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Analyzing Mathematical Problem-Solving Skills from the Perspective of Psychological Well-Being

Riza Fatimah Zahrah[1*], Winarti Dwi Febriani[2], Agus Ahmad Wakih[3], Vera Ratna Pratiwi[4]
[1,2,3]Perjuangan University of Tasikmalaya, Tasikmalaya, Indonesia
[4]Pertamina Kilang International, Indramayu, Indonesia

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ABSTRACT

Mathematical problem-solving is a fundamental competency in mathematics education that is influenced not only by cognitive ability but also by students' affective and psychological conditions. This study aimed to analyze elementary students' mathematical problem-solving skills from the perspective of psychological well-being (PWB). A mixed-methods sequential explanatory design was employed. The quantitative phase used a pre-experimental One-Group Pretest–Posttest design in which students participated in Mathematics in Context (MiC) learning. Data were collected using a mathematical problem-solving test based on Polya's four problem-solving stages and a psychological well-being questionnaire measuring self-acceptance, positive relations, autonomy, environmental mastery, purpose in life, and personal growth. In the qualitative phase, classroom observations and semi-structured interviews with selected students were conducted to explain and enrich the quantitative findings regarding students' problem-solving processes and learning experiences. The quantitative results indicated a significant improvement in students' mathematical problem-solving performance following the intervention, particularly in understanding problems, planning solution strategies, and evaluating solutions. A moderate positive correlation was also found between psychological well-being and mathematical problem-solving skills ($r = 0.470$, $p = 0.010$), indicating that students with higher psychological well-being tended to demonstrate greater persistence, confidence, and creativity when solving mathematical problems. Qualitative findings further revealed that students with higher psychological well-being showed stronger engagement, better self-regulation, and greater confidence during contextual problem-solving activities. These findings suggest that integrating Mathematics in Context with learning environments that support students' psychological well-being contributes to improved mathematical problem-solving performance and more meaningful learning experiences.

INTRODUCTION

Mathematical problem-solving is one of the most essential competencies in 21st-century education, as it equips students with critical thinking, logical reasoning, and decision-making skills that are applicable to real-life contexts (Cai & Hwang, 2020; Schoenfeld, 2020) However, studies reveal that many elementary school students struggle to solve word problems due to difficulties in comprehending problem statements, identifying relevant information, and constructing appropriate mathematical models (Hwang & Ham, 2021; Vula et al., 2017) . Mathematical problem-solving is one of the core objectives in school mathematics curricula worldwide, aimed not merely at fostering procedural fluency but also at nurturing students' critical and reflective thinking abilities (Hafriani, 2021; OECD, 2021). Despite this, many students, particularly at the elementary level, struggle to decode word problems, identify essential data, and translate real-world situations into mathematical expressions (Mullis et al., 2020; Ng & Lee, 2009). These struggles often originate from a lack of contextual familiarity and

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limited vocabulary, which hinder the problem-solving process (Hwang & Ham, 2021; Orosco et al., 2013).

Beyond cognitive ability, affective and psychological factors significantly influence mathematical performance. Among these, psychological well-being (PWB) plays a pivotal role in shaping students' attitudes, motivation, and emotional resilience when encountering problem-solving tasks (Ryff, 1989; Yang et al., 2022). Students with higher levels of psychological well-being are more likely to approach problems with confidence, persistence, and creativity, thereby achieving better outcomes (Baas et al., 2008; Putwain et al., 2020; Riza F Zahrah et al., 2025). Polya's four-phase framework understanding the problem, devising a plan, executing the plan, and reviewing the solution offers a structured approach to develop students' problem-solving capabilities (Liljedahl & Cai, 2021; Polya, 1973). However, success in applying this model does not solely depend on cognitive skills, as recent research emphasizes the role of emotional and psychological factors in facilitating mathematical reasoning (Falecki & Mann, 2020; Mercader et al., 2022). One such influential factor is psychological well-being, which encompasses self-acceptance, autonomy, environmental mastery, positive social relations, and personal growth (Pritchard et al., 2020; Stenling & Tafvelin, 2014). Students with higher psychological well-being are more resilient, motivated, and open to facing cognitive challenges (Lavy & Naama-Ghanayim, 2020; Ryff, 1989; Yang et al., 2022). This study aims to analyze mathematical problem-solving skills from the perspective of psychological well-being. Specifically, it examines how students' psychological well-being influences their ability to understand problems, plan strategies, execute solutions, and evaluate outcomes, in line with (Polya, 1973) four stages of problem-solving. While global attention on socio-emotional learning in mathematics is growing, there remains a lack of empirical studies especially in the Indonesian context that directly examine how psychological well-being interacts with mathematical problem-solving. This study aims to fill that gap by investigating the relationship between students' levels of psychological well-being and their mathematical problem-solving skills, with the use of a context-based learning model, namely the Mathematics in Context (MiC) approach.

RESEARCH METHOD

This study adopted a mixed-methods approach using a sequential explanatory design. The quantitative phase employed a pre-experimental One-Group Pretest–Posttest design involving elementary school students who learned mathematics through the Mathematics in Context (MiC) approach. This design was selected because it enables researchers to examine the effectiveness of an educational intervention by comparing students' mathematical problem-solving performance before and after the implementation of MiC (Creswell, 2014)(Creswell & Creswell, 2018; Yin, 2018). Following the quantitative analysis, a qualitative phase was conducted to explain and elaborate on the statistical findings. The sequential explanatory design therefore provided a comprehensive understanding by integrating numerical results with students' learning experiences and behaviors during the intervention (Creswell & Plano Clark, 2018; Doyle, Brady, & Byrne, 2020). The qualitative phase was conducted after the quantitative data had been analyzed. Based on the quantitative results, several students representing different levels of psychological well-being and mathematical problem-solving performance were purposively selected for further investigation.

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Qualitative data were collected through classroom observations during MiC learning activities and semi-structured interviews conducted after the posttest. The interviews explored students' learning experiences, problem-solving strategies, motivation, confidence, and perceptions of the Mathematics in Context approach. The qualitative data were analyzed using thematic analysis by coding, categorizing, and identifying recurring themes. These findings were subsequently integrated with the quantitative results to provide explanations for the observed differences in students' mathematical problem-solving performance and psychological well-being.

Moreover, the MiC approach has been shown to enhance problem-solving and reasoning by situating mathematical tasks within meaningful real-world contexts, which not only promotes conceptual understanding but also supports students' engagement and psychological well-being (Cai et al., 2021; Yang et al., 2022). The participants of this study were 31 Grade VII students selected using a purposive sampling technique. The subjects were chosen because they experienced difficulties in mathematical problem-solving skills, as indicated by previous learning outcomes and classroom observations conducted by the teacher and researcher. Therefore, the selection of these participants was considered appropriate to achieve the objectives of the research. Thus, the chosen methodology provides both empirical rigor and contextual richness in addressing the research objectives.

Table 1. Instruments

Instrumets	
Mathematical problem-solving test (based on Polya's stages) (Polya, 1973).	Psychological well-being questionnaire (covering dimensions such as self-acceptance, positive relations, autonomy, environmental mastery, purpose in life, and personal growth) (Ryff, 1989).

Procedure Pretest and posttest were administered to measure changes in problem-solving skills, while PWB was assessed to determine its role in learning outcomes. Statistical tests were conducted to identify significant differences and correlations between problem-solving performance and psychological well-being.

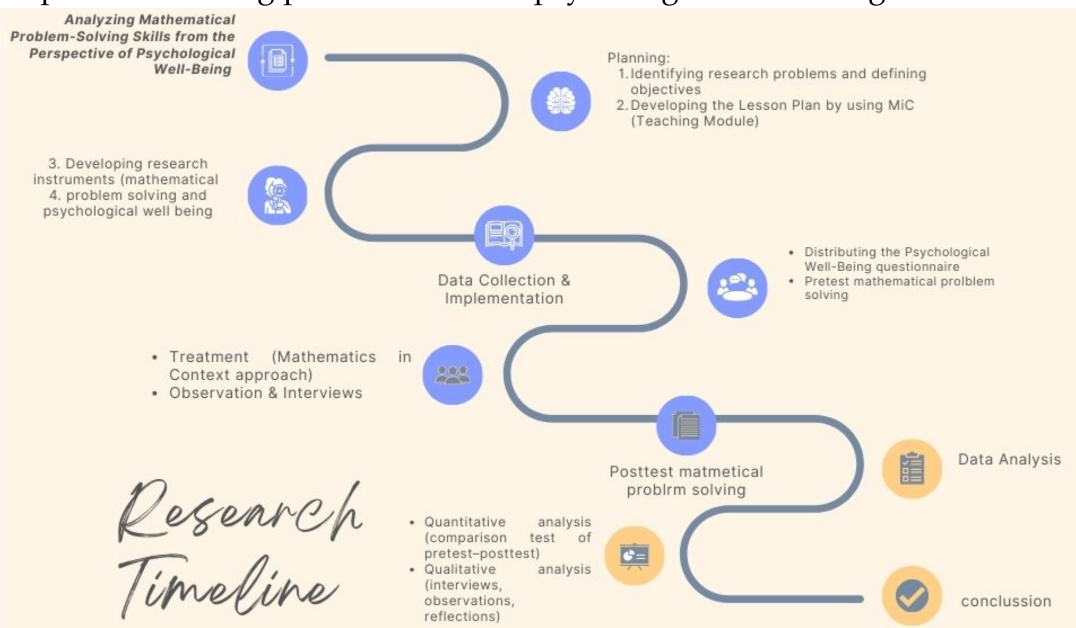

Figure 1. Research timelime

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RESULTS AND DISCUSSION

Results

Psychological well-being is the level of an individual's ability to accept themselves as they are; to build warm relationships with others, to be independent of social pressures, to control the external environment, to have meaning in life, and to continuously realize their potential (Ryff & Keyes, 1995). Students with higher levels of PWB outperformed their peers in problem-solving tasks. They were more effective in identifying relevant information, generating multiple strategies, and reflecting on alternative solutions (Baas et al., 2008; Ryff, 1989).

There are five aspects of psychological well-being, namely: Self-acceptance, Positive relations with others, Autonomy, Environmental mastery and purpose in life, and Personal growth. These five aspects were operationalized into 24 positive and negative statements in the psychological well-being questionnaire administered to students after receiving instruction using the Mathematics in Context (MiC) approach. The following are the results of the descriptive analysis of students' psychological well-being.

Table 2. Descriptive Analysis of Students' Psychological Well-Being

Descriptive Statistics													
	N	Range	Min	Max	Sum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
item_1	29	4	1	5	126	4.34	.167	.897	.805	-2.044	.434	5.835	.845
item_2	29	2	3	5	116	4.00	.131	.707	.500	.000	.434	-.872	.845
item_3	29	4	1	5	113	3.90	.213	1.145	1.310	-.859	.434	-.032	.845
item_4	29	4	1	5	95	3.28	.185	.996	.993	-.373	.434	.591	.845
item_5	28	4	1	5	122	4.36	.213	1.129	1.275	-2.110	.441	4.148	.858
item_6	29	4	1	5	74	2.55	.220	1.183	1.399	.424	.434	-.515	.845
item_7	29	4	1	5	122	4.21	.175	.940	.884	-1.828	.434	4.370	.845
item_8	29	4	1	5	108	3.72	.192	1.032	1.064	-.655	.434	.307	.845
item_9	28	4	1	5	117	4.18	.230	1.219	1.485	-1.292	.441	.477	.858
item_10	27	3	2	5	110	4.07	.150	.781	.610	-.657	.448	.493	.872
item_11	29	4	1	5	105	3.62	.230	1.237	1.530	-.663	.434	-.024	.845
item_12	29	4	1	5	88	3.03	.219	1.180	1.392	-.491	.434	-1.028	.845
item_13	28	4	1	5	93	3.32	.225	1.188	1.411	-.254	.441	-.141	.858
item_14	29	4	1	5	107	3.69	.244	1.312	1.722	-.700	.434	-.369	.845
item_15	27	2	3	5	109	4.04	.155	.808	.652	-.070	.448	-1.445	.872
item_16	27	4	1	5	107	3.96	.181	.940	.883	-1.123	.448	2.304	.872
item_17	27	3	2	5	106	3.93	.184	.958	.917	-.411	.448	-.809	.872
item_18	26	4	1	5	77	2.96	.162	.824	.678	.074	.456	1.134	.887
item_19	26	3	1	4	76	2.92	.183	.935	.874	-.793	.456	.109	.887
item_20	27	4	1	5	112	4.15	.175	.907	.823	-1.646	.448	4.391	.872
item_21	27	3	2	5	109	4.04	.155	.808	.652	-.543	.448	.022	.872
item_22	27	4	1	5	89	3.30	.225	1.171	1.370	-.476	.448	-.159	.872
item_23	27	4	1	5	83	3.07	.250	1.299	1.687	-.147	.448	-.980	.872
item_24	27	4	1	5	98	3.63	.240	1.245	1.550	-.643	.448	-.432	.872
Skor_Total	29	59	50	109	2462	84.90	2.585	13.922	193.810	-.901	.434	1.314	.845
Valid N (listwise)	23												

Based on Table 2, the item with the highest score is item number 1, with the statement *"I accept myself as I am"*, which obtained a total score of 126. Meanwhile, the item with the lowest score is item number 6, with the statement *"I place full trust in other people whom I consider worthy"*, which obtained a total score of 74. The descriptive analysis of the psychological well-being of 29 students, based on the total score, shows a skewness value of -0.901, indicating a left-skewed distribution, with most of the values concentrated on the higher side and a few extreme low values. This suggests that the data are clustered above the average. The following section provides a descriptive explanation of students' psychological well-being based on the responses given to each item.

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Table 3. Categories of Psychological Well-Being

High	$X \geq M + 1$ SD
	$X \geq 72 + 16$
	$\mathbf{X \geq 88}$
Moderate	(M – 1 SD) ≤ X < (M + 1 SD)
	(72– 16) ≤ X < 72 + 16
	$\mathbf{56 \leq X < 88}$
Low	X < M – 1 SD
	X < 72– 16
	$\mathbf{X < 56}$

Based on Table 3 regarding the categories of psychological well-being, the researcher categorized the psychological well-being levels of students according to the questionnaire administered on January 27, 2024, to 29 students of class 5B, as shown below.

Table 4. Students' Psychological Well-Being Categories

Nu.	Name	Categories
1	S1	High
2	S2	Moderate
3	S3	Moderate
4	S4	Moderate
5	S5	Moderate
6	S6	High
7	S7	High
8	S8	High
9	S9	High
10	S10	High
11	S11	High
12	S12	Moderate
13	S13	Low
14	S14	Moderate
15	S15	High
16	S16	Moderate
17	S17	Moderate
18	S18	Moderate
19	S19	Moderate
20	S20	Moderate
21	S21	High
22	S22	Moderate
23	S23	Low
24	S24	Moderate
25	S25	Moderate
26	S26	Moderate
27	S27	Moderate
28	S28	Moderate
29	S29	Moderate

Based on Table 4, with a total of 29 participants, 9 students were classified in the "High" category, 18 students in the "Moderate" category, and 2 students in the "Low" category. These results are supported by observations conducted from November 2023 to February 2024. Students demonstrated significant improvement in problem-solving performance after being taught with the MiC approach. This improvement was evident across all four stages of Polya's model: understanding the problem, devising a plan, carrying out the plan, and looking back at the solution (Polya, 1973; Schoenfeld, 1985).

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Table 5. Pretest Scores, Posttest Scores, and N-Gain of Problem-Solving Based on Learning

Nu	Student	Pretest	Posttest	N-Gain
1	S1	75,0	91,7	0,67
2	S2	58,3	83,3	0,60
3	S3	16,7	50,0	0,40
4	S4	50,0	83,3	0,67
5	S5	16,7	42,82	0,31
6	S6	50,0	75,0	0,50
7	S7	83,3	100,0	1,00
8	S8	58,3	83,3	0,60
9	S9	33,3	75,0	0,63
10	S10	33,3	75,0	0,63
11	S11	41,7	83,3	0,71
12	S12	16,7	66,7	0,60
13	S13	50,0	75,0	0,50
14	S14	16,7	50,0	0,40
15	S15	25,0	75,0	0,67
16	S16	25,0	66,7	0,56
17	S17	33,3	75,0	0,63
18	S18	41,7	58,3	0,28
19	S19	58,3	83,3	0,60
20	S20	16,7	50,0	0,40
21	S21	91,7	100,0	1,00
22	S22	66,7	91,7	0,75
23	S23	25,0	75,0	0,67
24	S24	16,7	58,3	0,50
25	S25	58,3	91,7	0,80
26	S26	75,0	83,3	0,33
27	S27	25,0	66,7	0,56
28	S28	25,0	66,7	0,56
29	S29	75,0	91,7	0,67

Table 6. Descriptive Analysis Results of Students' Problem-Solving Ability Acquisition Based on Learning

	Aspek yang diamati	Statistic	Std. error
Pretest_ProblemSolving	N	29	
	Range	75.00	
	Minimum	16.70	
	Maximum	91.70	
	Sum	1258.40	
	Mean	43.3931	4.26409
	Std. Deviation	22.96281	
	Variance	527.291	
	Skewness	.474	.434
Posttest_ProblemSolving	N	29	
	Range	58.30	
	Minimum	41.70	
	Maximum	100.00	
	Sum	2166.70	
	Mean	74.7138	2.849
	Std. Deviation	15.34572	
	Variance	235.491	
	Skewness	-.387	.434

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Based on the mean score, standard deviation, and skewness values shown in Table 3.5, the descriptive analysis indicates that the average problem-solving ability of students who received learning through the Mathematics in Context approach was 74.71. This result is higher compared to the average problem-solving ability of students before the application of the Mathematics in Context approach, which was 43.39. The distribution of students' problem-solving ability scores was wider before the Mathematics in Context approach was implemented compared to after its implementation. This is reflected in the standard deviation scores of the pretest and posttest, which were 22.96 and 15.345, respectively. In terms of skewness, after the application of the Mathematics in Context approach, the skewness value was -0.387. This result shows that the distribution of students' problem-solving scores on both the pretest and posttest tends to be left-skewed, meaning there were slightly more lower scores than higher scores. However, the degree of skewness was not significant.

The psychological well-being data of students were obtained and categorized into three levels: high, moderate, and low psychological well-being. This categorization process was based on the responses of each research subject to the questionnaire administered during the learning activities. A total of 29 students completed the psychological well-being questionnaire. The following presents the data on the improvement of problem-solving and creative reasoning abilities in relation to students' psychological well-being levels, as shown in Table 7 and Table 8.

Table 7. Pretest Scores, Posttest Scores, and N-Gain of Problem-Solving Based on Students' Psychological Well-Being Levels

Nu	Student	Level of *Psychological Well Being*	Pretest	Posttest	N-Gain
1	S1	High	75,0	91,7	0,67
2	S2	Moderate	58,3	83,3	0,60
3	S3	Moderate	16,7	50,0	0,40
4	S4	Moderate	50,0	83,3	0,67
5	S5	Moderate	16,7	42,82	0,31
6	S6	High	50,0	75,0	0,50
7	S7	High	83,3	100,0	1,00
8	S8	High	58,3	83,3	0,60
9	S9	High	33,3	75,0	0,63
10	S10	High	33,3	75,0	0,63
11	S11	High	41,7	83,3	0,71
12	S12	Moderate	16,7	66,7	0,60
13	S13	Low	50,0	75,0	0,50
14	S14	Moderate	16,7	50,0	0,40
15	S15	High	25,0	75,0	0,67
16	S16	Moderate	25,0	66,7	0,56
17	S17	Moderate	33,3	75,0	0,63
18	S18	Moderate	41,7	58,3	0,28
19	S19	Moderate	58,3	83,3	0,60
20	S20	Moderate	16,7	50,0	0,40
21	S21	High	91,7	100,0	1,00
22	S22	Moderate	66,7	91,7	0,75
23	S23	Low	25,0	75,0	0,67
24	S24	Moderate	16,7	58,3	0,50
25	S25	Moderate	58,3	91,7	0,80
26	S26	Moderate	75,0	83,3	0,33
27	S27	Moderate	25,0	66,7	0,56
28	S28	Moderate	25,0	66,7	0,56
29	S29	Moderate	75,0	91,7	0,67

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Based on the data in Table 7, it can be seen that 9 students belonged to the high psychological well-being category, 18 students were in the moderate category, and 2 students were in the low category. The table also shows the pretest and posttest scores of students' problem-solving ability according to their respective psychological well-being categories. The following presents the average scores of students' problem-solving ability based on their psychological well-being levels.

Table 8. Average Scores of Students' Problem-Solving Ability Based on Psychological Well-Being Categories

Level of *Psychological Well Being*	Pretest Mean Score	Postest Mean Score	N-Gain
High	41.67	76.38	0.75
Moderate	38.19	71.52	0.57
Low	31.25	56.25	0.37

Based on the table, it can be seen that students with different levels of psychological well-being achieved varying improvements in their problem-solving abilities. Students with high psychological well-being obtained a mean pretest score of 41.67 and a mean posttest score of 76.38, resulting in an N-Gain of 0.75, which is categorized as high improvement. Students with moderate psychological well-being achieved a mean pretest score of 38.19 and a mean posttest score of 71.52, with an N-Gain of 0.57, which falls into the moderate improvement category. Meanwhile, students with low psychological well-being obtained a mean pretest score of 31.25 and a mean posttest score of 56.25, resulting in an N-Gain of 0.37, which is categorized as low improvement. These results indicate that students with higher levels of psychological well-being tend to show greater improvement in problem-solving ability compared to those with moderate or low psychological well-being.

Table 9. Results of Normality Test of the Improvement in Problem-Solving Ability Viewed from Students' Psychological Well-Being

Tests of Normality

	Kriteria_Psychological_Well_Being	**Kolmogorov-Smirnov**[a]			**Shapiro-Wilk**		
		Statistic	df	Sig.	Statistic	df	Sig.
NGain_Score	Tinggi	.223	9	.200*	.892	9	.210
	Sedang	.196	18	.066	.940	18	.289
	Rendah	.260	2	.			

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on Table 9, in the Shapiro-Wilk column, which provides the output of the normality test, it can be concluded that the improvement in problem-solving ability for students with high psychological well-being is normally distributed, with a significance value of 0.210, since the sig. value > 0.05. Similarly, the improvement in problem-solving ability for students with moderate psychological well-being is also normally distributed, with a significance value of 0.289, as the sig. value > 0.05.

Based on Table 10, the results of the post hoc test using SPSS 26 indicate differences in students' problem-solving abilities when viewed from their psychological well-being levels. The comparison shows that students with high psychological well-being generally achieved significantly higher scores in both problem-solving and creative reasoning compared to those in the moderate and low categories. Meanwhile, the difference between the moderate and low psychological well-being groups was smaller and, in some cases, not statistically significant. This suggests that higher psychological well-being contributes positively to the enhancement of students' cognitive abilities, particularly in terms of problem-solving strategies processes. In summary, the post hoc analysis strengthens the findings that psychological well-being is an important factor influencing students' mathematical problem-solving performance.

Tabel 10. Post Hoc Analysis of Problem Solving Across Psychological Well Being Levels

Dependent Variable		(I) Psychological_Well_Being	(J) Psychological_Well_Being	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Kemampuan Problem Solving	Bonferroni	Tinggi	Sedang	14.3444	5.86111	.064	-.6538	29.3427
			Rendah	9.2556	11.22316	1.000	-19.4639	37.9750
		Sedang	Tinggi	-14.3444	5.86111	.064	-29.3427	.6538
			Rendah	-5.0889	10.70087	1.000	-32.4718	22.2940
		Rendah	Tinggi	-9.2556	11.22316	1.000	-37.9750	19.4639
			Sedang	5.0889	10.70087	1.000	-22.2940	32.4718
	Games-Howell	Tinggi	Sedang	14.3444*	5.19866	.029	1.3224	27.3665
			Rendah	9.2556	3.52704	.070	-.8228	19.3339
		Sedang	Tinggi	-14.3444*	5.19866	.029	-27.3665	-1.3224
			Rendah	-5.0889	3.81916	.397	-14.8864	4.7086
		Rendah	Tinggi	-9.2556	3.52704	.070	-19.3339	.8228
			Sedang	5.0889	3.81916	.397	-4.7086	14.8864

Based on the output in Table 10, since the results of the homogeneity test for mathematical problem solving abilities showed significance values of sig. = 0.000 and sig. = 0.000, which are smaller than 0.05, the output referred to is the Games-Howell test.

- Problem-Solving Ability: High vs. Moderate Psychological Well-Being The mean difference between students with high and moderate psychological well-being was 14.34. The significance value was Sig. = 0.029, indicating that the difference between the high and moderate groups was significant (≤ 0.05). The 95% confidence interval [1.3224, 27.3665] does not include zero, confirming the significance of the difference.
- Problem-Solving Ability: Moderate vs. High Psychological Well-Being The mean difference between students with moderate and high psychological well-being was also 14.34. The significance value was Sig. = 0.029, indicating that the difference between the moderate and high groups was significant (≤ 0.05). The 95% confidence interval [-27.3665, -1.3224] does not include zero, confirming the significance of the difference.

A significant positive correlation was found between psychological well-being and mathematical problem-solving skills ($r = 0.470$, $p = 0.010$). This indicates that psychological well-being not only supports cognitive processes but also strengthens persistence and creativity in solving mathematical problems (Pelzer, Lithner, & Palm, 2017; Suseelan et al., 2022).

Discussion

Discussion, The process of identifying students' psychological well-being levels revealed that 9 students were categorized as having high psychological well-being. The researcher then examined the students' responses and conducted interviews to obtain further information regarding the characteristics of their problem-solving abilities at this level of psychological well-being. For instance, in answering question number 1, two students from the high category, namely S1 and S21, were interviewed.

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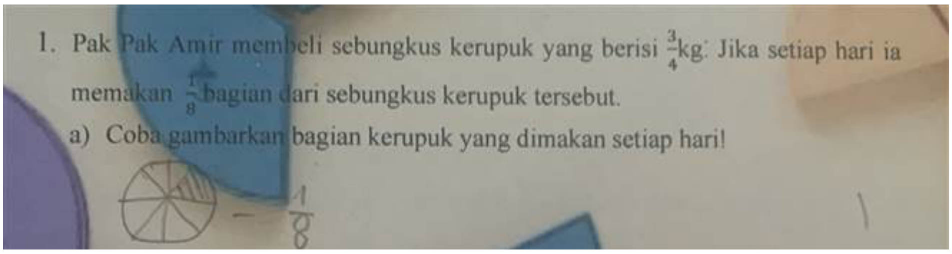

Figure 2. S1's Answer to Question 1a

Based on Figure 2, S1's response to question 1a, with the achievement indicator *"understanding the situation of the fraction problem"*, showed that the student was able to comprehend the problem by illustrating the portion of crackers consumed each day. Students in the high psychological well-being category answered question 1a in a similar way, using either a circle or a bar diagram with shading of one out of eight parts. The weight of the crackers mentioned in the problem was not the students' focus, as they concentrated on the more relevant information, namely the fraction 1/8 representing the portion consumed daily.

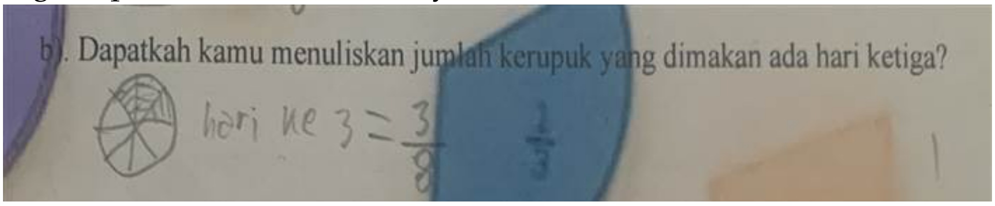

Figure 3. S1's Answer to Question 1b

As shown in Figure 3, with the indicator *"identifying relevant information in their own words"*, S1 correctly understood the problem in 1a and was able to briefly explain the number of crackers eaten on the third day. S1 drew a circle divided into eight parts, shading three of them. In writing, S1 stated concisely: *"Day three =3/8 ."* Although short, the explanation was clear and accurate.

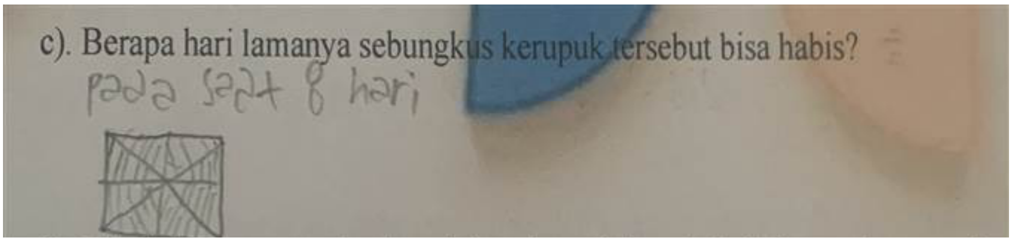

Figure 4. S1's Answer to Question 1c

Figure 4 shows that in question 1c, with the indicator *"stating what is being asked in the problem"*, S1 answered appropriately with *"at the 8th day"* and supported the response with an illustration of the number of cracker pieces that would be finished over eight days.

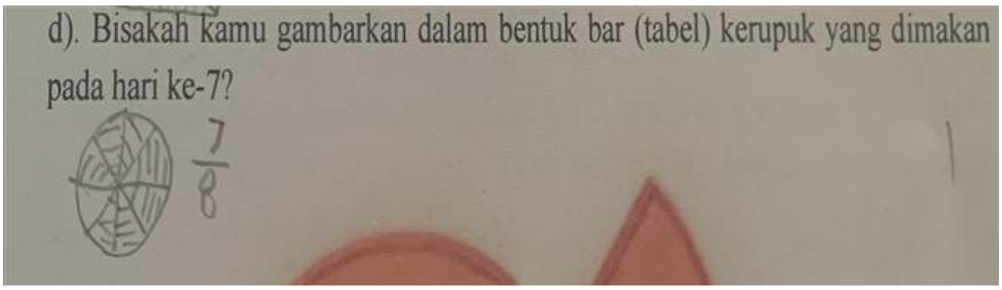

Figure 5. S1's Answer to Question 1d

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Based on Figure 5, S1, with the indicator *"illustrating the solution of the problem"*, was able to create a diagram of a circle divided into eight parts with seven parts shaded, correctly showing that $\frac{1}{8}$ would remain after the seventh day and would be consumed on the eighth day.

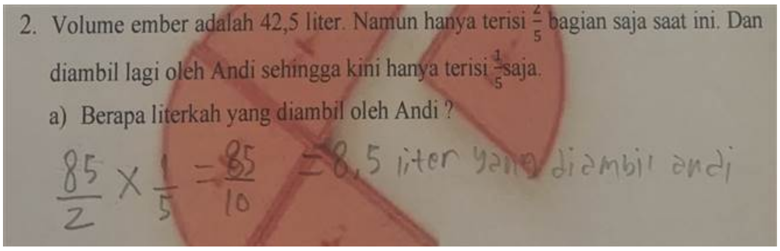

Figure 6. S1's Answer to Question 2a

At the second stage of problem-solving ability (*devise a plan for solving it*), with the indicator *"using appropriate mathematical models"*, S1 successfully developed a mathematical plan by writing 85/2 × 1/5 (Figure 6). To confirm the reasoning, the researcher conducted an interview:

R : Why 85/2 × 1/5?
S1 : That's the volume of the bucket multiplied by the part Andi took.
R : Why 85/2 ? The problem stated 42.5 liters.
S1 : That's the fractional form, Miss.
R : Oh okay, then why multiply by 1/5?
S1 : "Because the volume was 2/5, and the remainder was 1/5, so Andi also took 1/5.

S1 was then able to correctly perform the calculation, writing: 85/10 = 8.5 liters of water taken by Andi. This demonstrates the ability to substitute information into the mathematical model and correctly execute the solution, corresponding to the third stage of problem solving (*carry out your plan*).

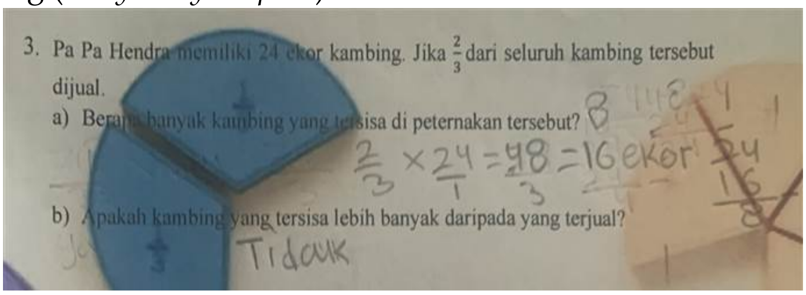

Figure 7. S21's Answer to Question 3

Based on Figure 7, student S21 also reached the third stage (*carry out your plan*) with the indicator of substituting information into the mathematical model and solving the problem accurately. S21 wrote: 2/3 × 24/1 = 48/3 = 16 chickens, and then performed subtraction 24 – 16 = 8, concluding that the answer to 2a was *8 chickens*. For question 3b, S21 was able to achieve the fourth stage of problem-solving ability (*looking back*), meaning the student evaluated the answer using the given information. The interview confirmed this reasoning:

R : Why did you answer 'no'? What was the reason?
S21 : Because there are 8 left, Miss.
R : And then?

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S21 : The ones sold were more, Miss—16.

Overall, the responses of students with high psychological well-being demonstrate that their problem-solving abilities are relatively strong across all stages and indicators. These students showed deeper comprehension of the problem-solving process and were able to proceed systematically and purposefully through each stage. This indicates that high psychological well-being supports cognitive abilities and critical thinking skills required in mathematical problem solving.

The findings from students' responses to the fraction problem demonstrate varying levels of problem-solving skills depending on their psychological well-being. Students in the high psychological well-being category, such as S1, displayed strong abilities in understanding the problem, which Polya (1973) identifies as the foundational stage of problem-solving. They employed appropriate representations, such as circle or bar diagrams, and accurately highlighted the relevant informationnamely, the fraction 1/8 consumed daily. These results align with Schoenfeld (2019) and Cai et al. (2021), who argue that effective problem-solving requires not only procedural fluency but also conceptual representation, where learners link mathematical symbols with real-world contexts.

Conversely, students in the moderate category demonstrated partial comprehension and occasionally focused on irrelevant details, echoing prior findings that lower levels of self-regulation may lead to difficulties in filtering extraneous information . This suggests that while both groups recognized the symbolic representation of fractions, students with higher well-being were more efficient in prioritizing meaningful numerical relationships and applying strategic reasoning.

The relationship between psychological well-being and mathematical problem-solving performance is well supported in recent literature. Students with high psychological well-being were able to maintain focus on relevant information, ignore distractors, and apply more systematic strategies. This finding resonates with Cognitive Load Theory (Paas & Van Merrienboer, 2020; Sweller et al., 2019) as students with stronger emotional regulation experience reduced extraneous cognitive load, allowing more resources for germane processing. We have revised the discussion section by not only presenting the numerical improvements in students' mathematical problem-solving skills, but also critically comparing the findings with broader international studies in mathematics education. The revised discussion now highlights similarities and differences between our results and previous studies related to problem-solving learning models, student engagement, and conceptual understanding in mathematics classrooms. In addition, we strengthened the theoretical interpretation of the findings to provide deeper insight into how the chosen learning model contributes to students' mathematical learning outcomes. We have strengthened the discussion section by providing a deeper analysis of why several students continued to experience difficulties with specific mathematical problem-solving indicators at the end of the final cycle. Explains that these difficulties may be caused by persistent mathematical misconceptions, particularly in understanding concepts, interpreting problem information, and selecting appropriate solution strategies. In addition, we linked these findings to mathematical misconception theory, which suggests that students often construct incomplete or inaccurate conceptual understanding that can hinder their problem-solving performance. This revision provides a more critical interpretation of

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the findings and offers a stronger theoretical foundation for explaining students' learning difficulties.

Recent studies further confirm that psychological well-being is positively associated with resilience, motivation, and engagement in academic contexts (Cheng, 2020; Falecki & Mann, 2020). The autonomy and environmental mastery described by (Matud et al., 2019; Ryff, 1989; Tang et al., 2020) appear evident in students' ability to independently select relevant information and represent it effectively. Moreover, (Stenling & Tafvelin, 2014) emphasize that students with high intrinsic motivation and psychological satisfaction are more likely to engage in deep learning processes, which supports the superior performance observed in the high well-being group.

The consistent pattern of accurate and meaningful responses among high psychological well-being students indicates that well-being plays a crucial role in supporting higher-order thinking and problem-solving. Teachers should therefore integrate both cognitive and affective components in mathematics instruction. As suggested by (Lavy & Bocker, 2018) caring classroom practices and a focus on student well-being can enhance learners' self-efficacy and overall academic achievement. Similarly, (Mercader et al., 2022; Rushton et al., 2020; Schotanus-Dijkstra et al., 2017; Wentzel et al., 2018) highlight the importance of fostering academic well-being and engagement as pathways to success.

For students in the moderate category, scaffolding strategies such as guided questioning, collaborative group work, and explicit reflection activities can help them develop stronger conceptual understanding while also enhancing their psychological well-being. Embedding positive education practices into mathematics classrooms may thus be an effective approach to simultaneously strengthen both problem-solving skills and psychological resilience. In summary, this study provides empirical evidence that psychological well-being is not only correlated with but also serves as a mediating factor in students' mathematical problem-solving processes. High levels of well-being are associated with more accurate comprehension, effective use of representations, and the ability to filter irrelevant information. Conversely, students with moderate well-being may need additional support to reach similar levels of problem-solving performance. These findings reinforce the growing consensus in recent research (Liljedahl & Cai, 2021; Putwain et al., 2020; Schoenfeld, 2020)that fostering psychological well-being in educational settings is essential for developing both cognitive skills and emotional resilience.

At the first stage, *understanding the problem*, students with high psychological well-being were able to identify important information and grasp the problem thoroughly. They not only recognized what was being asked but also understood the context and the final objective of the problem. This deeper comprehension forms an essential foundation for effective problem solving (Fathani & Pangestu, 2024; Pangesti, 2018; R F Zahrah, 2016; R F Zahrah & Suryana, 2019; Riza Fatimah Zahrah & Febriani, 2020).

CONCLUSION

This study concludes that students' mathematical problem-solving skills are associated with their psychological well-being. Students with higher levels of psychological well-being tend to demonstrate better performance in solving mathematical problems, as they exhibit greater motivation, resilience, self-confidence, and persistence when facing challenging tasks. These findings are consistent with Self-Determination Theory, which posits that the fulfillment of individuals' basic psychological needs for autonomy, competence, and relatedness promotes intrinsic motivation and meaningful engagement in learning. Students who experience positive psychological well-being are therefore more likely to regulate their learning effectively, employ adaptive coping strategies, and remain focused throughout the problem-solving process.

The findings also highlight the educational value of integrating Mathematics in Context (MiC) with learning environments that support students' psychological well-being. By presenting mathematical concepts through meaningful real-life contexts, MiC encourages active participation, reduces mathematics anxiety, and facilitates deeper conceptual understanding. Furthermore, incorporating supportive instructional strategies such as collaborative learning, reflective activities, constructive feedback, and positive teacher–student interactions can strengthen both cognitive and affective learning outcomes. Consequently, mathematics instruction should address not only students' cognitive development but also their psychological well-being, as both dimensions play complementary roles in fostering mathematical problem-solving skills and promoting sustainable learning success.

This study contributes to the growing body of literature by demonstrating the importance of considering psychological well-being as a key factor in mathematics learning. The findings provide empirical evidence that integrating contextual learning approaches with psychological well-being support can enhance students' problem-solving abilities. Future studies are encouraged to examine these relationships using larger and more diverse samples, longitudinal research designs, and additional psychological variables to further validate and extend the present findings.

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***Riza Fatimah Zahrah (Corresponding Author)**
Department of Primary School Teacher Education, Faculty of Teacher Training and Education
Perjuangan University of Tasikmalaya,
Jl. Peta no 177, Tasikmalaya, West Java, 46115, Indonesia
Email: rizafatimah@unper.ac.id

Winarti Dwi Febriani
Department of Primary School Teacher Education, Faculty of Teacher Training and Education
Perjuangan University of Tasikmalaya,
Jl. Peta no 177, Tasikmalaya, West Java, 46115, Indonesia
Email: winartidwi@unper.ac.id

Agus Ahmad Wakih
Department of Primary School Teacher Education, Faculty of Teacher Training and Education
Perjuangan University of Tasikmalaya,
Jl. Peta no 177, Tasikmalaya, West Java, 46115, Indonesia
Email: winartidwi@unper.ac.id

Vera Ratna Pratiwi
PT Kilang Pertamina, Indramayu, Indonesia
Indonesia
Email: vera.v.pratiwi@gmail.com