APPROACHES TO MATHEMATICAL LITERACY TASKS: FINDINGS FROM A STUDY INVOLVING MATHEMATICS AND MATHEMATICAL LITERACY LEARNERS

France Machaba
Department of Mathematics Education, University of South Africa
South Africa
emachamf@unisa.ac.za

ABSTRACT - This paper emerges from an analysis of 207 learners' responses to a mathematical literacy task (Task 4) presented to learners studying mathematics and mathematical literacy in South Africa. Officially, mathematics and mathematical literacy are two separate learning areas. Learners from Grade 10 onwards are supposed to take either one or the other, but not both. This means that there is the potential that by the time learners reach Grade 11, they would have acquired different kinds of knowledge and problem-solving skills depending on which of these they take. In this paper, I present an analysis involving data from mathematics and mathematical literacy learners, which shows that it is not really possible for mathematical literacy to stand alone – to assume an exclusive identity. Using a qualitative and a quantitative approach, I argue that a mathematical literacy task will have many other aspects (especially mathematics) embedded in it. That which gives mathematical literacy an identity cannot be divorced from mathematics. I illustrate this assumption by examining the ways in which mathematics and mathematical literacy learners solved mathematical literacy tasks.

Keywords: mathematics, mathematical literacy, strategies, Task 4.

1. INTRODUCTION

In our previous paper (Machaba & Mwakapenda, forthcoming); we argued that Task 3 appears to have attracted multiple interpretations from most of the teachers involved in the study. Four (4) mathematics teachers and three (3) mathematical literacy teachers viewed Task 3 as both mathematics and a mathematical literacy task. This occurred even though the task was selected from a previous national mathematics question paper. Similarly, for Task 2, also selected from a previous national mathematics question paper, 5 of the 8 teachers involved in the study viewed the task as both a mathematics and mathematical literacy task. We argued that the way in which teachers viewed Tasks 2 and 3 appears to be consistent with the orientations of the tasks themselves. Both Tasks 2 and 3 have mathematics and a mathematical literacy orientation in two ways: (i) in their form; and, (ii) in the ways in which these tasks demand to be engaged with in order to obtain correct solutions. On the other hand, for tasks like 1 and 4 whose dominant orientations are explicitly mathematics or explicitly mathematical literacy (not both) respectively, the identity of mathematics appears to be stronger and more visible than that of mathematical literacy. Seven teachers viewed Task 1 as being about mathematics only, while 4 teachers viewed Task 4 as being about mathematical literacy only and 4 teachers viewed Task 4 as being both mathematics and mathematical literacy. This suggests that when a task is a mathematics task, teachers seem not to struggle to see it as being explicitly about mathematics. However, when a task is a mathematical literacy task, fewer teachers appear to see it as explicitly about mathematical literacy. The analysis, although revealing this interesting distinction between mathematics and mathematical literacy, arose from data involving a small number of teachers. Thus the paper is directed by the following research questions, (1) how do Mathematics learners interact with Mathematical Literacy tasks?; and, (2) When given a Mathematical Literacy task, what variations, if any, exist in the solution strategies of Mathematics and Mathematical Literacy learners? In this article, I present a further analysis involving data from mathematics and mathematical literacy learners in order to examine whether it is still the case that it is not possible for mathematical literacy to stand alone – to assume an exclusive identity. I argue that a mathematical literacy task will have many other aspects (especially mathematics) embedded in it. That which gives mathematical literacy an identity cannot be divorced from mathematics. I illustrate this assumption by examining the ways in which mathematics and mathematical literacy learners solved mathematical literacy tasks.

To develop the argument, I analysed the Curriculum and Assessment Policy Statement (CAPS) for mathematics and mathematical literacy to identify similarities and differences between mathematics and mathematical literacy using ideas from the work of Bernstein's (1982) constructs (especially classification and framing), and Kilpatrick, Swafford and Findell's (2001) strands of mathematical proficiency, particularly conceptual understanding and procedural proficiency. The reason I looked into the two curricular was because teachers' and learners' official pedagogical identities are embedded in them. Bernstein's constructs of classification and framing, which are related to recognition and realisation rules respectively, and Kilpatrick et al's (2001) strands of mathematical proficiency, were further used to describe and explain learners' solution strategies in mathematics and mathematical literacy.

1.1 Mathematics

Mathematics has been defined within the Curriculum and Assessment Policy Statement (CAPS) of the FET phase in the following terms:

Mathematics is a language that makes use of symbols and notations for describing numerical, geometrical and graphical relationships. It is a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena and between mathematical objects themselves. It helps to develop mental processes that enhance logical and critical thinking, accuracy and problem-solving that will contribute in decision-making. Mathematical problem-solving enables us to understand the world (physical, social, and economic) around us, and most of all, to teach us to think creatively (DBE, 2011:8).

It is evident from the definition above that mathematics is viewed as a practice that constitutes skills or practices such as problem-solving, observing patterns and generalising, and representation of mathematics numerically and symbolically. It is a discipline developed through both language and symbols. This emphasises the issue of the language of mathematics. Mathematics is regarded as a tool, through using problem-solving skills, to enable us to understand everyday contexts. The incorporation of everyday contexts was intended to make the learning of mathematics easier for the learner. Key aspects such as observing patterns, generalising, representation, and language as highlighted in the above definition of mathematics are critical for teachers to help learners to develop mathematical proficiency. These mathematical teaching practices such as description, analysis, representation, explanation and justification are not peculiar to mathematics. They are also key aspects in mathematical literacy as discussed below.

1.2 Mathematical literacy

The Curriculum and Assessment Policy statement (2011, p. 10) defines mathematical literacy as:

a subject that develop competencies that allow learners to make sense of, participate in and contribute to the twenty-first century world – a world charactered by numbers of different ways. Such competencies include the ability to reason, make decisions, solve problems, manage resources, interpret information, schedule events and use and apply technology.

Competencies such as the ability to reason, make decisions, solve problems, manage resources, interpret information, schedule events, and use and apply technology are what Kilpatrick, Swafford and Findell (2001) refer to as mathematical teaching practices to develop mathematical proficiency. To develop these competencies the Department of Basic Education (2011, p. 10) indicated that "learners must be exposed to both mathematical content and real-life contexts". It is further indicated that mathematical content is needed to make sense of real-life contexts; on the other hand, contexts determine the content that is needed. The purpose of introducing mathematical literacy is to develop the "self-managing person", the "contributing worker" and the "participating citizen" (DBE, 2011, p. 10). Brombacher (2006) noted that the FET curriculum is designed in such a way that mathematics and mathematical literacy are different in "kind and purpose"; thus mathematical literacy is not subsumed in mathematics. The difference of structures of knowledge between mathematics and mathematical literacy are underpinned by the classification of knowledge and pedagogical practices. Bernstein's (2000) constructs of recognition and realisation were used below to analyse the nature of mathematics and mathematical literacy.

2. THEORETICAL PERSPECTIVE

According to Bernstein (2000), the fact that mathematics is a content-oriented subject makes it strongly classified and framed, which results in its recognition and realisation rules being clearer. Bernstein (1982, p. 59) refers to classification as:

the nature of differentiation between contents. Where classification is strong, contents are well insulated from each other by strong boundaries. Where classification is weak, there is a reduced insulation between contents, for the boundaries between contents are weak and blurred

Framing refers to the "form of the context in which knowledge is transmitted and received and refers to the specific pedagogical relationship between the teacher and the taught" (Bernstein, 1982, p. 59). The concepts of classification and framing, according to Bernstein, yield to concepts of recognition and realisation rules. Recognition rules, according to Bernstein (2000), are criteria (special relationships) for making distinctions, for distinguishing the speciality of a thing or a practice or a specialisation or a context; that which makes it what it is. Recognition rules are principles for recognising the "legitimate text" (p. 50), the voice to be acquired, and are determined by the classification principle at work (relations between different knowledge discourses and practices). Realisation rules are the "means for creating and producing the special relationship internal to what is recognised as the 'legitimate text', that is, the means for reproducing/ creating the speciality in practice" (Bernstein, p. 50).

According to Bernstein (2000), this implies that the mathematics context can easily be recognised due to its strong classification of a knowledge structure, unique identity, unique voice and internal rules. The acquirer (the learner or the teacher) is able to recognise mathematics pedagogical text (e.g. textbooks) in the classroom. This means that teachers or learners are able to identify themselves in the context of mathematics. They can ably recognise "the speciality of the context they are in" (Bernstein 1996, p. 31). However, this may not necessarily happen in the case of mathematical literacy. To supplement Bernstein's constructs of recognition and realisation rules for data analysis, I used Kilpatrick, Swafford and Findell's (2001) strands of mathematical proficiency, particularly conceptual understanding and procedural proficiency, as discussed below.

2.1 Strands of mathematical proficiency

Kilpatrick et al (2001:116) describe five strands of mathematical proficiency, namely: conceptual understanding; procedural fluency; strategic competence; adaptive reasoning and productive disposition.

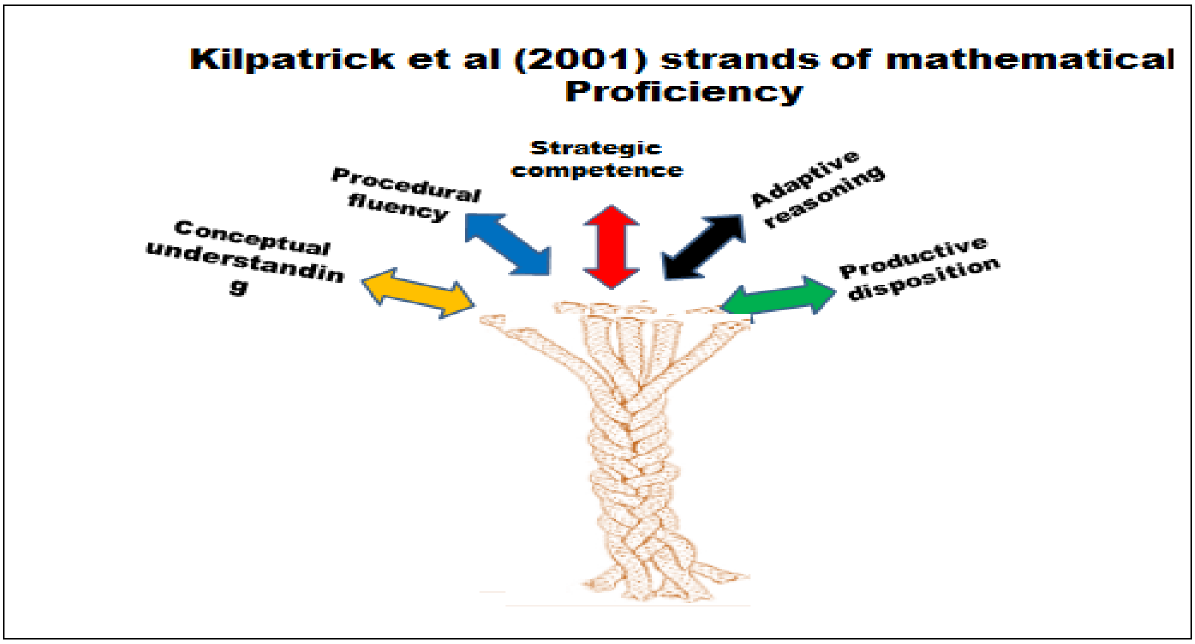


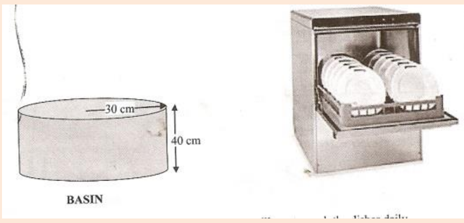
Figure 1: The Kilpatrick et al. (2001) strands for mathematical proficiency

Conceptual understanding refers to comprehension of mathematical concepts, operations, and relations. *Procedural fluency*: This refers to knowledge of procedures, that is, the knowledge of when and how to use them appropriately, and the skill in performing them flexibly, accurately and efficiently. *Strategic competence:* This refers to the ability to formulate mathematical problems, represent them, and solve them. *Adaptive reasoning*: This refers to the capacity to think logically about the relationships among concepts and situations. It includes knowledge of how to justify the conclusion. In the tasks that were given to learners in this study, learners were required to justify their mathematical claims and explain their ideas in order to make their reasoning clear. *Productive disposition*: This refers to the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics. The analysis of the two curricula – mathematics and mathematical literacy using strands of mathematical proficiency, suggest that there are similarities between mathematics and mathematical literacy curricula in terms of mathematical practices foregrounded in the two curricula.

These similarities suggest that learners from mathematics and mathematical literacy may be equally positioned to tackle given mathematics problems. To test this proposition, a study was undertaken at a Grade 11 level. It investigated Grade 11 learners' abilities to solve context-based tasks. The study explored what happens when learners, who come "loaded" with the knowledge of mathematics, that is, from the mathematics learning area, interact with a task that is officially from another learning area called mathematical literacy. And, conversely, what happens when learners, who come "loaded" with the knowledge of mathematical literacy, that is, interact with a task that is officially from a learning area called mathematical literacy. By allowing learners to interact with a task from mathematical literacy, the study attempted to remove the "boundary" (Bernstein, 1996) that has been officially placed between mathematics and mathematical literacy. Task 1 -4 are attached on Annexure A below. Three tasks were from previous years' of Grade 12 Mathematics National question papers, while the fourth task was from previous years' Grade 12 Mathematical Literacy National question paper. However, for this paper only Task 4 was used to determine and how mathematics and mathematical literacy learners interact with mathematical literacy oriented task. A mathematical literacy task (Task 4) was selected on the basis that learners from both mathematics and mathematical literacy would be able to solve it. Task 4, which was presented to learners, was as follows:

TASK 4

1. Thandi washes her dishes by hand three times daily in two identical basins. She uses one basin for washing the dishes and the other for rinsing the dishes. Each basin has a radius of 30 cm and a depth of 40 cm, as shown in the diagram below.



Thandi is considering buying a dishwasher that she will use to wash the dishes daily.

1.1 Calculate the volume of one cylindrical basin in cm^3
1.2 Thandi fills each basin to half its capacity whenever she washes or rinses the dishes. Calculate how much water (in litres) she will use daily to wash and rinse the dishes by hand ($250cm^3 = 0.025\ell$).
1.3 A manufacturer of a dishwasher claims that their dishwasher uses **nine times** less water in comparison to washing the same number of dishes by hand.
1.3.1 How much water would this dishwasher use to wash Thandi's dishes daily?
1.4 Is the claim of the manufacturer realistic? Justify your answer by giving a reason(s).

Figure 1: Task given to the learners

During the analysis and the interpretation of data, I had to take the data back to the subjects in order to check if it was correct to ensure respondent validity. I also consulted my supervisors to check my data analysis – i.e. do they come up with similar categories in their viewing of my data? I also piloted my instrument to ensure the issue of validity is ensured

3. METHODOLOGY

The research focused on four secondary schools from contrasting backgrounds in South Africa. The research is located within a qualitative approach, adopting a multiple case study approach. The four schools were located in socially divergent sites – two former Model C schools that serve middle to upper well-resourced schools, where parents typically were of high-income professionals. The other two schools were public township schools serving children from predominantly poor backgrounds; less affluent schools offering both mathematics and mathematical literacy, where parents are typically low-income earners. In this study, we used purposeful sampling to choose four schools with different socioeconomic experiences and two classes of mathematics and mathematical literacy in each school. In a school where there was more than one mathematics or mathematical literacy class, one class for maths and one for mathematical literacy was provided; 207 learners' scripts for both mathematics and mathematical literacy for all four schools were collected and analysed.

During the analysis and the interpretation of data, I had to take the data back to the subjects in order to check if it was correct to ensure respondent validity. I also consulted my supervisors to check my data analysis – i.e. do they come up with similar categories in their viewing of my data? I also piloted my instrument to ensure the issue of validity is ensured. Before reading learners' responses, data using a coding system to name learners' scripts were organised. For example, the first learner's script for School 1 for mathematics class was coded S1ML1 (Learner 1 in mathematics class for School 1). S1MLL1 was for Learner 1 in mathematical literacy class in School 1.

As indicated in Task 4 below, the following codes have been used in this task to describe the mathematical ideas embedded in the task. The formula of the volume of the cylindrical basin is divided into two parts. There are solution strategies that show formulae with the concept of Pi (π), coded with π, and there are learners' solution strategies without the concept of Pi (π), coded without π. Learners' solution strategies that show conversions are coded C; correct conversions are coded CC. Some learners' solution strategies suggest that the idea of halving is there even though the solution is correct, are coded ÷ 2. Similarly, some learners' solution strategies reflect the understanding that there are 2 basins even though the solution is incorrect, that is coded x 2. Again, some learners' solution strategies reflect the understanding that dishes are washed three times daily by hand even though the solution is incorrect, that is coded x 3, if the strategy has x 3. The interpretation of nine times less is coded ÷ 9; x9 or -9. Learners' justification of their reasoning in question 1.3.1 is divided into justification based on mathematics (JBM) and justification based on everyday experiences (JBE).

4. RESULTS AND DISCUSSIONS OF FINDINGS

A table 1 below provides a summary of mathematics and mathematical literacy learners' solution strategies in mathematical literacy tasks across the four schools. The four key findings, as discussed below, which emerged in this study, are related to the understanding of the formula, conventions of units, mathematical language embedded in the task, and the relationship between mathematics and everyday knowledge.

Table 1: Summary analysis of M and ML learners' solution strategies to Task 4

Schools	%	Volume formula		C	CC	÷2	X 2	X3	÷9	X9	-9	JBM	JBE
		Without(π)	With(π)										
1M (41)	%	63	22	68	14	24	10	24	51	5	5	37	41
1ML(25)	%	64	36	96	32	4	4	4	24	16	8	40	40
2M(16)	%	25	69	75	63	31	19	31	50	0	0	38	6
2ML(16	%	75	31	94	0	25	13	6	19	13	25	44	13
3M (43)	%	35	63	91	51	44	5	21	35	14	5	65	2
3ML(23)	%	0	100	95	39	4	4	4	70	0	0	39	17
4M (23)	%	74	17	83	39	30	35	43	65	4	0	52	26
4ML(20)	%	75	20	80	10	15	15	10	60	10	10	70	20

4.1 Understanding of a formula

The inclusion and exclusion of the concept of Pi (π) in the formula of the volume of the cylindrical basin was an indication of whether learners understand the concept of volume. It is clear from Table 1 that most mathematics learners in these schools were unable to come up with the correct formula to determine the volume of the cylindrical basin. Failure to come up with the correct formula of volume (used the formula of area instead) was evidence that they did not understand the question. They were unable to see through the context to the mathematical demands of the task. In fact, there are only a few learners whose solution strategies reflect the concept of Pi (π) as reflected in Table1. Most learners just saw 30 cm and 40 cm from the instruction and thought the two numbers have to be multiplied. Some of learners, such as L15 and L14 as shown below, might be confusing the formula of rectangular area with the formula for calculating the volume. The reason why learners were confusing the formulae may be because of a lack of understanding of concepts such as area and volume. Most learners do not seem to know what the concept area and the concept volume mean conceptually and how they are related. For example, if learners knew that an area means a surface or a region of two-dimensional shape, and volume means a space of three-dimensional shape, they wouldn't be confusing them. It is clear from learners' solution strategy that they lacked knowledge that most formulae are derived from the idea of the area of a surface, which is base x height. The formula for the volume of the cylindrical basin is the area of the base of a circle and its height, which is made of many invisible circles. Two of the responses from mathematics (S1ML15) and mathematics literacy (S2MLL14) learners to the first part of Task 4 were as follows:

S1ML15 4.1 Calculate the volume of one cylindrical basin in cm^3

$V = L \times b$
$= 40cm \times 30cm$
$= 1200cm^3$

S3MLL14 4.1 Calculate the volume of one cylindrical basin in cm^3

$L \times b$
$30cm \times 40cm$
$= 1200cm^3$

The learners (S1ML28 for mathematics and S1MLL23 for mathematical literacy) below confused the formula of calculating area and volume.

S1ML28 4.1 Calculate the volume of one cylindrical basin in cm^3

$V = \pi r^2$
$= 3.14 \times (30)^2$
$= 2826cm^2$

S1MLL23 4.1 Calculate the volume of one cylindrical basin in cm^3

πr^2

$30 \times 40 = m$
$= 1200$

4.2 Two other responses from mathematics and mathematical literacy were as follows:

S3ML47 4.1 Calculate the volume of one cylindrical basin in cm^3

$V = \pi r^2 . h$
$= 3.14 \times (30cm)^2 \times 40cm$
$= 3.14 \times 900cm \times 40 cm$
$= 113040 cm^3$

S4MLL4 4.1 Calculate the volume of one cylindrical basin in cm^3

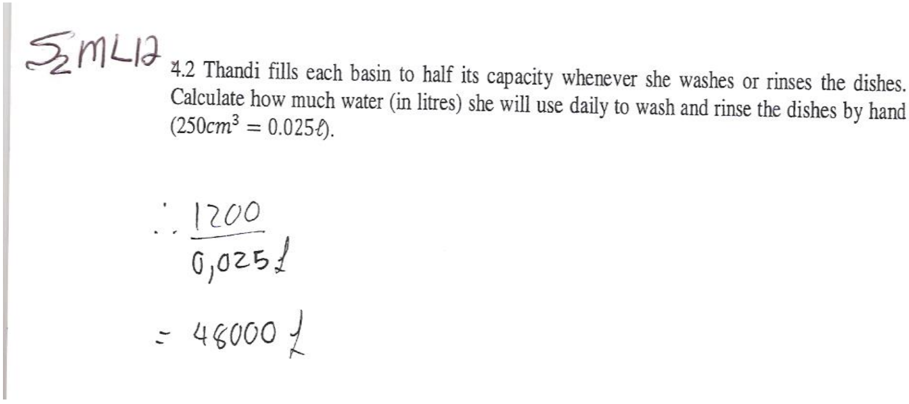
$V = \pi r^2 h$
$= 3.14 \times 30^2 \times 40$
$= 113\ 040\ cm^3$

Inability to produce the correct formula could be attributed to the fact that most learners learn formulae procedurally without a proper understanding of the concepts (Hierbert, Carpenter, Fennema, Fuson, Human, Murray, Olivier & Wearne, 1996; Hierbert & Carpenter, 1992; Van De Walle, 2013). It appears that most learners don't know where formulae come from and how they have been developed. For example, it appears that most learners in this class could not recognise that every circle formula must have the concept of Pi (π). Most learners seem not to have an idea of what Pi (π) is and where it comes from. If learners knew that Pi (π) is the ratio of the circumference of circle to its diameter, half of the problem could have been solved. Failure of most learners to recognise Pi (π) as the key mathematical idea in this task hindered the realisation of mathematical competencies in this task. It appears that most learners don't have a knowledge that all formulae that required volume are derived from the idea of area of a base times height. In fact, not only volume formulae, but even the 2-

D shapes formulae are derived from the same idea. It appears in most learners' solution strategies that concepts such as Pi (π), radius, volume and circumference of a circle are learnt in isolation from each other. Hence, there is no evidence of relational understanding from learners' solution strategies. The fact that mathematics learners are given formulae on the back sheet of national examination question papers seems to be encouraging teachers to teach concepts such as volume and area procedurally without a conceptual understanding. This further encourages learners to learn these concepts procedurally.

4.3 Conventions

Table 1 further reveals that there are still learners who seem to be experiencing some challenges when it comes to the concept of conventions of units. They also seem to be experiencing challenges in determining the relationship between those units. Others still think when conversions of units are required it means dividing, multiplying by 100 or by 1 000. Others just use numbers in the instruction without any understanding. It is evident that most learners lack the understanding between the concept of proportion and ratio when it comes to the idea of units' conventions. L12 and L30 have demonstrated these strategies below.

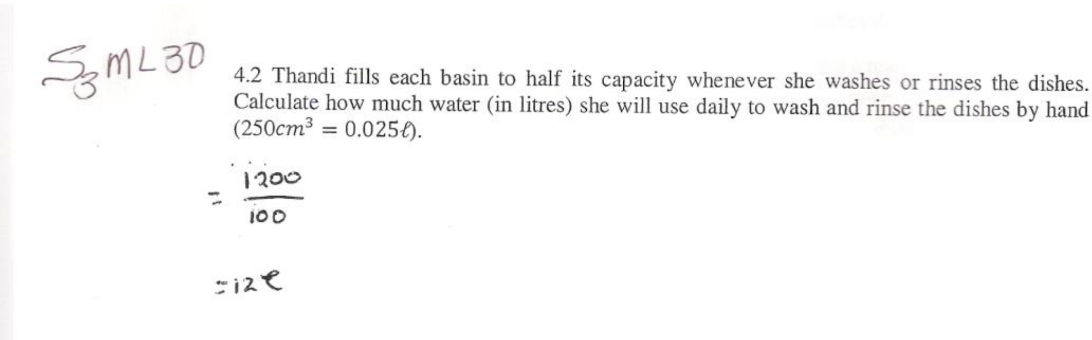


S_2ML12

4.2 Thandi fills each basin to half its capacity whenever she washes or rinses the dishes. Calculate how much water (in litres) she will use daily to wash and rinse the dishes by hand ($250cm^3 = 0.025\ell$).

$\therefore \frac{1200}{0{,}025\ell}$

$= 48000\ell$



S_3ML30

4.2 Thandi fills each basin to half its capacity whenever she washes or rinses the dishes. Calculate how much water (in litres) she will use daily to wash and rinse the dishes by hand ($250cm^3 = 0.025\ell$).

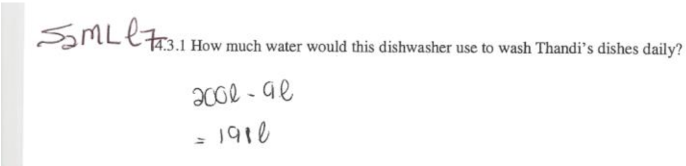
$= \frac{1200}{100}$

$= 12\ell$

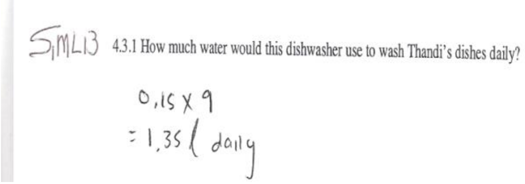
These findings confirm what Skemp (1976) discovered in his research when investigating how learners deal with the concepts of area, perimeter and units. He found that most learners do not have a relational understanding of the concepts of area and perimeter but demonstrate instrumental understanding. Instrumental understanding, according to Skemp (1976), is when learners possess rules and formulae and the ability to use them without reason, not knowing where those rules and formulae come from. For example, many learners know that the formula to calculate the area of a rectangle is length multiplied by breadth, but they do not know why it is so. He argues that learners should develop a relational understanding, and so too of area and perimeter. In other words, learners should know both what to do and why when dealing with problems that involve area and perimeter (p. 20). This also implies that learners should be able to associate or relate the concept of area and perimeter with other mathematical concepts and their everyday life experiences.

4.4 Mathematical language

The other part of Task 4 required learners to understand and interpret the phrase, “nine times less”. Most learners interpreted “nine times” as multiplied by 9 while others interpreted it as subtracted by 9 as evidenced in mathematics (S1ML13) and mathematical literacy (MLL2) learners below.


S2MLℓ7 4.3.1 How much water would this dishwasher use to wash Thandi’s dishes daily?

200ℓ - 9ℓ
= 191ℓ

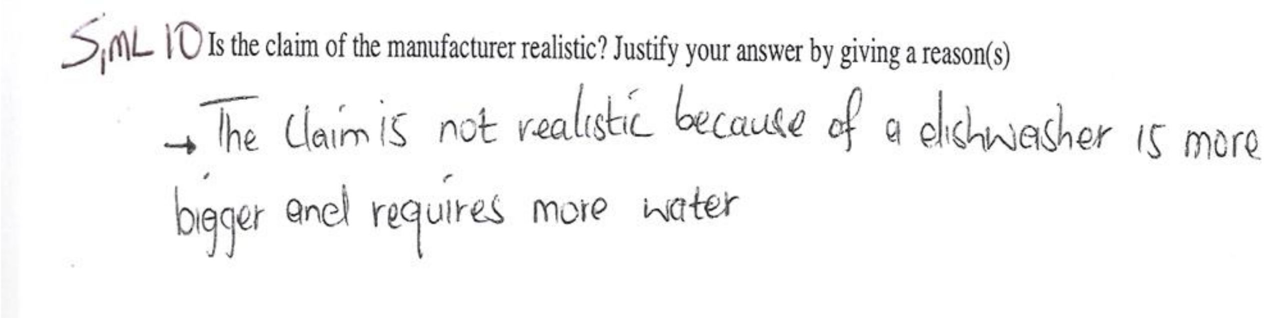

S1ML13 4.3.1 How much water would this dishwasher use to wash Thandi’s dishes daily?

0,15 x 9
= 1,35 ℓ daily

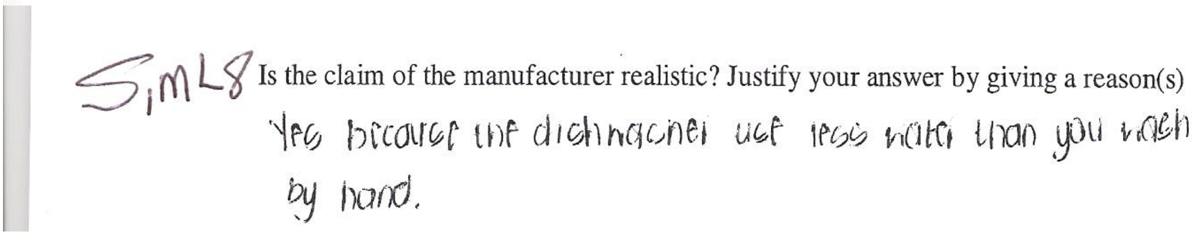
It was very surprising that many learners’ solution strategies as indicated in table 1 evidenced their correct interpretation of the idea of “nine times less”. This suggests that these learners were able to understand the relationship between mathematics as a language and everyday language. Most learners were able to move from everyday language to the mathematics in this area. The idea of number, operations and relationship appears to have been mastered very well when it comes to this question. Most learners demonstrated an idea of the relationship between division and subtraction as operations.

4.5 Mathematics and everyday knowledge

The last part that required learners to justify the claim of the manufacturer that the “dishwasher machine uses nine times less water in comparison to washing the same number of dishes by hand” is realistic. To answer this question, learners had to look at their mathematical work in order to provide a response. However, most learners answered this question without considering their mathematics. They answered the question based on their personal preferences and their everyday knowledge. For example, it seems that learners from Grades 10 and 8 compared the dishwashers in terms of size instead of taking an informed decision based on their mathematical reasoning.


S1ML 10 Is the claim of the manufacturer realistic? Justify your answer by giving a reason(s)

→ The claim is not realistic because of a dishwasher is more bigger and requires more water


S1ML8 Is the claim of the manufacturer realistic? Justify your answer by giving a reason(s)

Yes because the dishwasher use less water than you wash by hand.

S3MLL2 Is the claim of the manufacturer realistic? Justify your answer by giving a reason(s)

yes because the dishwasher indeed uses less water than the basin.

The fact that this task is contextualised, that is, it connects mathematics and learners in everyday life knowledge, appears to be a challenge to most learners (Nyabanyaba1999, 2000; Sethole 2005; Cooper & Dunne, 2000). Most learners were unable to see and recognise the mathematics embedded in the everyday context. In other words, the context appears to be obscuring the mathematics embedded in it and as a result most learners were unable to access it (the mathematics) (Nyabanyaba, 1999). In particular, the idea that Thandi washes her dishes by hand three times daily and in two identical basins was not understood by most learners. That is why in question 4.3.1 – the question that required learners to justify their answer as to whether the claim of the manufacturer is realistic or not – some learners in this class did not base their justifications on the mathematics but their justifications were based on their everyday knowledge of the comparison between the dishwasher machine and the basin (Cooper & Dunne, 2000; Cooper & Harries, 2003; 2004). The dishwasher machine was just there to camouflage or dress up the problem (Sethole 2004). There was no need for it to be placed there, hence some learners started to compare them in terms of size.

In summary, all the strategies and mathematical ideas emanating from learners' solutions from this class were also in mathematical literacy learner's solution strategies. The only difference was the concept of Pi (π) was more prevalent in mathematical literacy learners' solution strategies than in mathematics learners. This suggests that mathematical literacy learners could recognise Pi (π) as the key mathematical idea in solving this task. Most mathematical literacy learners did better in converting cubic centimetres to litres than did mathematics learners. The understanding of halving, usage of two basins, washing dishes three times daily and the idea of nine times less appears to be understood better by mathematics learners than by mathematical literacy learners. ML learners were expected to do better in this area of the interpretation and analysis of the contextualised problem than M learners, because this is part of their community of practice. Table 2below shows the number of learners who got Task 4 correct.

Table 2: Number of learners who got Task 4 correct.

SUBJECTS	TASK 4	
	No of learners	%
M (123)	26	21%
ML (84)	24	29 %

The fact that ML learners out-performed M learners in Task 4 raises concern regarding how contextualised our own mainstream maths is to real life. Despite the fact that maths lit learners outperformed the mainstream mathematics learners, there is not that big a difference between the percentage of maths lit learners who did well in this task compared with the mathematics learners. This is suggestive of the fact that even though mathematics learners are not explicitly exposed to this type of mathematics, critical analysis and real life reasoning and contextualisation of mathematics is an inherent trait they are implicitly trained in. Thus even in their case, nothing big justifies underperformance in this task.

In this paper, the results show from mathematics and mathematical literacy learners that it is not really possible for mathematical literacy to stand alone – to assume an exclusive identity. I therefore argue that mathematical literacy tasks will most likely have many other aspects (especially mathematics) embedded in it. That which gives mathematical literacy an identity cannot be divorced from mathematics.Using both quantitative and qualitative data analysis frames, the analysis has revealed that in Task 4, which was between mathematics and mathematical literacy orientations, both groups of learners demonstrated the same abilities! This is contrary to what research would expect: that mathematics learner would perform better due to exposure to mathematics. In addition, for tasks that are more oriented towards mathematical literacy, both groups of learners demonstrated the same abilities for success! We conclude that the separation of mathematics and mathematical literacy, as required by the National Department of Education, is artificial. The analysis has shown that learners from both learning areas used similar knowledge and strategies to solve similar mathematics tasks with limited success. Contrary to common perceptions in the field of mathematics education (particularly in South Africa), I argue that engaging in mathematical literacy does not and should not make one less mathematically advanced than engagement in the so-called pure mathematics. This paper questions the introduction of mathematical literacy as a subject being offered parallel to mathematics in the South African curriculum. I recommend that in order to minimise confusion, there is a need for curriculum policy-makers to combine mathematics and mathematical literacy curricula into one learning area.

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Annexure A: TASKS

The tasks were as follows:

Solve for x

$$3x + \frac{1}{x} = 4$$

2 Calculate the value of: 1234567893 x 1234567894- 1234567895 x 1234567892

3 A sequence of squares, each having side 1, is drawn as shown below. The first square is shaded, and the length of the side of each shaded square is half the length of the side of the shaded square in the previous diagram.

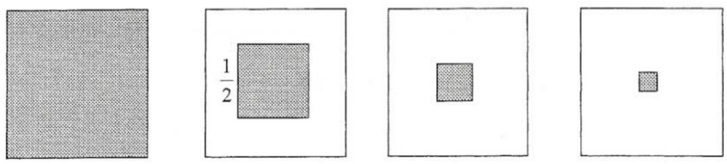
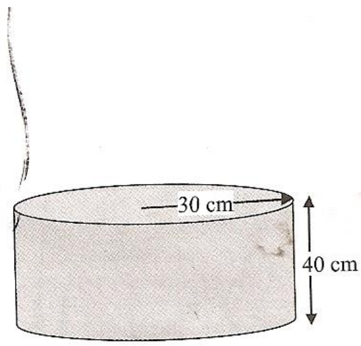


DIAGRAM 1 DIAGRAM 2 DIAGRAM 3 DIAGRAM 4

3.1 Determine the area of the unshaded region in the DIAGRAM 3

What is the sum of the areas of the unshaded regions on the first seven squares?

4. Thandi washes her dishes by hand three times daily in two identical basins. She uses one basin for washing the dishes and the other for rinsing the dishes. Each basin has a radius of 30 cm and a depth of 40 cm, as shown in the diagram below.



BASIN

Thandi is considering buying a dishwasher that she will use to wash the dishes daily.

4.1 Calculate the volume of one cylindrical basin in cm^3

4.2 Thandi fills each basin to half its capacity whenever she washes or rinses the dishes. Calculate how much water (in litres) she will use daily to wash and rinse the dishes by hand (250$cm^3 = 0.025\ell$).

4.3 A manufacturer of a dishwasher claims that their dishwasher uses **nine times** less water in comparison to washing the same number of dishes by hand.

4.3.1 How much water would this dishwasher use to wash Thandi's dishes daily?

Is the claim of the manufacturer realistic? Justify your answer by giving a reason(s)