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ANALYSIS ON STUDENTS' NUMERACY SKILLS IN SOLVING PROPORTION PROBLEMS IN THE CONTEXTS OF *CANDI UMBUL* TRADITIONAL MARKET

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Abstract: The weaknesses in students' abilities in applying mathematical concepts and rules to non-routine problems caused them difficulties in solving them. This study was aimed at analyzing students' numeracy skills in solving proportion problems with the contexts of *Candi Umbul* Traditional Market. The study was qualitative descriptive research involving two seventh-grade students in Indonesia as research subjects. The two student subjects were selected from 10 students who completed the numeracy task, one with the most correct answer and one with the most incorrect answer. The ten students who completed the numeracy task were the ones with the highest test scores among 32 students in the topics of proportion and social arithmetics. The research instruments used in the study were students' work sheets (in the form of essay tests) and interviews. The data analysis technique used was descriptive analysis. Findings show that not every student with high math scores had high numeracy skills. This is evident from the fact that students faced problems when completing proportion items in the context of *Candi Umbul* Traditional Market; they encountered difficulties in solving the problems. The results of this study are expected to serve as a reference for further research on students' numeracy skills.

Keywords: Numeracy, problem-solving, proportion, Candi Umbul Traditional Market

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INTRODUCTION

Numeracy is learners' ability in solving daily-life problems through various processes by using the concepts, procedures, facts, and math tools (Kusmaharti *et al.*, 2022; Stacey & Turner, 2014; Steen *et al.*, 2007). Similarly, numeracy is a person's capacity to apply mathematics effectively in the contexts that are related to one's personal life, work place, and responsbility as a public worker (Geiger *et al.*, 2015; Steen, 1999).

Therefore, numeracy is a skill that must be owned by a learner or adult in relation to job work. The problem is that, according to the results of the Program for the International Assessment of Adult Competencies (PIAAC) and Program for International Student Assessment (PISA), 30–60% of the adults and teenagers in the middle-earning countries and 10–40% adults and teenagers in the high and low-earning countries have low or very low numeracy skills (OECD, 2019). This indicates that the numeracy skills of adults and teenagers need to be improved in order to support their abilities in solving daily-life problems, their capacities in the work place, and their responsibilities as civil workers.

Numeracy has five core dimensions which make the numeracy model of the 21st century. These five dimensions are (1) mathematical knowledge (mathematics concepts and skills, problem-solving strategies, and knowledge-judging capacities); (2) contexts (the capacities to use mathematics knowledge in various contexts, both in and outside the school environments); (3) disposition (confidence and commitment to use mathematical strategies to be involved in the responsibilities related to life, readiness to use mathematical knowledge flexibly and adaptively; (4) tools (use of materials (models and measuring instruments), representational (symbol systems, graphs, maps, diagrams, pictures, tables, ready-for-use calculations), and digital equipment (computers, softwares, calculators, the Internet) to mediate and form thoughts), and (5) critical orientation (use of mathematical information to make decisions and evaluations; orientation gives support to argumentation: challenging arguments or positions) (Geiger *et al*., 2013; Geiger *et al*., 2014). Meanwhile, OECD constructs the numeracy thinking pattern on three components, namely (1) context and situation to be implemented on a particular problem as a stimulus; (2) mathematical competencies which need to be activated to link mathematics with real situations; and (3) solution to the problem being confronted and connects it with mathematical concepts (Lange, 2006; Mizaniya, 2020). In order to improve numeracy skills in various dimensions and thinking patterns, skills are needed to solve daily-life problems (Goos *et al*., 2011; Sulistyowati *et al*., 2021).

Problem solvings is not separated from learners' knowledge of the nature of the problem; such as how the core of the problem is understood, what steps are to be used, and which is the manner to effectively solve the problem (Irfan *et al*., 2023; Sulistyowati *et al*., 2017; Sulistyowati *et al*., 2019; Widodo *et al*., 2021; Yuwono, 2016). There are various contexts in the daily-life environments that can be used to improve numeracy skills through the processes of mathematical problem solving.

For example, in the concepts of proportion in mathematics related to learners' competencies in understanding a problem, it can be directly or inversely proportional (Hardi *et al*., 2013). In the contexts of selling-buying in daily-life activitities, the matters of proportion can occur (Wulanningtyas & Marhaeni, 2022). This means that the concepts of proportion in mathematics can occur in daily life (nonformal mathematics). This is is line with ethnomathematics in the sense that mathematics develops in daily life and life in the daily activities of man (D'Ambrósio & Knijnik, 2020).

Ethnomathematics studies about mathematical thinking manners in different cultures including traditional measurement systems, calculating techniques, unique mathematical problem solving, and the ways mathematics is applied in daily lives (D'Ambrosio & D'Ambrusio, 2013). The purpose is to understand mathematics as an expression of cultures that are closely related to daily life. Through ethnomathematics, one can expand one's views about mathematics, appreciate the diversities of cultures in mathematical expressions, and enrich learning experiences for students by bringing cultural and social contexts into mathematics learning.

It is important for teachers to make mathematics close to every students' daily activity. It is one of the efforts to make mathematics become close and tied to students. However, it is unfortunate that there are still many teachers who have not optimalized the richness of the cultures around the students' environments to be used as mathematics learning resources in the class. This can be seen from the results of a number of research studies such as one by Fauzi & Gazali (2022) who explore Sasak ethnic cultures in the perspectives of mathematics but they are not yet much used for learning at school. The same case happens in Wonolelo, Sleman, Indonesia, in which a traditional ceremony is held every year but the schools around have not used this cultural event as a resource in the learning of mathematics (Irfan *et al*., 2019).

The village of Candi Umbul is one of the regional units in the district of Grabag, regency of Magelang, and province of Middle Java, Indonesia. This village has a tourism icon in the form of a traditional fancy-fair public market called *Candi Umbul* Market (CUM). A traditional market is one of the commodities in developing Small and Middle Grade Micro Businesses (SMGMB) for the community members. The activities of the communities have unconsciously applied mathematical concepts such as in calculating the capital and profit that is gained, the quantity of ingredient materials to make a mixture, and the selling-buying matters. It is, therefore, highly conceivable that many of the activities of the CUM are adopted as problem contexts in improving numeracy competencies. However, based on observation done in various schools in and around

Candi Umbul, not many have used the contexts of CUM as an instructional resource in the mathematics learning in class.

In addition, several research studies show that (1) many students do not know about the Wonolelo traditional ceremony (Irfan *et al*., 2019), (2) many students cannot connect the form of the rice cake with the rhomb shape in mathematics (Utami *et al*., 2022), (3) many cannot relate the traditional ethnic cloth of the Dawan tribe to geometric shapes (Elu & Sulistyowati, 2023). This is ironic knowing that Candi Umbul is a superior tourism destination in the district of Grabag. It is in this spirit that the present study is aimed at analyzing the students' numeracy abilities in solving the problems of proportions in the contexts of the CUM. Furthermore, the study is expected to increase students' knowledge on the richness of the local cultures.

METHOD

The study is descriptive qualitative research using the case-study method which is aimed at analyzing students' work results in solving numeracy problems in the topic of proportion using the contexts of Candi Umbul Market (CUM). The study has the involvement of ten students of the 7th grade of Junior High School whose instructional program is problem- or project-based. The ten participants have taken proportion materials and social arithmatics so that they are judged to have enough knowledge to solve the numeracy assignments that are given. They are also students who do not have to take remedial tasks for the results of their daily tests. The researchers then give them numeracy tasks and analyze the results. Finally, out of the ten students, two are chosen who have the most incorrect answer and the most correct answer and who have good communicative abilities. The first subject (R1) is chosen among the wrong answers and subject 2 (R2) among the right answers.

The researchers in this study act as the main research instruments assisted by students' worksheets (in the form of essay tests) and interviews. The data analytical technique is descriptive by conducting the following steps: 1) data reduction, in which the researchers pay attention to the relevance of the responses to the questions; this is followed by interviews to confirm the order of the respondents' answers, 2) data presentation, in which the results of the data analyses are presented in narrative forms, and 3) conclusion, which is drawn as the results of the data reduction and data presentation processes (Creswell, 2009; Moleong, 2012; Taylor *et al*., 2015). In addition, results of other studies are used as comparative references to support the findings of the study.

RESULTS AND DISCUSSION

The subjects of the study are two 7th grade students who are selected on the basis of the results of their work in responding to the numeracy questions. The first subject (R1) is chosen from the wrong answers and subject 2 (R2) from the right answers. The research data are the subjects' responses in answering the numeracy tasks and transcripts of the interviews. The numeracy task can be seen in Figure 1.

> Every week-end, Tio and family spare a time to go visit his grandmother in the village of Kartoharjo, Magelang. In their visit, it is not considered complete if they do not go to the Candi Umbul pool and soak themselves in the warm water. The pool is one of the sites inherited from the old Javanese kingdom that now becomes a tourism icon. Besides, the village of Candi Umbul is also well-known for its traditional people's market called Candi Umbul Market (CUM) held on Saturday evening and is itself a special attraction for the people around. There are many sellers trading in CUM, one of whom is Mrs Iva who sells egg rolls. Many visitors like to buy the egg rolls because they taste good. In fact, the blend of the food is very simple, eggs, water, and flour which are stirred to become a dough. Usually, 3 eggs will make 12 egg rolls. One egg roll is sold at Rp. 1,000. The idea of selling egg rolls is very profitable, but presently Mrs Iva is faced with the problem of scarcity in frying oil and, thus, she only sells the egg rolls in accordance with the frying oil that she has. This evening, Mrs Iva only uses 1 pack of 2 litres of frying oil with the price of Rp. 29,000. Meanwhile, she buys the eggs, each of which costs Rp. 3,000. In order to economize, she buys one tray of 30 eggs with the price of Rp. 53,000. If for every 9 egg rolls, the frying oil decreases by 10 ml, then determine the biggest profit that Mrs Iva can gain.

Figure 1. Numeracy Task used in the Study

The numeracy task in Figure 1 is a problem of proportion in an essay test item with the contexts of the Candi Umbul Market (CUM). It is called a problem of proportion because it gives the students the opportunity to solve a daily problem through various processes by applying concepts, procedures, facts, and mathematical tools (Anwar, 2018; Mathematics, 1988; Mendikbud, 2020; OECD, 2016; Ojose, 2011; Prabawati, 2017; Stacey & Turner, 2014; Steen *et al*., 2007). In this case, the concepts and procedures in the problem solution are focused on proportion while facts and mathematical tools can be seen from the problem of the egg rolls and the use of the frying oil.

Besides, the problem in Figure 1 is designed according to the core dimensions of the numeracy (context, mathematics knowledge, disposition, tools, and critical orientation) (Geiger *et al*., 2013; Geiger *et al*., 2014), such that it can measure the students' numeracy abilities. This means that, by solving the problem in accordance with the numeracy dimensions, the students can be said to have a high level of numeracy abilities (Bynner & Parsons, 1997). The steps in completing the numeracy task in Figure 1 can be seen in the following Table 1.

Table 1. Steps in Completing the Numeracy Task

Numeracy Dimension	Solution
Mathematics knowledge (Matematics concept and skills; problem solving strategies; knowledge judgement capacities) Contexts (Capacities to apply mathematic knowledge in various contexts, both in and ouside of the school environments)	Collecting information needed to apply mathematical concepts and skills in building strategies for problem solving in the context of CUM. Given: a. Selling price per one egg roll Rp 1,000 b. 3 eggs make 12 egg rolls, meaning 1 egg makes 4 egg rolls c. 1 egg costs Rp 3,000 d. Price of 1 tray of eggs (30 egg) Rp 53,000 e. Price of 2 litres frying oil Rp 29,000 f. Every 9 egg rolls decreases 10 ml (0,01 litre) frying oil g. Maximum number of sold egg rolls is up to the 2 litres of frying oil is used up
Disposition (Confidence and commitment to use mathematics approaches to be involved in duties related to life; preparedness to use mathematical knowledge flexibly and adaptively)	Forming the problem solving steps conceded to be correct by using mathematical steps to be applied for completing the numeracy task. Completing steps: 1. Determining the number of egg rolls produced by 30 eggs (Using the concept of multiplication) and calculating the remain of frying oil according to the number of egg rolls produced (Using the concept of proportion) 2. Determining the number of egg rolls to use up 2 litres of frying oil (Using the concept of proportion) 3. Determining the number of eggs to produce egg roles as produced in step 2 (Using the concept of proportion) 4. Comparing the results of step 1 and 3 to determine the needs for eggs and frying oil 5. Multiply the number of egg rolls to price per egg roll 6. Determining profit by the formula: Profit = Selling price - Buying price
Tools (Use of materials (models, measuring tools), representational (symbol systems, graphs, maps, diagrams, pictures, tables, ready-for-use calculations) and digital equipment (computers, softwares, calculators, the Internet to mediate and form thoughts)	Carrying out the completion steps by making use of mathematical concepts, mathematic symbols to find the biggest profit. 1. Determining the number of egg rolls produced by 30 eggs (using the concept of multiplication) Suppose the number of egg rolls is symbolized x, then, using the concept of multiplication, x = number of eggs × number of egg rolls per egg $x = 30 \times 4 = 120$ egg rolls Amount of frying oil needed to produce 120 egg rolls can be obtained by using the following formula $\frac{frying\ oil}{120} = \frac{0,01}{9}$ $\Leftrightarrow frying\ oil = \frac{0,01 \times 120}{9} = \frac{1,2}{9}$ $\Leftrightarrow frying\ oil = 0,133$ litre Remain of frying oil = 2 – 0,133 = 1,867 litre 2. Determining number of egg rolls produced by using up 2 litres of frying oil (using the concept of proportion) Suppose the number of egg rolls is symbolized x, then, by using the concept of proportion, $\Leftrightarrow \frac{x}{2} = \frac{9}{0,01}$ $\Leftrightarrow 0,01x = 18$ $\Leftrightarrow x = \frac{18}{0,01} = 180$ eg rolls

Numeracy Dimension	Solution
	3. Determine number of eggs to produce egg rolls as obtained in step 2 (using the concept of proportion) Suppose number of eggs is symbolized y, then, by using the concept of proportion, $\frac{y}{180} = \frac{30}{120}$ $\Leftrightarrow \frac{y}{180} = \frac{1}{4}$ $\Leftrightarrow 4y = 180$ $\Leftrightarrow y = \frac{180}{4} = \frac{90}{2} = 45$ eggs Therefore, it needs to buy 15 more eggs at Rp 45,000, if in ones, or buy 1 tray at Rp 53,000 leaving over 15 eggs. 4. Based on the previous steps, it needs a. 45 eggs and 2 litre frying oil to produce 180 egg rolls b. 30 eggs and 0,133 litre frying oil to produce 120 egg rolls 5. Determining selling price of egg rolls a. Selling price of 180 egg roles = 180 × Rp 1000 = Rp 180,000 b. Selling price of 120 egg rolls = 120 × Rp 1000 = Rp 120,000 6. Determining profit by the formula Profit = Selling price - Buying price a. Profit = 180,000 - (53,000 + 29,000 + 53,000) = 180,000 - 135,000 = 45,000 b. Profit = 120,000 - (53,000 + 29,000) = 120,000 - 82,000 = 38,000
Critical Orientation (Use of mathematics to: make decision and evaluation: add support to argumentation: challenge argument or position)	Deciding on biggest profit. The biggest profit obtained is Rp 45,000 leaving over 15 eggs. In addition, for subsequent selling with the same profit, Mrs Iva needs only to prepare a capital of Rp 82,000 to buy 2 litres of frying oil and 1 tray of eggs.

In Table 1, an alternative solution is offered to solve the problem of the numeracy task in line with the numeracy dimensions. In Table 1, no scoring guide is included since the focus is on how far the students give answers compared to the alternative solution according to the numeracy dimensions. Students are regarded to have a high level of numeracy abilities if their responses conform to the dimensions listed in Table 1 (Bynner & Parsons, 1997). The numeracy ability of the subject will be measured on the basis of Table 1 above. Meanwhile, the depth of the matters faced by the subject is elicited from the unstructured interviews. In this way, a scheme can be obtained to improve the quality of learning of the subject based on the obtained results.

The works of R1 and R2 in completing the numeracy task are vastly different. The differences can be seen from the ways the students approach the problem, R1 doing it by listing one by one, R2 using the proportion concepts. The work of R1 is presented in Figure 2 below.

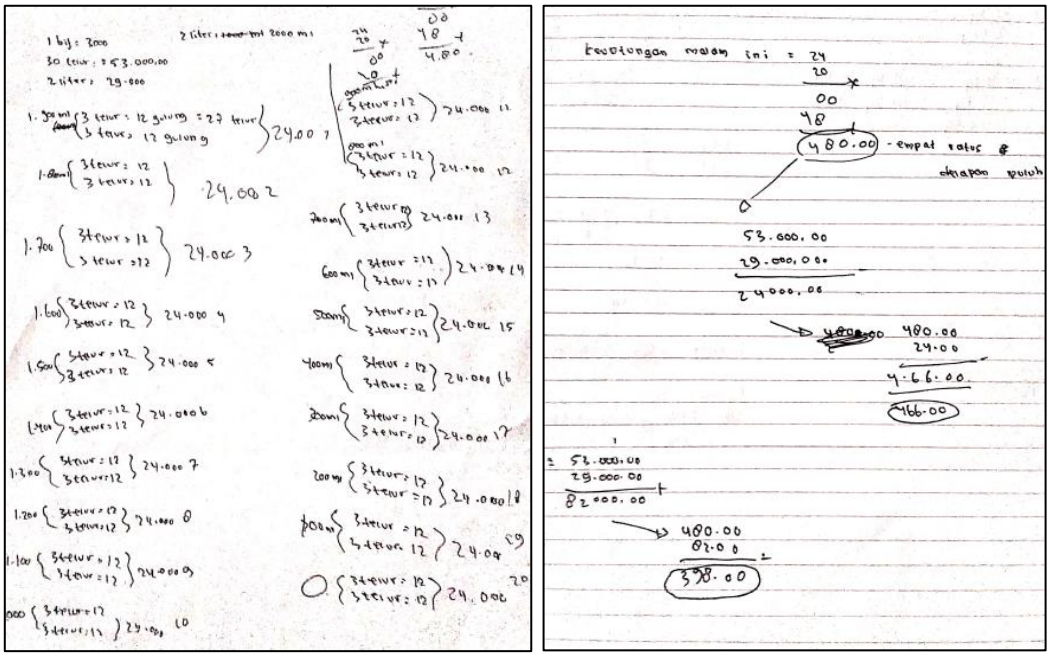

Figure 2. Work of R1

In Figure 2 above, it can be seen that, generally, R1 completes the task in the steps: (1) tabulating the data of the results of the selling per 24 egg rolls (from 6 eggs) till the 2 litres of frying oil is used up; (2) multiplying the results of the selling per 24 egg rolls by the number of times of frying; (3) subtracting results of the selling from the initial capital. This step is actually not incorrect, and is conceivable to be conducted although the concept of proportion does not explicitly surface.

The problem is that R1 does a miscalculation when doing step 1, i.e. by subtracting the volume of the frying oil by 10 ml when frying the dough with 6 eggs. In fact, in the numeracy task, it is written that the frying oil will decrease by 10 ml for frying the dough with 9 eggs. Based on Table 1, R1 has understood the problem and is able to find the information to solve it, but still makes a mistake in using the information when determining the number of eggs for the 10 ml decrease of the frying oil. This error causes subsequent errors in the task completion so that, holistically, (according to Tabel 1) the numeracy ability of R1 has not yet reached the high level (Bynner & Parsons, 1997). Viewed more heuristically, however, this error can be seen as non-problematic because the outcome of the work is regarded as a unity.

This heuristic judgement is useful for teachers as it can lead to probe deeper on students' numeracy abilities. It is possible that the mistake may not be because R1 does not understand the concepts, but maybe because of other factors such as misreading. This matter becomes a topic in the ensuing interview to dig into the cause of the emergence of this error. Results of the interview with R1 can be seen through the transcripts below.

Researcher	:	*What do you understand of the problem given?*
R1	:	*The task states that 3 eggs can make 12 egg rolls. The price of one egg roll is Rp 1,000; then we're asked to find Mrs Iva's profit.*
Researcher	:	*Do you have difficulty?*
R1	:	*Yes, confused to do it using what ways*
Researcher	:	*In your opinion the material in the item is concerned with what?*
R1	:	*Silent……. proportion perhaps?*
Researcher	:	*If proportion, then what're you going to do to solve it?*
R1	:	*Silent ……. forget, Ma'am.*
Researcher	:	*Then, why did you do it in that way?*
R1	:	*As far as I know, the profit Mrs Iva gets depends on the 2 litres of frying oil; then the litre is converted to ml, so the the amount of the frying oil is 2,000 ml. Then, we just take away the frying oil by 10 ml for every frying of 9 egg rolls till the oil is 0 ml. It is then can we find Mrs Iva's profit by subtracting selling from capital.*
Researcher	:	*Then what's the number of the egg rolls produced, yes?*
R1	:	*Silent ……. the number comes to after we take away the frying oil till it's all up, Ma'am.*
Researcher	:	*Right, ghow many?*
R1	:	*I don't know, Ma'am.*
Researcher	:	*According to you, is there or not another way to solve the problem?*
R1	:	*Silent ……. maybe there is, but I don't know, Ma'am.*
Researcher	:	*Are you sure or not with your answer?*
R1	:	*Silent ……. Sure Ma'am.*
Researcher	:	*Before submitting, have you checked or not your work?*
R1	:	*Not yet, Ma'am.*

The interview scripts above strengthen the previous statements that R1 understands the contexts of the problem (shown by the blue underlines). However, for the second expression with a blue underline, R1 answers that it needs 9 eggs to take away 10 ml of frying oil. This shows that R1's answers during the interview are not congruent with the work in Figure 2. This means that R1 does make a small mistake (misreading, inaccurate, etc.) when trying to understand the problem. Such small mistakes can be handled by giving students more drills and exercises in doing contextual tasks so that they become more familiar with context dimensions and mathematical knowledge.

In the scripts, it can also be seen that R1 does not show enough confidence by oftenly staying silent and using "maybe" (shown in texts with green underlines) (Parsons *et al*., 2009). Besides, R1 is also sure of having not checked the work before submitting (red underline). This means that R1's statements are not based on facts but merely on perceptions. These findings show that R1 does not have confidence in completing the task (not showing the disposition dimension) nor conduct checking before submitting the work (not showing the critical orientation dimension).

In contrast with R1, R2 completes the numeracy task structurally and with explicit proportion concepts. R2's work can be represented in Figure 3 below.

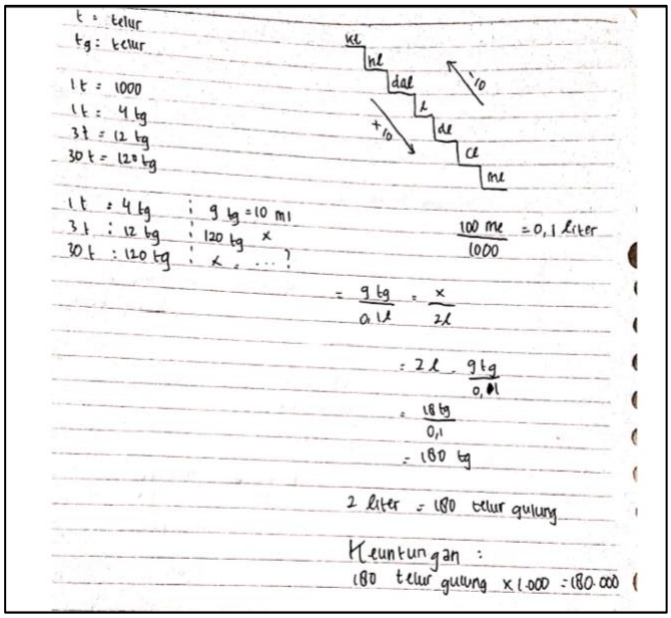

Figure 3. Work of R2

In Figure 3 above, it can be seen that, in general, R2 completes the problem in the following steps: (1) tabulating the data for the egg rolls that can be produced by 30 eggs; (2) converting the volume of the decreasing frying oil in litres; (3) applying the proportion concept to determine the number of the egg rolls to use up 2 litres of frying oil; (4) multiplying the result of step 3 by the selling price per egg roll.

The steps conducted by R2 conform with the completion steps that are congruent with proportion concepts. Besides, R2 is able to understand the problem by writing down the information needed to construct the strategy for completing the task (the dimension for mathematical knowledge and contexts). However, the steps used by R2 has an error in step 4 when multiplying the result of step 3 by selling price per egg roll. This is because, in R2's work, it is written that Rp 180,000 is the profit. In fact, Rp 180.000,00 is the selling price of 180 egg rolls. In other words, R2 executes incorrect calculation or makes a mistake in using a mathematical tool or mathematical concept and so, according to Table 1, it can be said that R2 has not mastered the tool dimension.

This finding shows that R2 is almost able to complete the problem, but still has a major error that has an impact on the soluion of the problem in general. This, therefore, will be analyzed further by way of the interview results. The transcript of the the interwiew with R2 is presented below.

Researcher	:	*What can you understand of the problem given?*
R2	:	*It is known from the item that the price of one egg roll is Rp 1,000. To make the dough mixture it needs 3 eggs that make 12 egg rolls. So, one egg produces 4 egg rolls. Because there are 30 eggs, it means that 120 gg rolls are produced.*
Researcher	:	*What are you going to find?*
R2	:	*How many egg rolls are produced and then the profit gained by Mrs Iva's.*
Researcher	:	*How do you do it?*
R2	:	*By way of proportion, but converting the 100 ml to litres first.*
Researcher	:	*Why converted?*
R2	:	*It's still in ml, isn't it? So convert to litres first so that it is the same like the frying oil. What is left is just enter it into the proportion formula until the result is found.*
Researcher	:	*Then after that?*
R2	:	*Find the profit that is gained, because there are 180 egg rolls, so just multiplied by 1,000. So the profit is 180.000*
Researcher	:	*Sure that's the profit?*
R2	:	*Of course, see, the egg rolls produced are 180 so the profit is 180 thousand.*
Researcher	:	*Before submitting did you or not check your work?*
R2	:	*I did, Ma'am.*

From the interview scripts above, it can be seen that R2 has completed the numeracy task with high confidence as seen from the ways the interviewer's questions are answered confidently, fluently, and in details (Parsons *et al*., 2009). Besides, R2 explains the problem contexts sequentially and is able to predict the strategies used to comprehend the contexts of the problem given (shown by texts underlined in blue). This means that, according to Table 1, R2 has mastered the dimensions of mathematical knowledge, contexts, and disposition. However, R2's confidence can cause a problem, i.e. when determining the produced egg rolls. In fact, initially, R2 has stated that the produced egg rolls are 120. But, when asked again, R2 mentioned 180 egg rolls (shown by texts marked by green underlines). This finding shows that what R2 thinks and does are not in tune. Looking at R2's responses shown in Figure 3, what most possibly happens is that R2 makes a mistake earlier, but is aware of it, and makes correction to the mistake, and so is able to obtain the selling price of Rp 180,000.

In another finding, when asked whether or not checking is done before submitting, R2 confidently answers yes (shown by a red underline); however, the checking is not done carefully so that the mistake remains. Furthermore, R2 has actually done the correct steps but there needs to be advocacy from the teacher so that R2 can avoid carelessness.

Looking at the results of the analyses, it can be shown that R1's numeracy abilities are at a low level as seen from the fact that the overall numeracy dimension is not mastered. Meanwhile, R2 can be said to have numeracy abilities that are almost the high level considering that only a few components in the numeracy competency are not understood. However, away fom numeracy competency levels, both subjects are able to comprehend the sitution given in the problem, but they are not careful enough to understand the information given. Briefly, results of the analyses that have been done can be seen in Table 2.

Table 2. Summary of the Analyses of Subjects' Works and Interviews

R1	R2
• Understands contexts but has not collected information needed to use mathematical concepts and skills in forming a strategy for problem solving (has not acquired the dimensions of mathematical knowledge and contexts)	• Is able to collect information needed to use the mathematical concepts and skills in forming a problem-solving strategy in the contexts of PCR shown by the abilities to comprehend the problem contexts and forming a solution in accordance with the problem (acquires the dimensions of mathematical knowledge and contexts)
• Has not had the confidence to form completion steps using mathematical approaches when facing the problem of completing a numeracy task (has not acquired the disposition dimension)	• Has the confidence to form solution steps using mathematical approaches when completing a numeracy task (acquires the disposition dimension)
• The mathematical tool (in this case, calculation) used is far below the level of Junior-High-School age (the dimension of tools is almost acquired, but not in accord with the Junior-High-School age level)	• Use of mathematical tools is almost accurate, but there is a lack in adapting the formula given when calculating profit and selling price (has not acquired the dimension of tools)
• Does not conduct checking after applying the solution that has been planned (has not acquired the dimension of critical orientation)	• Is less able in determining the ways applied that are in accord with the formula or scheme that is taken at the beginning of the work (has not acquired the dimension of critical orientation)

In Table 2, important points are shown that become a problem in the completion of the numeracy task. These are (1) abilities in understanding and formulating the problem; (2) levels of self-confidence; dan (3) checking in applying the formula that is adopted.

These important points can be overcome by getting used to completing contextual problems. Students who are not used to solving contextual problems will certainly face difficulties in forming completion steps and applying mathematical concepts. Teachers often assume that incorrect solutions for given problems arise from the lack of mathematical understanding or skills in applying them (Gal *et al*., 2020a). This happens because the math learned at school is not automatically for daily life without the presence of complex problems (Lüssenhop & Kaiser, 2020). Besides, contextual problem solving in real situations often involves the processes of reading, interpreting, solving, and communicating mathematically (Gal *et al*., 2020a). It is similar with the mathematical model of the 21st century that can be seen in Table 3.

Tabel 3. Mathematical Model of the 21st Century

Element	Description
Critical Thinking	Use of mathematical information for making decisions and evaluations; giving arguments to support an argument; to attack an argument.
Contexts	Capacity to use mathematical knowledge in various contexts, in and outside of school.
Disposition	Willingness and confidence to use mathematical knowledge flexibly and adaptively.
Mathematical Knowledge	Mathematical concepts and skills; problem-solving strategies; and estimation capacity.
Tools	Use of materials (models, measuring instruments), representation (symbols, graphs, tables, pictures, diagams), and digital appliances (computers, calculators, the Internet, and software) to mediate thinking.

In the contexts of numeracy, mathematical knowledge does not only include concepts and skills, but also problem-solving strategies and abilities to make logical estimation (Goos *et al*., 2012). In solving a problem, students do not only know and use an efficient method, but they also evaluate the outcome that they obtain and are aware of the basis for the mathematical thinking that is right or not right to analyze the situation before making a decision (Geiger *et al*., 2015; Noss *et al*., 2005). On the other side, the nature of numeracy has five core objectives; they are: (1) practical (focusing on the mathematical knowledge, skills, and statistics that can assist in the handling of daily-life duties); (2) professional (the mathematical experties and statistics that are used in specific job work); (3) civic (data and uses that are useful for the community members); (4) recreation (concerning the roles of mathematical ideas and processes in games, sports, lotteries, and other various recreational activities); and (5) culture (appreciation of the mathematical aspects of human cultures such as artistic artefacts) (Gal *et al*., 2020b). In other words, numeracy is not merely about making calculation to solve a problem.

But, much more, numeracy also has an impact on students in making use of mathematical concepts in daily-life activities, a job work, community life, and arts and cultures. In similar essences, numeracy tasks that are constructed and become the results of the present study are forms of numeracy which have the destinations of practicality, professionalism, civility, recreation, and cultures that have an impact on students' competencies.

CONCLUSION

Findings of the present study show that initial mathematical abilities have an impact on determining numeracy levels in problem solving in the environment of cultural contexts. Students' difficulties in completing numeracy assignments has an implication on the importance of developing specific strategies in learning that is oriented to numeracy. Teachers can make the students be used to doing non-routine problem-solving assignments that are designed according to numeracy dimensions with varied contexts so that their numeracy abilities can increase and be used to handle problems in real life and, in particular, in achieving the numeracy objectives. More importantly, basic mathematical competencies will support in the understanding of numeracy in various contexts, including cultures.

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