Linking Context to Concept: How Different Types of Context Shape Grade 9 Mathematics Learning

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Abstract

This study explores how different types of contexts influence the learning of mathematics in a Grade 9 classroom. Framed within situated learning theory and the constructs of affordances and constraints, the research explores how various contextual approaches, namely, familiar, real, extended, contrived, and contexts of the discipline, shape learners' engagement with mathematical concepts. Employing a qualitative teaching experiment design, the researcher assumed a dual role as teacher and observer, using purposive sampling to focus on nine learners. Data were collected through video-recorded classroom interactions and analysed using narrative and retrospective techniques. Findings reveal that context significantly influences how learners interpret and approach mathematical problems. While certain contexts enhance participation, understanding, and problem-solving strategies, others introduce barriers, such as linguistic complexity or unfamiliar references, that distract from conceptual comprehension. Notably, learners often struggled more with interpreting the context than with the mathematical tasks themselves. The study underscores the importance of deliberate context selection in instructional design and highlights how aligning context with learners' experiences can facilitate deeper mathematical understanding.

Keywords: contextual teaching, situated learning, affordances, constraints, attunements

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Introduction

Learners' persistent underperformance in mathematics, particularly in the General Education and Training (GET) band in South Africa, remains a concern for educators and researchers (Makofane et al., 2025). To address this challenge, educators and researchers have proposed various instructional approaches, and the literature highlights contextual teaching as a noteworthy option. Context seeks to connect mathematical concepts to situations, problems, or experiences that are meaningful to learners, thereby enhancing their understanding and engagement (Anugraheni et al., 2025; Laughbaum, 2001).

Research suggests that teaching using context can make mathematics more accessible and meaningful by linking abstract concepts to learners' lived experiences (Selvianiresa & Prabawanto, 2017; Williams, 2007). However, studies have also indicated that the use of context may pose challenges, such as linguistic complexity, unfamiliar references, and misalignment between the context and the mathematical concept (Barnes & Venter, 2008). Importantly, much of the existing literature has relied on written assessments (Bansilal & Debba, 2012; Kappassova et al., 2025) or teacher reports rather than examining classroom interactions in natural teaching settings, of which learners' real-time sense-making, participation, and interpretation of contextual tasks remain under-explored.

This article draws on the author's master's dissertation to examine how contextual teaching may afford or constrain mathematics learning. Therefore, different types of contexts were employed to shape mathematics learning in a Grade 9 mathematics classroom, where learners' participation and meaning-making were the center of attention.

Literature Review

Conceptual Nature of Context and Its Types in Mathematics

Defining context in mathematics education is complex because the term encompasses a range of meanings and purposes (Brown, 2019). Rather than offering a single definition, researchers have proposed classifications of context that are useful for instructional design. This study understands context as a situation used to enhance the teaching and learning of mathematics (Laughbaum, 2001).

Building on Metz's (2013) model of contextual understanding, five types of contexts are central to this study: familiar, real, extended, contrived, and context of the discipline. Familiar contexts draw on learners' everyday experiences and interests; real contexts involve authentic situations that can be directly experienced; extended contexts integrate mathematics with broader social, cultural, or scientific issues; contrived contexts are fictional scenarios designed to highlight specific mathematical ideas; and the context of the discipline situates learning within abstract mathematical structures and relationships (Metz, 2013).

Linking Context to Mathematics Learning

Context has long been recognised as a powerful influence in mathematics learning, shaping not only what learners attend to, but how they interpret and engage with mathematical concepts (MacDonald, 2022). Research echoes that contextualisation in mathematics, particularly when it draws on learners' real-world experiences and cultural backgrounds can make abstract mathematical concepts meaningful and accessible (Luneta, 2023). Research on culturally responsive assessment further supports this, showing that culturally familiar contexts embedded in mathematical word problems can significantly improve learners' performance, engagement, and confidence because they reduce unnecessary cognitive load and link mathematics to students' lived experiences (Ntumi et al., 2026).

Contextual Teaching in Mathematics

Contextual teaching is regarded as an approach that actively involves learners in constructing mathematical knowledge through engagement with meaningful situations (Selvianiresa & Prabawanto, 2017). By encouraging discussion, interpretation, and problem-solving, contextual teaching promotes learner participation and mathematical communication (Brown & Redmond, 2017). However, the effectiveness of contextual teaching depends on the nature of the context used and learners' ability to interpret it appropriately (Mahmuti et al., 2025).

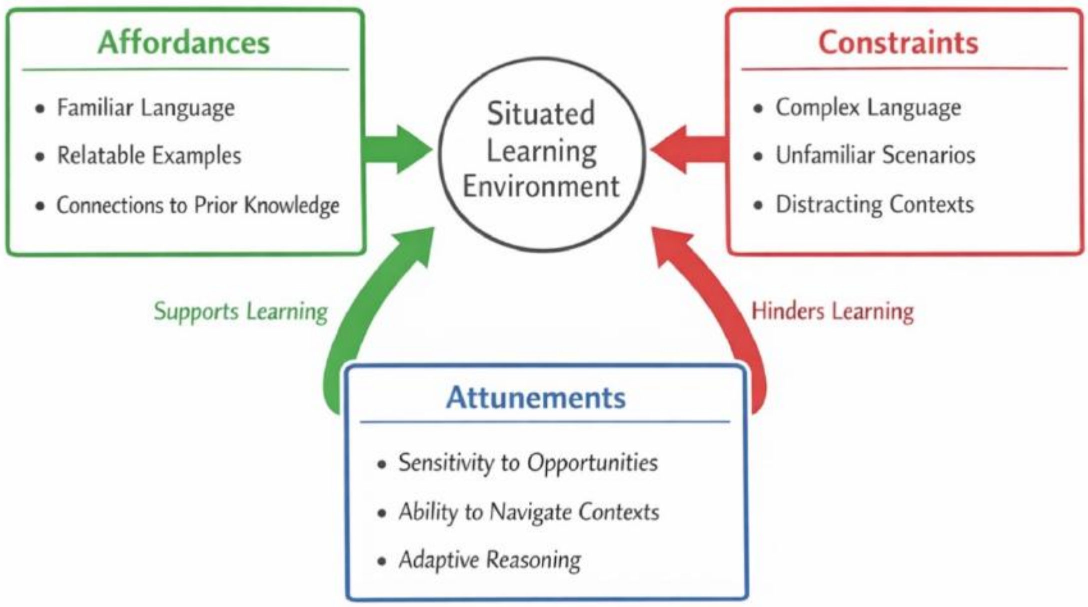
Yasin et al. (2023) allude that while context can stimulate interest and provide cognitive support, it may also divert learners' attention away from the mathematical goal, particularly when the language or scenario is unfamiliar. This dual nature of context underscores the need to examine both its affordances and constraints within actual classroom interactions.

Theoretical Framework

This study is theoretically framed by situated learning as set out by Greeno (1998). Situated learning theory offers a useful framework for understanding how learners engage with mathematical contexts in classrooms. According to Greeno (1998), learning is inherently situated and occurs through interactions with the environment, tasks, and social processes. Within this perspective, three constructs affordances, constraints, and attunements help explain how contexts can either afford or hinder learning.

Situated Learning, Affordances, Constraints, and Attunements in Mathematics Contexts

Figure 1.1
Situated Learning Model



Affordances are opportunities within a learning environment that enable meaningful action (Greeno, 1998). In mathematics classrooms, these include familiar language, relatable examples, and links to prior knowledge that support reasoning and problem-solving. Contexts grounded in learners' experiences and culture can enhance engagement and understanding.

Conversely, constraints are features that limit interpretation or action, such as complex language, unfamiliar scenarios, or distracting details. The study found that contrived or extended contexts sometimes hindered learning by adding cognitive demands or disconnecting from learners' experiences.

Attunements describe learners' ability to perceive and use available affordances while managing constraints. In the Grade 9 classroom studied, learners often struggled more with interpreting contextual features than with the mathematics itself. This framework highlights how context type and learner attunement interact to shape mathematics learning and underscores the importance of accessible context design and appropriate scaffolding.

Methodology

Research Design and Approach

This study adopted a qualitative research approach within a constructivist paradigm, recognizing learning as a social construct through interaction (Guba & Lincoln, 1994). A teaching experiment design was employed, enabling the researcher to investigate learners' mathematical thinking as it developed during teaching and learning (Steffe & Thompson, 2000).

Participants and Data Generation

Purposive sampling was used to select nine learners from a Grade 9 mathematics class for an in-depth analysis. These learners participated in a series of teaching experiments in which different types of contexts were used. Data were generated through video recordings of classroom interactions, capturing both verbal and nonverbal participation, as recommended for teaching experiments (Steffe & Thompson, 2000).

Data Analysis

Data were analyzed retrospectively using narrative analysis, which involved rewriting classroom interactions as analytic stories to identify patterns of participation and meaning making (Polkinghorne, 1995). Greeno's (1998) constructs of affordances, constraints, and attunements within situated learning theory guided the interpretation of learners' interactions in this study.

Summary of Results

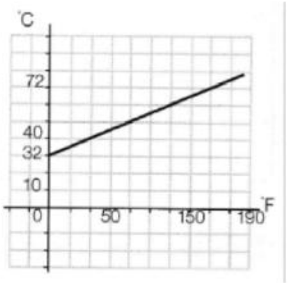
This section provides a concise narrative summary of the results of the teaching experiments, while retaining most of the tables and figures from the original document. Samples of this information are presented. This section frames the analysis within situated learning theory, focusing on affordances, constraints, and learner attunement (Greeno, 1998).

Teaching Experiment 1: Extended Context

In this teaching experiment, the extended context was adopted to teach functions and relationships. For the purpose of reporting, an excerpt from one of the groups, which consists of my target participants, was captured. Below is an activity, which is then followed by an excerpt from the group discussions.

Figure 1.2
Learning Activity

A chef uses a recipe from the UK. Use the equations $F = \frac{9C}{5} + 32$, that converts degrees Fahrenheit to degrees Celsius, to determine how many degrees Celsius are equal to:



a.) 150^0F b.) 50^0F c.) 190^0F

How many degrees Fahrenheit are equal to:

d.) 40^0C e.) 72^0C f.) -18^0C

Learners were observed in a discussion on their approach to solving the first activity. The following excerpt is from my target participants Tebatso (female), Ngoako (male), Chegofatso (male), Mohlago (female) and John (male). They were observed during the discussion of the learning activity. I then started initiating the discussion regarding the activity.

Excerpt: 1

1.1 Teacher: Let's hear how you will work out the problems.

Out of excitement, Tebatso answers the question before everyone else does.

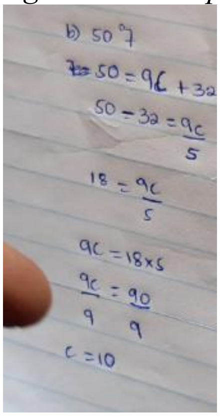
1.2 Tebatso: Sir, here we are going to use the equation that we have in order to convert Celsius to Fahrenheit.

Ngoako further explained the details of how they were solving the equation, and now that I realized that they have an idea of what to do in a.), b.) and c.).

1.3 Ngoako: In so doing that we will replace the F by 50 in the given formula.

Ngoako started doing the calculation in his book to show the rest of the group members how it should be done.

Figure 1.3
Ngoako's Attempt



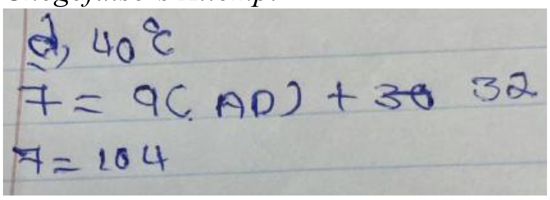
1.4 Teacher: Then how will you go about answering d.), e.) and f.)?
1.5 Tebatso: We also are going to substitute F, by 40, 72 and -18 degrees Celsius.

Tebatso then gave an input as to how the problem that required them to convert degrees Fahrenheit to Celsius should be approached. However, Chegofatso (in line 1.6) noticed that the temperatures in problem d.), e.) and f.) were already expressed in Celsius.

1.6 Chegofatso: but here in d.), e.) and f.) They are already in Celsius.
1.7 Tebatso: Why do you say so? Am confused.
1.8 Ngoako: I also don't understand.

Even Ngoako was confused. However, Chegofatso notice that d.), e.) and f.) had to be done differently. Then he started writing d.) as a collaborative effort with Ngoako, although Chegofatso was the one doing the writing and managed to do substitutions in order to obtain the final answer. However, the formula was not used correctly as: F = 9C/5 + 32 , the number "5" was missing, but Ngoako included it when he came up with the answer.

Figure 1.4
Chegofatso's Attempt



1.9 Chegofatso: look at the units, they are in degrees Celsius, and the question says: 'how many degrees Fahrenheit?'

After discussing their approaches, learners completed the activity and produced consolidated solutions. The focus was to analyse how they interpreted the scenario to identify contextual affordances and constraints. The extended scientific context supported connections between mathematics and science, and learners showed procedural competence in substitution and formula use. However, some learners misinterpreted contextual language and struggled with unit conversions, which limited their understanding and highlighted constraints within the context.

Teaching Experiment 2: Familiar Context (Application of a Rule)

In this teaching experiment, learners applied a rule or equation within a familiar context. Using relatable terms such as fashion, fabrics, cost, and money helped align the activity with learners' experiences and interests, making the concept of applying a rule more accessible and engaging.

Figure 1.5
Learning Activity

A fashion designer buys fabric online from an overseas supplier. The total cost in rands including postage depends on the length, x metres of fabric purchased, where$c = 120x + 50$.

a) Complete the table

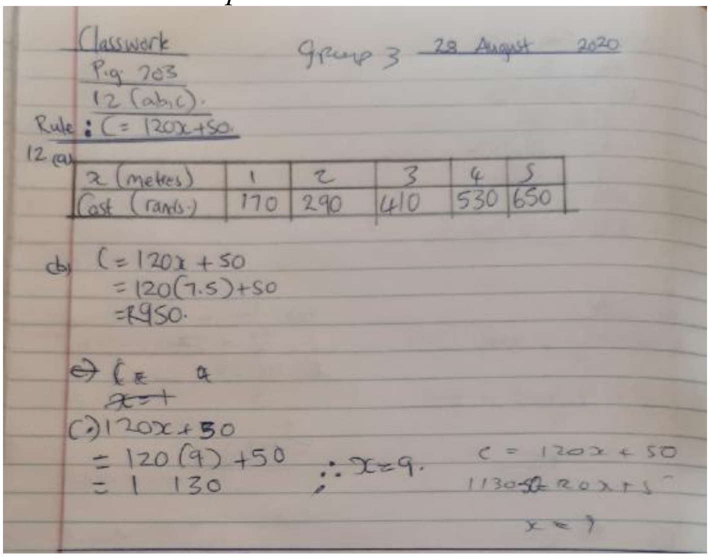
x(metres)	1	2	3	4	5
Cost (rands)					

b) How much would it cost the fashion designer if she bought $7\frac{1}{2}$ metres of fabric?

c) The fashion designer paid R1130. How much fabric did she buy?

Figure 1.6 below represents the consolidated responses from the target group. The discussions on how they went about consolidating their responses are provided, and one member of the group was asked to write down the ideas and responses as the activity unfolded. An excerpt is provided to highlight the discussions at play.

Figure 1.6
Consolidated Response



The excerpt below presents the deliberations that took place during the group discussion between; Tumelo (male), Dioka (female), Lethabo (Female) and Malope (male). Prior to the discussions, I encouraged learners to participate and feel free to raise their inputs.

Excerpt: 3

3.1 Teacher:	From the way you understand the scenario given, what does the x and the c on the formula represent?

Tumelo is one of the talkative learners in my class, he is always overconfident in giving out answers, irrespective of whether the answers are correct or not. He always wants to outshine his fellow learners whenever there is an opportunity to do so. He was the first one to participate, as he was the first to answer the question that I just asked.

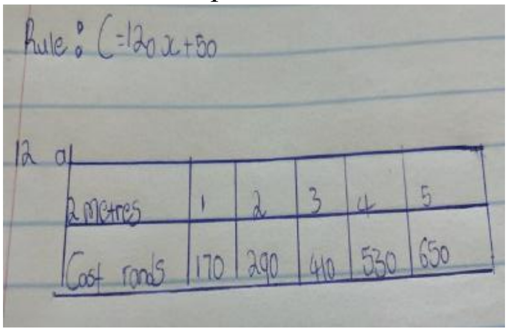
3.2 Tumelo:	x represents metres and c represents the cost or rands.

I asked the rest of the group members if they agreed with Tumelo's response, and they all confirmed that they did, and therefore confirmed that indeed his response is correct. Thereafter, I posed a follow-up question (in line 3.3) to the learners.

3.3 Teacher:	So now in a.) you are required to complete the given table. How are you going to complete the table?
3.4 Dioka:	We are going to use the given formula.
3.5 Teacher:	How do you use the formula?
3.6 Lethabo:	We are going to take the values of x as they are given on the table, then we shall substitute them in the given formula.

After the deliberations with Lethabo, I then requested the group to fill in the answers in the table in a.). I observed them as they discussed the activity and Dioka suggested to the rest of the group that they use a calculator to obtain the answers without showing the workings on how they arrived at the answers. The answers were then presented in Figure 4.6 below.

Figure 1.7
Lethabo's Attempt



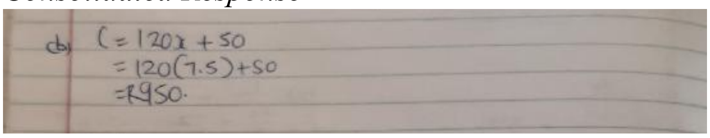
3.7 Teacher: Is there any other approach you used to complete the rest of the questions?

The rest of the group members were listening to the deliberations between me, Lethabo and Dioka (in lines 3.3–3.6) and they worked as a group to complete a.). Thereafter, I asked them a question about a different approach to the one Dioka presented (in line 3.7) and they all answered "no".

3.8 Teacher: Ok then, let's discuss b.), anyone to help us with an explanation?
3.9 Tumelo: Sir, I think we should use the same formula to calculate the cost of seven and half mitres of fabric, and we are going to substitute 7,5 into the formula.
3.10 Teacher: Okay then, can you now write the response to b.).

When responding to the second problem in b.), Tumelo suggested to the rest of the group that they should only write down the answer. I then intervened and requested them to show all the steps they took when they calculated the answer. My reason for requesting them to show the whole calculation was that I needed to see how they would substitute 7,5. Dioka suggested that they change 7.5 into 7.5. Ultimately, they agreed on the answer in Figure 4.7 below. Furthermore, I requested them to also complete the last question c.).

Figure 1.8
Consolidated Response



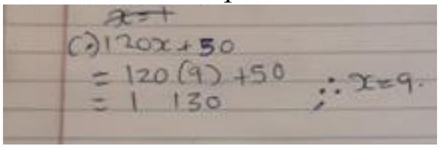
3.11 Teacher: Ok then, take me through to how you solved c.).
3.12 Dioka: For question c.), we looked for all the terms and we found it to be term number 9.

The response provided by Dioka (in line 3.12) is a clear indication that they adopted a trial-and-error strategy to answer the last question c.). Dioka's explanation was supported by Tumelo (in line 3.13), as he deliberated on how they verified whether their answer to c.) was correct or not.

3.13 Tumelo: We then substituted 9 in to the formula, so that we get the answer that we want.

Figure 4.8 below illustrates the consolidated response to the last question c.) of the activity. Although the formula was not written correctly and the solution does not show exactly how they arrived at an answer of “9”, they still managed to obtain the correct answer, which is 9.

Figure 1.9
Consolidated Response



3.14 Teacher: Oh, so you did not use the formula? What is this 9? Cost or length of fabric?
3.15 Dioka: It is the length (x) in metres
3.16 Lethabo: We only used the formula to check if 9 is the length equivalent to a cost of R1130. So, that means we substitute 9 as the length into the formula, so that we get an answer of R1130.

Lethabo was not actively participating during the discussions. She was only observed to agree with everyone’s answer. Ultimately, she supported the ideas presented by Tumelo.

3.17 Teacher: Okay I see, I was not expecting that approach. I was hoping you would substitute that amount of R1130 into the given formula so that you can calculate x.

Familiar contexts related to everyday experiences, such as fashion and medicine, increased learner engagement and participation. Learners were able to interpret variables meaningfully and apply given rules, suggesting strong affordances for sense-making (Selvianiresa & Prabawanto, 2017). Nonetheless, some learners relied on trial-and-error strategies or struggled to decontextualise problems, indicating that familiarity alone does not eliminate conceptual constraints.

Teaching Experiment 3: Contrived Context (Writing Algebraic Expressions)

In this teaching experiment, learners engaged in an activity based on a contrived context using familiar words, events, and real names to mimic reality. The purpose was to assess their ability to write mathematical expressions. A narrative of the teaching episode describes how learners discussed the activity in groups to explore and represent the intended mathematical ideas.

Figure 1.10
Learning Activity

Thabo is x years old and Lizzie is [illegible] years old.
Write down algebraic expressions for:

a.) Thabo's age in 6 years' time

b.) Thabo's age in 6 years ago

c.) Thabo's age doubled

d.) Half Thabo's age

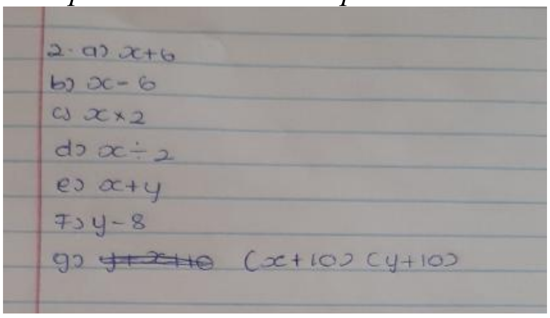
e.) The sum of Thabo and Lizzie's ages

f.) Lizzie's age 8 years ago

g.) The sum of Thabo's and Lizzie's age in 10 years' time

Presented below are the sampled learners' responses to Activity 5 The responses are followed by a narrative of what the teacher and the learners were saying and writing during the activity. In the narrative, excerpts from the group discussions were also captured as part of the narrative. The following excerpt is from a group of learners consisting of Ngoako, Mohlago, Tebatso, Chegofatso and John. Figure 4.12 shows the answers that the group agreed upon after their discussion and the interactions between the learners during their discussion of the answers are captured in the excerpt below.

Figure 1.11
Group's Consolidated Responses



Excerpt: 5

In this excerpt, I listened to and observed the learners as they discussed their answers to different questions. Ngoako was the first learner to attempt to answer the first question (in line 5.1), followed by the other participants. In this excerpt, I did not state whether the learners' responses were correct or not, all I did was to ask questions about how they approach the problems.

5.1 Ngoako:	The answer for a.) is x + 6
5.2 Teacher:	Why do you say so?

Ngoako could not account for the answer that he gave, however, Tebatso came to his rescue and attempted to respond (in line 5.3), while Ngoako and other members of the group were quiet and listening.

5.3 Tebatso:	Thabo's age in 6 years' time means that we add.
5.4 Teacher:	Oh! Okay?
5.5 John:	It is the same as when they say in the future.
5.6 Teacher:	Do you all agree that the answer is x + 6?

After Tebatso has explained, John then started supporting Tebatso's response (in line 5.5) and thereafter I asked all members of the group if they concurred with the response to the first problem in a.). They all said "yes".

5.7 Teacher:	… and what will be the answer for b.)?
5.8 Chegofatso:	Sir, the answer is 6-x, because in 2.a) the answer was 6-x, so this time *ree busetsa morago* (meaning that we are taking it back).
5.9 Ngoako:	No, but this time we are going to subtract 6 from x if we have to write an expression for his age six year ago. Therefore, the answer should be x-6.

Chegofatso's response to the second problem (in line 5.8) indicates that she is guessing answers instead of giving out well thought of responses. However, Ngoako came in and addressed Chegofatso's misconception regarding the answer for b.). There, after, Mohlago, John and Tebatso supported that Ngoako's answer is the correct one.

5.11 Teacher:	What about the answer for c.)?
5.12 Mohlago:	Thabo's age doubled can be expressed as x multiply by 2
5.13 Chegofatso:	I suggest the answer to be x multiply by 6.

This time, Mohlago is the learner who provided the answer for c.) and Chegofatso felt that he also had an answer, which was different from the one given by Mohlago. However, Ngoako also shared his answer (in line 5.14), which was unfortunately also not the correct one. Ultimately, Tebatso seemed to have an idea of what was required to solve this problem (in line 5.15) and, as a result, Ngoako now agreed with him (in line 5.16).

5.14 Ngoako:	No, the statement implies that his age is doubled, meaning that the answer is 6 times 6.
5.15 Tebatso:	But when you double you multiply by 2, not 6 multiply by 6.
5.16 Ngoako:	Oh okay I get you, that means the answer should be 6 times 2.

The discussions now seemed to become interesting, and I then asked a question (in line 5.17), in order to make the learners aware of how they should write their answer down. On that note, Mohlago was already aware that they should include the variable x when they answer the problem (in line 5.18). As a result, learner ended up agreeing that the answer should bex multiply by 2.

5.17 Teacher: But from the statement Thabo's age is x. Why is your expression not containing x?
5.18 Mohlago: Sir, that is why I said x multiply by 2, which means that Thabo's age is doubled.
5.19 Ngoako: Hhmm! Okay I see.
5.20 Teacher: So do you all agree with the answer?

While learners were still excited about the answer for b.), Chegofatso was now so excited and she could not wait and jumped to the next problem in d.) (in line 5.21). All members of the groups answered simultaneously and said "yes" to Chegofatso's answer. Following, Chegofatso's response, Mohlago and Ngoako could not wait, and they also gave answers for e.) and f.) (in line 5.23–5.25).

5.21 Chegofatso: So, now it means the answer for d.) we divide Thabo's age by 2, because we want half of his age
5.22 Mohlago: Then it means we express it as x divide by 2.
5.23 Ngoako: Then for number e.), the sum of Thabo and Lizzie's age we write x + y, because when they say sum, we plus (+).
5.24 Mohlago: So for f.) the answer will be y-8, *e swana le ka mokgwa o re arabileng b.)* (meaning that the answer can be found using the same method we used in b.) above.

At this stage, learners were participating and giving each other a chance to raise their views with regard to the answers.

5.25 Ngoako: The answer for g.) is x + y + 10, because the sum of Thabo and Lizzie's age will be added by 10 years.
5.26 Tebatso: But I think the answer should be (x + 10)(y + 10)
5.27 Ngoako: No, your expression has brackets, which implies that you multiply, and we should add because the statement said the 'sum'.
5.28 Chegofatso: *Eish*, this is confusing for me

Now that I realised that learners were stuck when trying to respond to the pervious problem, I saw the need to intervene. I then decided to help the learners by using the answer Tebatso gave (in line 5.26), by emphasizing that there should be an addition sign when writing the response: (x + 10) + (y + 10).

From the narrative above, the contrived context supported collaborative learning and peer explanation when writing algebraic expressions. Learners benefited from group discussions, which helped resolve misconceptions and attune learners to mathematical meanings embedded in language (Boaler, 1999). However, contextual wording sometimes led to confusion, especially with terms such as "sum", "double", and "half", highlighting language as a recurring constraint (Barnes & Venter, 2008).

Teaching Experiment 4: Context of the Discipline (Algebraic Equations)

In this teaching experiment, the learners were provided with learning activities that were based on the context of the discipline. In this type of context, mathematical concepts are not aligned to a situation outside the mathematics domain, they comprise abstract mathematical problems (Metz, 2013). Metz (2013) suggested that educators should look for contexts that are central to mathematical concepts.

Figure 1.12
Learning Activity

Solve for x

a.) $2x + 6 = 0$

b.) $\frac{2x-1}{3} + x + 2 = 0$

c.) $(x + 4)(x - 4) = 0$

d.) $x^2 + x - 6 = 0$

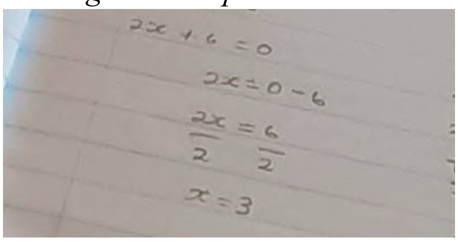
Learners Mohlago (female), Chegofatso (male), Ngoako (male) and John (male) started the discussions, which are captured in the excerpt below.

***Excerpt:** 7*

7.1 Teacher: Okay, can you deliberate on the activity and come up with solutions.
7.2 Mohlago: the first one is easy let's start from b.).
7.3 Teacher: No, let's start from a.) not b.), because it might not be easy for everyone. And since well you are saying it is easy, take us through a.).
7.3 Mohlago: Oh, okay sir.

Then Mohlago started doing the calculations, while the other members of the group observed him. Figure 1.13 below shows her solution to a.).

Figure 1.13
Mohlago's Attempt

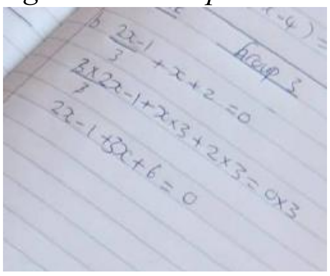


7.4 Chegofatso: Sir, can I say something.
7.5 Teacher: Yes say it. And please feel free to participate.

7.6 Chegofatso: I think Mohlago's answer from 0 - 6 should be - 6 in the next step, which means that the final answer should be - 3.
7.7 Mohlago: Oh yes, I just forgot that.
7.8 Teacher: Okay Mohlago, do you see that it is not easy? The other group members, together with Mohlago laughed.
7.9 Ngoako: Ok can I please do problem b.).

Ngoako offered to do the next problem, and his attempt is illustrated in Figure 1.14 below. He realised that he needed to simplify the equation by firstly eliminating the denominator of 3 in (3x-1)/3. However, was puzzled by the step where he had to add like terms, which is something I thought should be easy to do. I then requested the members of the group to assist him and John came in with a solution.

Figure 1.14
Ngoako's Attempt



7.10 John: Sir, I think 2x and 3x are like terms and we add them to give us 5x.
7.11 Tebatso: Yes, John is right, and that makes -1 and + 6 also like terms.

Tebatso attempted to finish the problem that Ngoako started by writing 5x + 5 = 0. Thereafter, Mohlago requested to take over the problem solving when she realised that the step written by Tebatso was similar to the first problem in a.)

7.12 Mohlago: Tebatso please let me finish it.

Tebatso let Mohlago to take over and finished the answer by writing 5x = -5, followed by 5x/5 = -5/5, and she wrote an answer of x = -1. This shows that Mohlago had learnt from the mistake she committed when attempting to solve the first problem in a.).

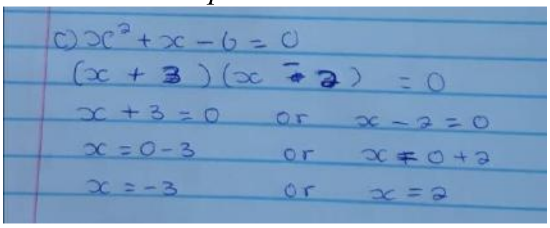
7. 13 John: Sir on the next problem in c.) I think the answers are x = 4 and x = -4.

In fact, John had completed this problem, which other members of the group were still focussed on b.). He found it an easy target. From John's answers he was able elaborated that, in the first step, one should write x + 4 = 0 or x - 4 = 0 and, thus, x = 4 or x = -4 As a result, all members of the group confirmed that they were satisfied about his efforts.

7.14 Mohlago: Tebatso can you please do the last one if you don't mind.
7.15 Tebatso: Okay, I am not sure about the last one. Sir, please intervene.

I then asked whether there is anyone who wanted to try it. Unfortunately, the learners confirmed that they were challenged by this problem. This is an indication that they were constrained towards solving the problem. I then explained to the learners that they needed to factorise first. The explanation served as an attunement of the constraint that had made learners not able to participate. Suddenly, Tebatso offered to proceed with solving the problem; her attempt is depicted in Figure 1.15 below. Thereafter, the members of the group confirmed that they were following what he had written, because the steps written by Tebatso when she was solving the problem were similar to the steps in the previous problem in c.).

Figure 1.15
Tebatso's Attempt



When problems were presented purely within the mathematical domain, learners relied on established algebraic procedures. Participation and peer correction indicated that the disciplinary context afforded access to core mathematical practices such as simplification and factorisation. Teacher intervention played a key role in attuning learners to overlooked strategies, thereby reducing constraints (Boaler, 1999).

Findings and Discussion

The findings indicate that the type of context plays a crucial role in shaping learners' interpretation and engagement with mathematical problems. This concurs with a study by MacDonald (2022), as they allude that context shapes how learners interpret and engage with mathematical concepts. Contexts that were familiar or drawn from learners' everyday experiences tended to enhance participation, promote collaborative discussion, and support problem-solving strategies (Brown & Redmond, 2017). In contrast, extended contexts encourage broader reasoning but occasionally introduce cognitive overload, making it difficult for learners to identify the core mathematical focus.

Contrived contexts effectively illustrate targeted mathematical concepts but sometimes limit engagement when learners question their relevance. Contexts closely tied to disciplinary norms promote formal mathematical reasoning but offer fewer accessible entry points for learners dependent on concrete contextual cues. Across all types, a consistent challenge emerged: learners often struggled more with interpreting contextual information than with solving the mathematical tasks themselves (Mahmuti et al., 2025).

These findings highlight the significance of carefully selecting the context for instructional design. Aligning context with learners' prior knowledge and experiences can facilitate a deeper understanding, whereas mismatched or overly complex contexts may distract from conceptual comprehension. Overall, context functions as both an affordance and a constraint in mathematics learning, shaping not only engagement but also the strategies that learners employ to approach problems.

Conclusion

This study shows that context significantly influences Grade 9 mathematics learning, both supporting and constraining learners' engagement and understanding. While contextual teaching can enhance participation and meaning-making, its effectiveness depends on careful alignment with learners' experiences and mathematical goals. The study provides classroom-based evidence emphasising deliberate context use. Future research should explore scaffolding learners' contextual interpretation and the long-term impact of contextual teaching on mathematical learning.

Limitations of the Study

The study is limited by its small, purposively selected sample of nine Grade 9 learners from one class, restricting generalisability to broader or diverse contexts. Learners' socio-cultural backgrounds, language proficiency, and prior mathematical experiences may have influenced their responses to contextual tasks, making the findings context-specific rather than universal. Additionally, the researcher's dual role as teacher and observer, while enabling close insight into learners' sense-making, may have influenced learner behaviour and interpretations during instruction.

Recommendations

Based on the findings, mathematics teachers should deliberately and reflectively select contexts that are engaging and conceptually aligned with Grade 9 mathematical ideas, especially when introducing new concepts to reduce cognitive overload. Curriculum designers and teacher educators should provide professional development on the affordances and constraints of different contexts. Future research should examine contextual teaching across diverse settings and explore learners' development of contextual interpretation skills over time.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

AI-assisted technology was used to support the writing, editing, and proofreading of this manuscript. Specifically, ChatGPT was employed to enhance clarity, correct grammar, and provide suggestions for phrasing and structure.

References

Anugraheni, I., Gufron, A., & Purnomo, Y. W. (2025). The impact of realistic problem-based learning on mathematical connection abilities: evidence from elementary schools in Indonesia. *Cogent Education, 12*(1). https://doi.org/10.1080/2331186X.2025.2523078

Bansilal, S., & Debba, R. (2012). Exploring the role of contextual attributes in a mathematical literacy assessment task. *African Journal of Research in Mathematics, Science and Technology Education, 16(*3), 302–316. https://doi.org/10.1080/10288457.2012. 10740747

Barnes, H. & Venter, E. (2008). Mathematics as a social construct: Teaching mathematics in context. *Pythagoras, 2008*(68), 3–14. https://doi.org/10.4102/pythagoras.v0i68.62

Boaler, J. (1999). The Community of the Mathematics Classroom: Situated Insights into Knowledge Development and Use.

Brown, J. P. (2019). Real-world task context: Meanings and roles. *In Lines of inquiry in mathematical modelling research in education* (pp. 53–81). Springer International Publishing.

Brown, R., & Redmond, T. (2017). Privileging a Contextual Approach to Teaching Mathematics: A Secondary Teacher's Perspective. *Mathematics Education Research Group of Australasia.*

Calo, I. C. (2025). Contextualized Teaching: Challenges and Opportunities in Teaching Secondary School Mathematics in Puerto Rico. Online Submission.

Greeno, J. G. (1998). The situativity of knowing, learning, and research. *American Psychologist, 53*(1), 5–26. https://doi.org/10.1037/0003-066X.53.1.5

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, *2*(163–194), 105.

Kappassova, S., Abylkassymova, A., Bulut, U., Zykrina, S., Zhumagulova, Z., & Balta, N. (2025). Mathematical literacy and its influencing factors: A decade of research findings (2015–2024). *Eurasia Journal of Mathematics, Science and Technology Education, 21*(7), em2671. https://doi.org/10.29333/ejmste/16615

Laughbaum, E. D. (2001). Teaching in context: Enhancing the processes of teaching and learning in community college mathematics. *Community College Journal of Research & Practice, 25*(5–6), 383–390. https://doi.org/10.1080/106689201750192238

Luneta, K. (2023). The essence of contextualising mathematics for effective learning. *African Journal of Teacher Education and Development, 2*(1), 3. https://doi.org/10.4102/ajoted.v2i1.32

MacDonald, A. (2022). Contextual influences on children's mathematical understandings. *Learning, Culture and Social Interaction, 35*, 100–632. https://doi.org/10.1016/j.lcsi.2022.100632

Mahmuti, A., Hamzic, D. K., & Thaqi, X. (2025). The Impact of Contextual Teaching and Learning on Improving Student Achievement in Economic Mathematics. *International Electronic Journal of Mathematics Education, 20*(3). https://doi.org/10.65141/jessah.v2i2.n7

Makofane, I. B., Ndlovu, S. M., Sepadi, M. D., Mphahlele, H., Themane, M. J., & Mkhonto, R. (2025). Factors Contributing to the Underperformance of Grades 8 and 9 Secondary School Learners in South Africa: A Scoping Review. *Sage Open, 15*(4), 21582440251375591.

Metz, D. (2013). Understanding contextual teaching in mathematics. *The Manitoba Education Research Network Journal, 7*(1), 53–60.

Ntumi, S., Adzifome, S. N., Nyamekye, T., & Vedor, F. K. (2026). Culturally responsive assessment in mathematical word problems and numerical cognition in multilingual education. *Scientific Reports, 16*, Article 5133. https://doi.org/10.1038/s41598-026-35864-0

Polkinghorne, D. E. (1995). Narrative configuration in qualitative analysis. *International Journal of Qualitative Studies in Education, 8*(1), 5–23. https://doi.org/10.1080/0951839950080103

Selvianiresa, D. & Prabawanto, S. (2017). Contextual Teaching and Learning Approach of Mathematics in Primary Schools. *Journal of Physics: Conference Series, 895*(1), 1–7). https://doi.org/10.1088/1742-6596/895/1/012171

Steffe, L. P. & Thompson, P. W. (2000). Teaching experiment methodology: Underlying principles and essential elements. *Handbook of Research Design in Mathematics and Science Education,* 267–306.

Williams, D. L. (2007). The What, Why, and How of Contextual Teaching in a Mathematics Classroom. *Mathematics Teacher, 100*(8), 572–575.

Yasin, B., Mustafa, F., Safina, D., Yusuf, Y., & Sarinauli, B. (2023). Introducing Contextual Teaching and Learning as a Transition from Textbook-Based Curriculum to the National Curriculum. *European Journal of Educational Research, 12(*4). https://doi.org/10.1108/QEA-05-2024-0046