data produced were descriptive in nature, obtained from words, writings, and documents originating from the subject being studied. The purpose of this study was to describe the mathematical belief of an introverted student in solving statistical problems

based on Polya's problem-solving stages. The research was conducted during the odd semester of the 2025/2026 academic year at MAN 2 in Palu City, Central Sulawesi.

The data collection process was carried out in three stages, namely the preparation stage, the implementation stage, and the data analysis stage. The preparation stage included determining the focus of the research, developing research instruments, and selecting the research subject. The implementation stage was carried out by giving the subject written tasks to complete, followed by a semi-structured interview to obtain a deeper understanding of the subject's thought processes during problem-solving. The data analysis stage involved organizing, interpreting, and drawing conclusions based on the results of the written tasks and interviews.

Participant

The subject of this research was one student who possessed an introvert personality type and a high level of mathematical ability. The selection of the subject was carried out using a purposive sampling technique, based on specific criteria relevant to the research objectives. The subject selection process consisted of two stages. The first stage was the identification of personality type, conducted using the instrument developed by Eysenck (2004), namely the *Eysenck Personality Inventory (EPI)*, which classifies students into introvert and extrovert categories. The second stage was the determination of the level of mathematical ability, obtained from the student's mathematics report card score in the even semester of the 2024/2025 academic year. The classification of high mathematical ability followed the criteria proposed by Arikunto (2013), which categorizes students' ability levels into high, medium, and low based on the mean score and standard deviation. The selected student demonstrated characteristics of an introverted personality, such as being reflective, calm, preferring to work independently, and showing persistence in completing mathematical tasks.

Instruments

This study used both a main instrument and supporting instruments. The main instrument in this research was the researcher himself, who acted as the planner, data collector, and data analyst. The supporting instruments included the Eysenck Personality Inventory (EPI) questionnaire to identify the student's personality type, a written task sheet containing one problem-solving question on statistics designed to reveal the student's

mathematical belief through five aspects, namely Difficult Problems, Understanding, Steps, Word Problems, and Effort, as well as an interview guideline consisting of open-ended questions aimed at exploring the student's thought processes and beliefs in solving the given problem.

To ensure the trustworthiness of the data, this study adopted credibility and dependability tests as suggested by Sugiyono (2013). The credibility test was carried out through sufficient engagement with the subject, continuous observation, peer debriefing, and member checking to verify the accuracy of the findings. Dependability was ensured through a comprehensive audit of the entire research process by the academic supervisor, which included proposal preparation, revisions, data collection, result analysis, and final revisions.

Data Analysis

The data analysis technique used in this research referred to the interactive qualitative data analysis model proposed by Miles et al. (2014), which consists of three main stages: data condensation, data display, and conclusion drawing and verification. Data condensation was carried out by selecting and categorizing relevant data based on the five aspects of mathematical belief. Data display was presented in the form of descriptive narratives that illustrated the student's mathematical beliefs in each stage of problem solving. Furthermore, conclusion drawing was performed by interpreting the data and verifying it to ensure its alignment with the research objectives. The written task used in this study was a statistical problem, as shown in Figure 1.

A mathematics teacher at state Islamic Senior High School was preparing for a city-level mathematics olympiad competition. To determine the potential participants, the teacher decided to select one of the parallel tenth-grade classes, namely the advanced class consisting of 35 students. To identify the candidates, the teacher wanted to find out the average score of the students' final semester mathematics exam in that class. The teacher believed that students who scored above the class average deserved to be recommended as candidates for the competition. The teacher recorded the exam scores as follows:

42, 55, 58, 60, 61, 62, 63, 64, 65, 66, 87, 90, 67, 68, 69,
70, 71, 72, 73, 74, 75, 76, 88, 92, 77, 78, 79, 80, 81, 82,
83, 84, 85, 86, 89.

By considering the problem faced by the mathematics teacher and the available data, carry out the necessary statistical analysis to assist the teacher by:

- Present the students' exam score data in the form of a grouped frequency distribution table so that the teacher can obtain a general overview of the distribution of the students' scores!
- Calculate the mean of the grouped data!
- Determine how many students are eligible to be recommended as candidates for the competition!

Note: $\log 35 = 1,5$

Figure 1. Statistics Written Task

The indicators employed were adapted from Kloosterman & Stage (1992), which were then adjusted to the problem-solving stages proposed by Polya (1973), as presented in Table 1.

Table 1. Indicators of Mathematical Belief Based on Problem-Solving Steps

Polya's Problem-Solving Steps	Sub-variables of Mathematical Belief	Indicators
Understanding the problem	Difficult Problems	Belief that one is capable of understanding problems that are considered difficult.
	Steps	Belief that understanding the problem is an essential step in solving mathematical problems.
	Understanding	Belief in one's ability to interpret the information and requirements contained in the problem.
	Word Problems	Belief that word problems can be analyzed and understood when examined carefully.
Devising a plan	Effort	Belief that effort and persistence can help in better understanding the problem.
	Difficult Problems	Belief that planning strategies can help in dealing with difficult problems.
	Steps	Belief that each step in devising a plan is important for achieving success.
	Understanding	Belief that understanding mathematical concepts supports the formulation of effective solution strategies.
Carrying out the plan	Word Problems	Belief that word problems can be systematically planned for their solutions.
	Effort	Belief that successful planning results from effort and carefulness.
	Difficult Problems	Belief that the strategy that has been planned can be implemented even when the problem seems difficult.
	Steps	Belief that following the solution steps systematically will lead to correct results.
Looking back	Understanding	Belief that understanding each step facilitates the execution of the strategy.
	Word Problems	Belief that word problems can be solved gradually and logically.
	Effort	Belief that hard work and consistency are essential when carrying out the planned strategy.
	Difficult Problems	Belief that reviewing the solution helps identify errors and improve solutions for difficult problems.
Looking back	Steps	Belief that the final review step is an important part of problem solving.
	Understanding	Belief that re-understanding the solution process can enhance reflective thinking skills.
	Word Problems	Belief that reviewing the solution to word problems reinforces understanding of the problem's context.
	Effort	Belief that evaluating one's work is part of the effort to become better at mathematics.

RESULTS AND DISCUSSION

The subject of this research consisted of one eleventh-grade male student who was selected based on the introvert personality type and a high level of mathematical ability. The class selection was made based on the recommendation of the mathematics teacher, considering that the class had heterogeneous characteristics in terms of students' abilities and personalities. From a total of 34 students who completed the Eysenck Personality Inventory (EPI) questionnaire, the results showed that 12 students were categorized as extroverts, 19 students as introverts, and 3 students as ambiverts, as presented in Table 2.

Table 2. Results of the Personality Type Questionnaire

Personality Type	Total Students
Ekstrovert	12
Introvert	19
Ambivert	3

Based on the results of the classification, the researcher focused the study only on students with the introvert personality type. The selection of the research subject was carried out by considering the teacher's recommendation and the student's mathematical ability. The students' mathematical abilities were classified into high, medium, and low categories based on the criteria proposed by Arikunto (2013), which use the mean (\bar{x}) and standard deviation (SD) of the mathematics report card scores from the even semester of the 2024/2025 academic year. The results of the classification of students' mathematical abilities are presented in Table 3.

Table 3. Results of Student Classification Based on Mathematical Ability

Score	Mathematical Ability	Total Students
$Score \geq \bar{x} + SD$	High	7
$\bar{x} - SD \leq Score < \bar{x} + SD$	Medium	22
$Score < \bar{x} - SD$	Low	5

From the seven students who had high mathematical ability, one male student with high mathematical ability was selected based on the mathematics teacher's recommendation, namely a student with an introvert personality type. This student was then chosen as the focus of the study to describe the profile of mathematical belief in solving statistical problems. The initials used to refer to the subject in this study are SI.

The Results of Mathematical Belief in Mathematics Learning

In this section, the data were obtained entirely from the subject's verbal explanations during the interview and are presented in Table 4 below.

Table 4. SI's in Mathematics Learning

Dialogue	
PN-001	: Alright, let's get started. What do you think about mathematics as a subject in general?
SI-002	: Personally, I think mathematics is actually fun, as long as I already understand how to solve the problems, how to work on the questions, I mean.
PN-003	: So, math is fun for you. Then, do you think mathematics is important in everyday life? Can you give an example?
SI-004	: It's very important. In math, it's not just about solving problems on paper; it's also about solving real problems. Like how we can apply certain formulas or methods, it's more about problem-solving, applying it to daily life.
PN-005	: Okay. How do you feel when learning mathematics in class like happy, challenged, or maybe find it difficult?
SI-006	: It depends on the material and the questions. If I understand the topic well, then I feel happy and excited.
PN-007	: How does your teacher usually explain the math material in class?
SI-008	: Usually, the teacher explains the material first, then gives exercises on the board.
PN-009	: Do you think that way of teaching helps you understand the lesson better?
SI-010	: Sometimes not. Sometimes the teacher explains too fast for me. But after doing the exercises, I can understand.
PN-011	: Which learning activity helps you the most in understanding mathematics (for example: discussions, exercises, teacher explanations, or group work)?
SI-012	: First, the teacher's explanation helps me the most. After I understand, I need to do a lot of exercises. I think that's the key to learning math, practicing a lot.
PN-013	: How confident are you in your ability to solve math problems, and when do you usually feel uncertain?
SI-014	: I feel confident when I fully understand the topic and have practiced a lot. But I feel unsure when I still don't understand the question or the material.
PN-015	: What do you usually do when you encounter a problem that you find difficult?
SI-016	: First, I look for the solution on YouTube or the Internet.
PN-017	: What do you think about people who don't like mathematics? Do you think they can still succeed if they try?
SI-018	: I think people who don't like math can still succeed or understand it, as long as they really try hard, study seriously, and stay consistent.
PN-019	: How do you react when you realize that your answer to a math problem is wrong?
SI-020	: I reflect on it. I look at where I went wrong. For example, if I got one question wrong, it means I still lack understanding there, so I try to fix it and study that part again.
PN-021	: What motivates you to keep trying even when the math problems are difficult?
SI-022	: My goals. I have personal goals, for example, something I really want to achieve. So, I have to work hard to reach that goal.
PN-023	: In your opinion, what can teachers do to make mathematics easier to understand?
SI-024	: I think teachers should explain more slowly so that students can follow better. Also, they should give more exercises, but not the difficult ones right away. Start with easier ones first, then move gradually to the harder levels.

The research findings show that the subject with an introverted personality type (SI) possesses a positive mathematical belief toward learning mathematics. SI perceives

mathematics as an enjoyable and useful subject in everyday life. This perspective motivates him to continue learning even when encountering difficult material. SI believes that success in learning mathematics can be achieved through consistent practice and repetition. He demonstrates high perseverance and independence, preferring to seek additional explanations from self-learning resources such as the internet or instructional videos rather than relying on others. In addition, SI believes that every student can understand mathematics if they make a sincere effort. This belief reflects strong internal motivation and self-control, where academic success is viewed as the result of personal effort.

Overall, SI demonstrates a positive mathematical belief from both affective and cognitive aspects. From the affective perspective, SI shows enjoyment, internal motivation, and perseverance in learning mathematics. From the cognitive perspective, SI exhibits the ability to plan learning strategies, utilize independent learning resources, and believe that understanding is achieved through continuous effort and reflection. These findings indicate that introverted students tend to develop self-confidence and mathematical belief through a reflective and in-depth independent learning process.

The Results of Mathematical Belief in Statistical Problem Solving

1. SI's Mathematical Belief in the Indicator of Understanding the Problem

SI's written test results on the mathematical belief indicator of understanding the problem are presented in Figure 2 below.

Dik:	Dit: -Tabel distribusi
nilai maks = 92	- Rata-rata
nilai min = 42	- Banyak siswa yang berhak
n = 35	jadi kandidat lomba
$\log 35 = 1,5$	

Figure 2. SI's in Understanding the Problem

During the interview stage, SI also provided explanations that reflected his mathematical belief in understanding the problem. The interview results containing these statements are presented in Table 5 below.

Table 5. SI's in Understanding the Problem

Dialogue	
PN-053	: Do you think this problem is difficult? Why?
SI-054	: No, because I already understand it and have studied it before.

-
- PN-055 : How do you understand this problem?
- SI-056 : I've studied this material before by doing lots of exercises and watching YouTube, so I understand it by identifying the problem first.
- PN-057 : In your opinion, is understanding the problem important before solving it?
- SI-058 : Yes, it's very important because if we don't understand the problem, we won't be able to solve it.
- PN-059 : What is the first step you take when reading a problem?
- SI-060 : I first look at the question, identify the problem, and then note what information is given.
- PN-061 : What information do you get from this problem?
- SI-062 : The students' scores, the maximum and minimum scores, n or the number of students, and $\log n$ or $\log 35$. Then the problem or question is stated — first, we make a frequency distribution table and then find the mean. So, the problem is that the teacher wants to calculate the average score of the students to choose candidates for a competition, and only students above the average score are eligible.
- PN-063 : How do you make sure that the information is correct?
- SI-064 : By checking again, rereading the problem, and matching the information I got with what's written in the question.
- PN-065 : Do you find this word problem easy to understand?
- SI-066 : Yes, it's very easy because the given data and the question are clearly stated.
- PN-067 : How do you understand word problems?
- SI-068 : By reading repeatedly and identifying what is asked and what is known.
- PN-069 : What do you do if you still find the problem confusing?
- SI-070 : I ask you again for clarification.
- PN-071 : What effort do you make to better understand it?
- SI-072 : By working more carefully and focusing better.
-

Based on the written test and interview results, SI demonstrated a positive mathematical belief at the stage of understanding the problem. In the difficult problems aspect, SI was confident in understanding the question because he had mastered the material and had previously worked on similar problems. In the steps aspect, SI recognized the importance of understanding the question before solving it to ensure accurate results. In the understanding aspect, SI was able to identify essential information such as score data, the number of students, and the requirement to construct a frequency distribution table carefully. In the word problems aspect, SI found the problem easy to comprehend because the data and purpose of the question were clear, and he reread the problem to ensure understanding. Meanwhile, in the effort aspect, SI demonstrated a positive attitude by staying focused, being thorough, and seeking additional explanations when uncertain. Overall, SI showed confidence, perseverance, and a reflective attitude in understanding mathematical problems.

2. SI's Mathematical Belief in the Indicator of Devising a Plan

In this section, the data were obtained entirely from the subject's verbal explanations during the interview and are presented in Table 6 below.

Table 6. SI's in Devising a Plan

Dialogue	
PN-073	: After you understand, what is your plan to solve this problem?
SI-074	: First I determine what is known from the problem, for example, the maximum and minimum scores, n and the $\log-n$. Then I decide which formulas to use. The first is the formula to find the number of classes, the second is to determine the class limits and interval length. After that I make the required tables, the frequency tables, and then compute everything using the formulas. So basically, choose the formula that fits the problem.
PN-075	: Does this plan make it easier for you to solve the problem?
SI-076	: Yes, it makes it easier and I can solve the problem.
PN-077	: What steps will you use and why did you choose those steps?
SI-078	: The steps I will use are the ones in my plan because they fit the problem.
PN-079	: Which concepts do you use in your plan and how do those concepts help?
SI-080	: The concept of calculating the average or mean, because the teacher wants to find the students' average score and select candidates with scores above the mean, so the mean concept helps.
PN-081	: How did you create your plan for this word problem and why is the plan appropriate?
SI-082	: I created the plan by first identifying the problem, then choosing the suitable concept or formula. I applied the mean formula because it fits the problem.
PN-083	: How do you make sure your plan is correct?
SI-084	: By re-checking the problem to ensure my plan matches the stated problem.
PN-085	: What effort do you make to ensure the plan succeeds?
SI-086	: Rereading and calculating carefully.

Based on the interview results presented in Table 6, SI demonstrated a positive mathematical belief at the stage of devising a plan for problem solving. In the difficult problems aspect, SI showed confidence in identifying key information and selecting the appropriate formula to deal with challenging problems. In the steps aspect, SI was able to clearly explain the sequence of solution steps and believed that following the planned steps would facilitate the problem-solving process. In the understanding aspect, SI developed a plan based on a correct conceptual understanding, such as applying the mean formula appropriately according to the context of the problem. In the word problems aspect, SI believed that story problems could be effectively planned and solved when the content and objectives of the question were carefully understood. Meanwhile, in the effort aspect, SI demonstrated accuracy and initiative by rechecking his plan and calculations to ensure the results were correct. Overall, SI displayed a systematic approach to planning, supported by a

strong conceptual understanding, as well as a careful and reflective attitude in designing strategies to solve mathematical problems.

3. SI's Mathematical Belief in the Indicator of Carrying Out the Plan

SI's written test results on the mathematical belief indicator of carrying out the plan are presented in Figure 3 below.

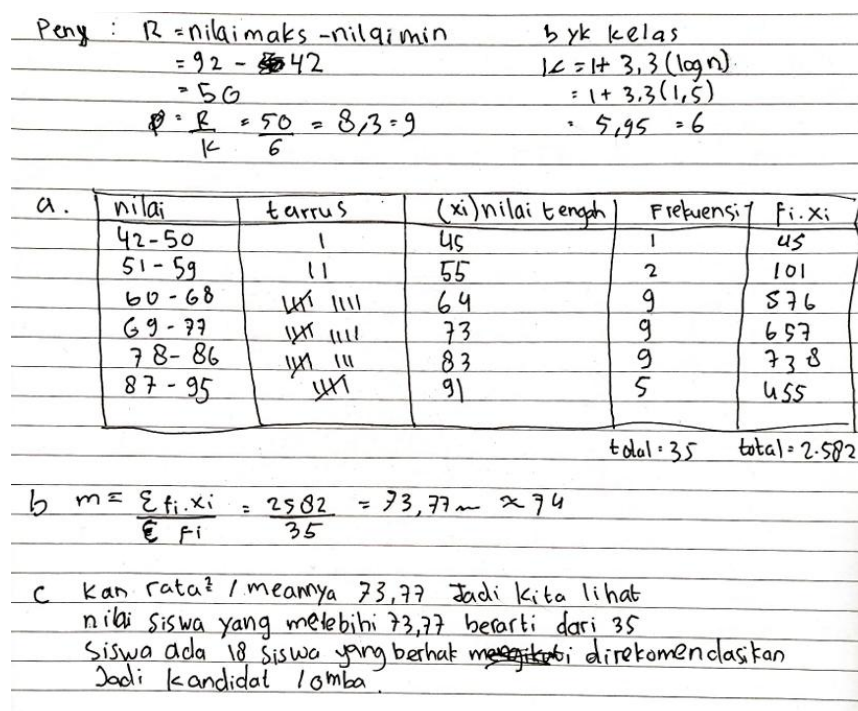


Figure 3. SI's in Carrying Out the Plan

During the interview stage, SI also provided explanations that reflected his mathematical belief in carrying out the plan. The interview results containing these statements are presented in Table 7 below.

Table 7. SI's in Carrying Out the Plan

Dialogue	
PN-087	: After making your plan, do you think you can carry it out?
SI-088	: Yes, I can, because I'm the one who made the plan myself.
PN-089	: What is the biggest challenge?
SI-090	: There isn't any, actually.
PN-091	: How do you follow the steps of your plan?
SI-092	: I just do them one by one according to the plan, and make sure everything is correct.
PN-093	: Did all the steps go smoothly?
SI-094	: Yes, everything went smoothly.
PN-095	: How did the concept you understood help in solving the problem?
SI-096	: The concept I understood was the concept of mean or average. That concept fits the problem in this question, where the teacher wants to find the class average to select candidates for a math competition.
PN-097	: Was there any concept that was difficult to apply?

SI-098	:	No, there wasn't.
PN-099	:	How did you solve the word problem, and do you think your steps were logical?
SI-100	:	I solved it by following the plan I made, and I think the steps were logical.
PN-101	:	How do you stay focused, and what effort do you make when you face difficulties?
SI-102	:	I stay focused on the problem and don't pay attention to others. When I face difficulties, I usually ask someone who understands better. But earlier, I didn't face any difficulty, so I just stayed focused while working on it.

Based on the written test and interview, subject SI showed a positive mathematical belief in implementing the problem-solving plan. For difficult problems, he was confident that the prepared plan would help overcome challenges. In terms of steps, SI executed the plan systematically and ensured each stage was correct. Regarding understanding, he applied the concept of the mean learned previously. For word problems, SI considered the steps logical and consistent with the problem's context, reflecting confidence in effective problem solving. In the effort aspect, he demonstrated determination and perseverance by staying focused, concentrating fully, and asking questions when needed. His written work also showed effort through the use of tally marks to ensure data accuracy before calculating the average. Overall, SI carried out the plan carefully and consistently, supported by high self-confidence and strong effort in solving mathematical problems.

4. SI's Mathematical Belief in the Indicator of Looking Back

In this section, the data were obtained entirely from the subject's verbal explanations during the interview and are presented in Table 8 below.

Table 8. SI's in Looking Back

Dialogue		
PN-105	:	Did you recheck your answer, and was there any part that you corrected?
SI-106	:	Yes, of course, and there was a part that I corrected.
PN-107	:	Which step did you recheck, and why did you check that part again?
SI-108	:	This part, the division. I checked it to make sure it was correct or not, and it turned out I was wrong at first, so I corrected it.
PN-109	:	How did you try to understand the process again?
SI-110	:	By looking again at what I had written.
PN-111	:	What did you learn from rechecking your work?
SI-112	:	I realized that I made a mistake when dividing. Luckily, I rechecked it. So I think reviewing is really important because it helps us feel more confident in our answers.
PN-113	:	Did you reread the word problem and what was the result after rereading it?
SI-114	:	Yes, I did. It matched. The information I got at first and after rereading the problem was still the same.
PN-115	:	What would you do if your answer was still wrong?
SI-116	:	If my answer was still wrong, that means I have to study more.
PN-117	:	What effort will you make so you won't make the same mistake in the next problem?
SI-118	:	I'll learn from my mistakes. I need to understand the material better so I won't make the same errors next time.

Subject SI demonstrated a positive mathematical belief during the looking back stage of problem solving. For difficult problems, he believed looking back was essential to ensure accuracy and was confident that errors could be corrected through careful review. In terms of steps, SI identified which parts required checking, such as correcting a division error, showing his awareness of the reviewing stage as integral to problem solving. Regarding understanding, he reread his written steps to locate mistakes, reflecting confidence in his ability to correct errors through reflection. For word problems, SI ensured that the information and solution steps aligned with the problem's context, demonstrating accuracy in interpretation. In the effort aspect, he sought to learn from mistakes by deepening his conceptual understanding to avoid repeating them, showing a commitment to continuous improvement. Overall, SI displayed a reflective, diligent, and responsible attitude, with strong belief in the importance of accuracy, effort, and deep understanding in mathematics.

DISCUSSION

Based on the results of the study above, it was found that SI, an introverted student with high mathematical ability, consistently demonstrated positive mathematical beliefs across all four stages of Polya's problem-solving stages. At the stage of understanding the problem, SI demonstrated strong beliefs in Understanding, Word Problems, and Effort by carefully rereading the question, identifying key information, and verifying its accuracy, showing that comprehension was viewed as a fundamental step before solving. When devising a plan, he adopted a structured and systematic approach, with dominant beliefs in Steps, Difficult Problems, and Understanding, as seen in his careful selection of formulas, conceptual justification, and alignment of the plan with problem requirements. In carrying out the plan, SI remained consistent with his earlier beliefs, following each step sequentially without major difficulties, and showing strong confidence in his strategies through tally marks, accurate calculations, and self-monitoring. Finally, in looking back, SI displayed high reflective ability by identifying and correcting division errors and emphasizing verification, which highlighted his beliefs in Effort and Difficult Problems and revealed that he regarded mistakes as opportunities for learning rather than signs of failure.

To better understand SI's profile, the findings can be connected with previous studies that highlight how introverted students develop and express mathematical beliefs. Consistent with Rudianti et al. (2021), SI appeared reflective, calm, and independent, relying on internal

reasoning, rechecking his own understanding, and working methodically behaviors that highlight strong self-regulation. In line with Jach et al. (2023), his tendencies toward careful planning, persistent review, and independent practice suggest that personality traits can be strengthened through learning experiences. SI's introversion not only shaped but was also reinforced by his study habits such as watching tutorials and practicing alone. Similarly, Putri et al. (2025) emphasize that reflective students engage more deeply with problem solving, and SI's consistent use of conceptual understanding, careful linkage of steps to context, and thorough engagement illustrate this point clearly. Taken together, these alignments show that SI's mathematical beliefs are both rooted in his introverted personality and cultivated through reflective learning practices, enabling him to exhibit the five belief aspects in a structured and thoughtful manner.

CONCLUSION

This study shows that the mathematical belief of introverted students is consistently reflected in every stage of the statistical problem-solving process. This belief is evident in the way students carefully understand problems, design structured solution strategies, execute plans meticulously, and review their work reflectively. The introverted students in this study also demonstrated a strong tendency toward independent learning, as shown by their preference for seeking explanations through online sources such as videos and the internet rather than discussing with peers. This independent learning pattern reinforces their confidence in their own abilities and supports a deeper and more focused thinking process.

The findings affirm that introverted personality traits such as high reflection, independence, and thoroughness make an important contribution to the development of positive mathematical belief. Furthermore, the results expand the understanding of how the five aspects of mathematical belief proposed by Kloosterman & Stage are manifested in the statistical problem-solving practices of introverted students. The implication is that teachers need to design learning experiences that allow room for independent exploration, provide time for reflection, and present materials that enable students to work systematically so that their mathematical beliefs can develop optimally.

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