Waikato Journal of Education

Journal website: http://wje.org.nz

ISSN 2382-0373

Published by the Wilf Malcolm Institute of Educational Research

Wilf Malcolm Institute of Educational Research
Te Pātahi Rangahau Mātauranga o Wilf Malcolm
THE UNIVERSITY OF WAIKATO

Online First, 2024

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Cite this article: Hortelano, J. C., & Prudente, M. (2024). Development of a questionnaire for understanding mathematics teachers' situated learning practices in the Philippines. *Waikato Journal of Education.* Advance online publication. https://doi.org/10.15663/wje.a1064

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Development of a questionnaire for understanding mathematics teachers' situated learning practices in the Philippines

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Abstract

This study sought to understand Philippine mathematics teachers' practices in relation to situated learning theory (SLT) by developing and administering a questionnaire. Following a five-step process for developing a questionnaire by Harlacher (2016), the final items reflected the teachers' performance indicators identified in the Framework for Philippine mathematics teacher education by the Science Education Institute of the Department of Science and Technology (SEI-DOST) and Philippine Council of Mathematics Teacher Educators Incorporated (MATHTED Inc.), and three of Herrington and Oliver's (1995) features of SLT: authentic context (AC), authentic activities (AAc), and authentic assessment (AAs). The final questionnaire, comprised of 22 items, was disseminated to 68 mathematics teachers at both elementary and secondary levels. Findings revealed that despite the low familiarity of teachers with SLT and the Framework for Philippine mathematics teacher education, questionnaire responses showed that the majority of teachers implement aspects associated with SLT "two to four times a week". Moreover, teachers' SLT knowledge was determined to correlate with the implementation of the three characteristics of SLT inside their classrooms, whereas other factors, such as primary or secondary teaching level, years of teaching experience, and teachers' knowledge about the Framework, had no significant correlation with SLT implementation. The study suggests that Philippine teachers should be given adequate training and teaching resources to ensure the practice of SLT inside their mathematics classrooms.

Keywords

Questionnaire development; situated learning theory; mathematics teaching; quality education; authentic instruction

Introduction

The Science Education Institute of the Department of Science and Technology (SEI-DOST) and the Philippine Council of Mathematics Teacher Educators Incorporated (MATHTED Inc.). published the Framework for Philippine mathematics teacher education as a guide for teachers to implement effective

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teaching practices (SEI-DOST & MATHTED Inc., 2011a). This was in response to the challenges experienced in mathematics education, particularly in relation to the needs of Filipino mathematics teachers in designing classroom curricula, teaching strategies, and lessons beneficial for students' engagement in learning. It is important that students' learning is supported through their participation in worthwhile activities that contribute to their personal development, relationships with others, and national progress (Roelofs & Terwel, 1999; SEI-DOST & MATHTED Inc., 2011b). As espoused in the Framework, teaching excellence and quality mathematics education are best achieved if teachers are equipped with principles identified as necessary for them to deliver lessons and to make learning evident in students' lives. Many of these principles are anchored in the active involvement of students, the use of authentic situations to foster the building of mathematical connections among students, and the required competence of Filipino mathematics teachers. Yang and Kaiser (2022) have explicated the critical role of teachers' professional competence and teaching performance to have a considerable effect on quality education and the learning of their students.

Lave and Wenger's (1991) situated learning theory (SLT), similar to the Framework, necessitates students' active engagement and immersion in a "community of practice" to enhance their learning. A community of practice is defined as a social learning environment where individuals share common interests and an avenue where they work collaboratively to overcome a particular problem with the purpose of development (Wenger, 1998). SLT has informed an approach in mathematics education where students are faced with real-life problem-solving, requiring them to innovate, share ideas, and apply their learning to generate solutions. This, in turn, requires teachers to design authentic activities that are reflective of the mathematical knowledge students should master at the end of the lesson. For example, in teaching geometry, teachers may opt to let students explore outside their classroom to identify geometric shapes they see in their surroundings, creating a link between mathematics and everyday life. Consequently, the goal of SLT is not only focused on students' content mastery but also on practical and wider life lessons. In order to realise this approach in practice, mathematics teachers' development programmes, such as during pre-service education, should support the development of teachers' ability to make mathematics more practical and less theoretical. Training should provide teachers with the knowledge on how to apply abstract concepts to authentic, real-word situations and to emphasise the value of mathematics in life rather than in the corners of a classroom (Bobis & Tripet, 2023; Korthagen, 2010; Renkl, 2001). By designing authentic situations based on SLT, mathematics teachers in the Philippines can practise in accordance with the Framework and contribute to its goals of excellent teachers and quality education. However, there are no pre-developed instruments in the Philippines to determine if mathematics teachers adhere to the SLT approach and, therefore, to the principles stated in the Framework.

SLT practices in a mathematics classroom

Instructional practices should align with the learning outcomes that students should demonstrate at the end of every mathematics lesson. Further, learning outcomes should be relevant to real-world contexts. However, instructional practices that emphasise procedures over the meanings of mathematical tasks do not help students build mathematical connections in their surroundings, causing their learning to be isolated. As a result, students fail to see the relevance of mathematics in real-world scenarios, decreasing their interest and affecting their conceptual understanding of mathematics as only a school subject and not a tool for everyday practical use (Korthagen, 2010; Masinglia, 1993; Roelofs & Terwel, 1999). For these reasons, SLT is considered useful for guiding teachers to teach mathematics in ways that enable students to see how mathematics can be helpful in their lives outside of school.

Herrington and Oliver (1995) described nine elements of designing an SLT learning environment, three of which are pertinent to the purpose of the study: authentic context (AC), authentic activities (AAc), and authentic assessment (AAc). AC pertains to the integration of relevant concepts and real-

life applications in mathematics lessons. Previous studies (e.g., Korthagen, 2010; Masinglia, 1993; Renkl, 2001) have emphasised that limiting the teaching resources within the boundaries of school does not suffice an effective approach to mathematics. Instead, mathematics problems should connect with students' lived experiences that they bring from outside the school. These experiences should be educative and reflective of the learning competencies stipulated in the curriculum and will make knowledge more context-bound.

AAs are mathematical tasks that include real-world problems that allow students to explore, cooperate, and discover their environments using higher-order thinking skills (HOTS). Problem-solving is an important type of activity in an SLT environment, where complex, real-world problems are to be understood and solved by the students. Such an approach can be supported by the appropriate use of technology in delivering activities that enhance the solution and exchange of ideas between students. However, this approach is in contrast with the practices of a traditional classroom that prohibits the use of technology and group work, especially on exams. SLT supports the discussion of students in any type of mathematical task to strengthen the value of collaboration and their relationship with one another (Herrington & Oliver, 1995; Renkl, 2001).

AAs is a means to assess learning outcomes and builds on the authentic concepts and activities employed by the teachers. When designing assessment tasks, teachers should consider the alignment of the learning that is being assessed with the learning outcomes to ensure the validity of the task. The task should also be authentic, or at least, direct the students towards the practical application of the mathematics concept in real life. Since an SLT environment aims to engage the students in the learning process, teachers should create opportunities for students to create their own problems as well as their own correct solutions. It is expected that by practising these SLT characteristics, students will be more motivated and inclined to learn mathematics (Fry et al., 2003).

The Framework for Philippine mathematics teacher education and the development of a research-based questionnaire

One of the means of developing the quality of mathematics education as perceived by SEI-DOST and MATHTED Inc. through the Framework is by developing excellent teachers. As indicated earlier, the Framework emerged as a response to the challenges experienced by mathematics teachers in the Philippines, particularly inadequate resources, rapid changes in educational technologies and pedagogical approaches, and the disconnection between school mathematics and real-world applications. As such, the Framework "puts together the most essential ideas that highlight the most important domains of knowledge that mathematics teachers should develop as they prepare for their future job in schools" (SEI-DOST & MATHTED Inc., 2011a, Preface section). There are nine non-negotiable teaching principles that teachers should follow when designing their instruction. These principles promote students' active engagement, the design of relevant mathematics lessons and assessments, and the effective use of digital technologies. The principles are presented in four domains: mathematical content knowledge (MCK), mathematical pedagogical knowledge (MPK), general pedagogical knowledge and management skills (GPK&MS), and mathematical disposition and professional development (MD&PD). Filipino mathematics teachers are also guided by performance indicators explaining how teachers should evidence each of the domains in their classrooms. In total, there are 102 performance indicators in the Framework and each pertains to a specific teaching skill in mathematics that a teacher should develop. It is expected that Filipino mathematics teachers must equip themselves with the majority of these indicators to be recognised as excellent teachers in the field.

The current study relates the principles and performance indicators in the Framework with the characteristics of an SLT-informed approach in order to develop a questionnaire that measures situated learning practices among Filipino mathematics teachers. SLT supports the intention of SEI-DOST and

MATHTED Inc. to support the continuing development of teachers, particularly in improving their knowledge and pedagogy in mathematics.

Methodology

This section outlines the methodological process of developing the questionnaire, including checks for validity and reliability. Harlacher (2016) provides a five-step guide for developing research-based questionnaires for educators, researchers, and school administrators: (1) decide on the goal of the questionnaire, (2) describe the objectives to achieve the goal, (3) draft the initial set of items, (4) check the validity and reliability of the questionnaire in accordance with the goal, and (5) construct the final format of the questionnaire. Details for these steps are as follows:

Step 1: Decide on the goal of the questionnaire

The goal of the questionnaire is to measure and understand the SLT practices of mathematics teachers in the Philippines through a survey. In designing the questionnaire and understanding SLT practice, the researchers sought to answer the following research questions:

RQ1. How frequently do mathematics teachers in the Philippines practise SLT in the classroom?

RQ2. What is mathematics teachers' perceived difficulty level regarding the practice of SLT?

RQ3. Is there a significant difference between the teachers' practices and their demographics? What is their relationship?

RQ4. What do mathematics teachers need as support in their practice of SLT in the classroom?

These are essential questions to achieve the goal for the development of the said questionnaire and for understanding SLT in the context of Philippine mathematics teachers.

Step 2: Describing the objectives to achieve the goal

The first objective in developing the questionnaire was to accumulate items about SLT practices in a classroom. Prior to that, a search of relevant articles and a review of related literature were conducted where the following sources were used:

1. Framework for Philippine mathematics teacher education (SEI-DOST & MATHTED Inc., 2011a)
2. Situated learning: Legitimate peripheral participation (Lave & Wenger, 1991).
3. Situated learning: Out of school and in the classroom (Renkl, 2001).
4. Critical characteristics of situated learning: Implications for the instructional design of multimedia (Herrington & Oliver, 1995).

The performance indicators in SEI-DOST and MATHTED Inc. (2011a) contributed substantively to the construction of the questionnaire items. First, as a research team, the evaluation of the performance indicators was carried out in each of the four domains—MCK, MPK, GPK&MS, and MD&PD—according to their relevance with SLT. As indicated earlier, MCK indicators are focused on teachers' mastery of the mathematics content that they are teaching, while MPK indicators revolve around teachers' knowledge about the curriculum; the pedagogy of mathematics, which includes appropriate teaching strategies in delivering the contents; and assessment style. GPK&MS indicators are about

teachers' knowledge about the nature of their students, general classroom pedagogy, and management of students' behaviour. Lastly, indicators for the MD&PD relate to dispositional aspects of teaching and professional development. It recognises the teacher as a human capable of making decisions and being responsible for their actions. Below is the summary of the performance indicators selected in the four domains by SEI-DOST and MATHTED Inc. (2011a).

Domain: Mathematics content knowledge (MCK)

1. The teacher is able to use problem explorations and modelling to extend the mathematical understanding of students.
2. The teacher employs objects and situations within the students' context in developing conceptual understanding.
3. The teacher includes activities in the lesson plan activities that show connection of the concepts to real world situations (p. 21).
4. The teacher connects mathematics to other disciplines (p. 22).

Domain: Mathematical pedagogical knowledge (MPK)

5. The teacher recognises and encourages students' invented strategies in solving problems (e.g., counting strategies, mental mathematics).
6. The teacher implements instructional activities that allow students to be active learners of mathematics.
7. The mathematical tasks that the teacher poses provoke, engage, and challenge students.
8. The teacher creates a learning environment where students formulate their own problems and solve problems in creative ways. In this environment, students are given opportunities to reflect upon the problems, their solutions (or alternative solutions), generalisations or extensions.
9. The teacher evaluates, selects, and uses appropriate learning activities that develop students' basic and HOTS.
10. The teacher uses authentic assessments and constructs rubrics that reflect knowledge of students' thinking processes and errors (p. 28).
11. The teacher creates a learning environment that allows students to use calculators, computers, and other technological devices when needed to enhance mathematical understanding of concepts and processes (p. 27).
12. The teacher evaluates, selects, and uses appropriate technologies as aids to effective mathematics teaching and learning.
13. The teacher encourages students to make connections and develop a coherent framework for mathematical ideas.
14. The teacher encourages and accepts the use of concrete materials as models.
15. The teacher uncovers the mathematical activities that students are implicitly doing (p. 29).

Domain: General pedagogical knowledge and management skills (GPK&MS)

16. The teacher motivates students by integrating the historical development of mathematics, contribution of cultures, communities, and real-life situations in appropriate lessons to develop meaningful conceptual understanding and connections to students' lives.
17. The teacher displays knowledge of group work, practical work, investigative studies, and class presentations as different ways of teaching mathematics to students (p. 35).
18. The teacher appropriately uses a variety of assessment methods to evaluate students' understanding, progress, and performance.
19. The teacher uses assessment results to diagnose student learning needs, align and modify instruction, and design teaching strategies (p. 36).

20. The teacher provides materials that are not available in school, whenever possible.
21. The teacher displays resourcefulness and creativity in providing materials that are not readily available.
22. The teacher promotes the use of indigenous resources through mathematical investigations, explorations, and projects.
23. The teacher provides learning experiences that promote awareness and appreciation of mathematics that is rooted in the students' culture.
24. The teacher invites resource persons for learning activities when appropriate and possible (p. 39).
25. The teacher encourages students to listen, respond, and pose questions to the teacher and to one another (p. 40).

Domain: Mathematical disposition and professional development of teachers (MD&PD)

26. The teacher turns students' mistakes into learning experiences and helps students realise that one can learn from mistakes; they are a part of the learning process.
27. The teacher engages students in mathematical discourse (as opposed to always lecturing) (p. 44).

Sample items that were not chosen to be included in the questionnaire, as these statements do not resemble an SLT approach include:

- The teacher can solve problems, analyse errors, reason out, formulate decisions, make conjectures, and prove theorems or conjectures (p. 21).
- The teacher recognises and understands the prerequisite concepts for each and every content material in the curriculum (p. 27).
- The teacher sets definite procedures for checking attendance and homework and is able to keep track of other procedures necessary to keep order in teaching (p. 35).
- The teacher displays professionalism in meeting with parents, peers, and supervisors (p. 36).
- The included and excluded performance indicators were validated further in Step 4.

Step 3: Drafting the initial set of items

Twenty-seven performance indicators were selected from the Framework as shown in the previous step, forming the basis for the items of the questionnaire. In order to interrelate the framework and SLT, the 27 indicators were regrouped according to the three characteristics of SLT as described by Herrington and Oliver (1995): AC, AAc, and AAs. Subsequently, the indicators were restated in simpler terms to reduce the cognitive burden on questionnaire respondents. Indicators resembling similar ideas were merged. Figures 1, 2, and 3 demonstrate the process of regrouping, merging, and restating the indicators. Merging items was only applicable to the AC indicators as there were indicators that resembled the same idea. It is important to remember that the item numbers in the "regrouping" process in Figures 1, 2, and 3 are the same numbers as the performance indicators outlined above in Step 2.

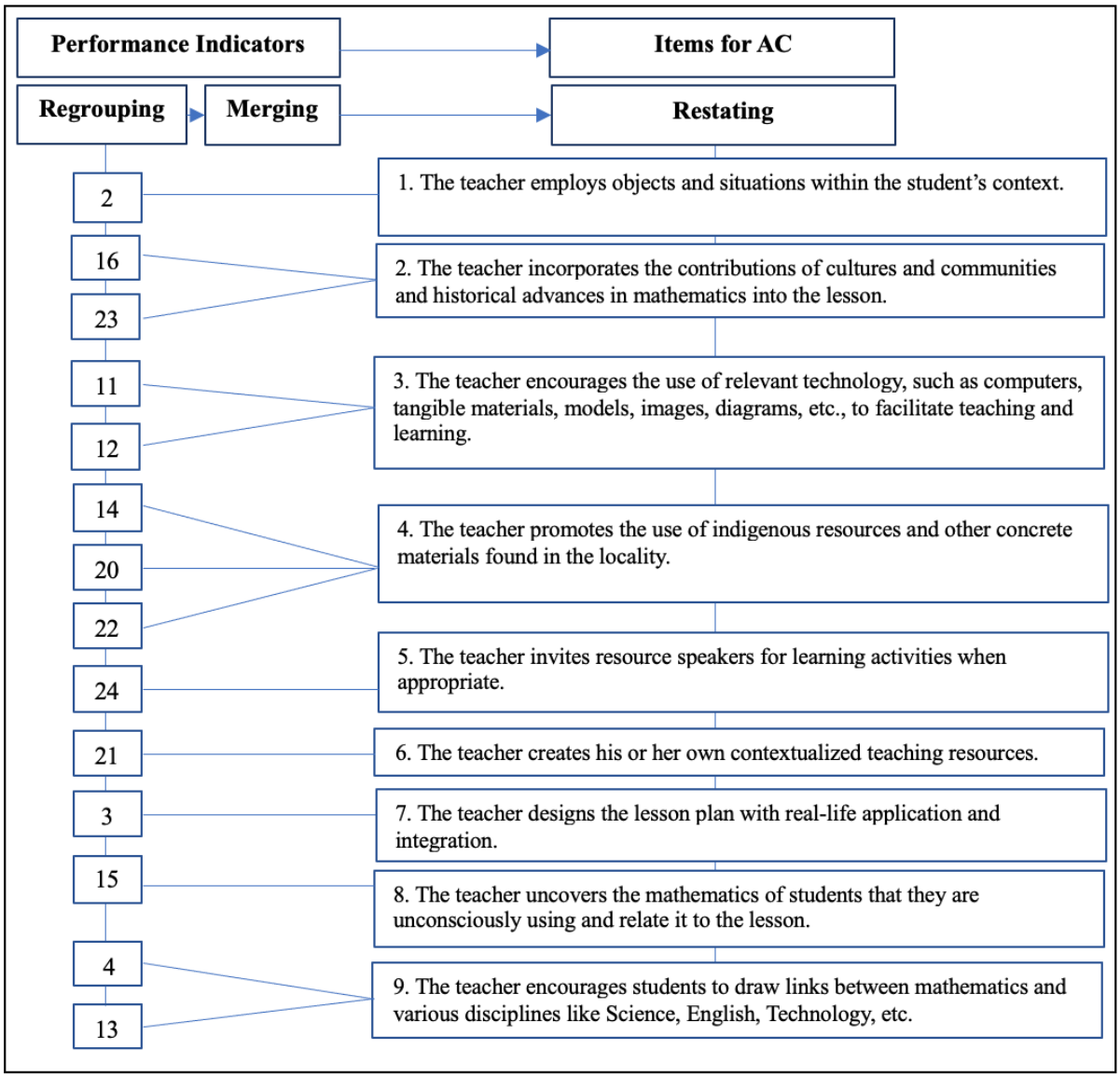

Figure 1. Regrouping, merging and restating procedures of the items for authentic content (AC).

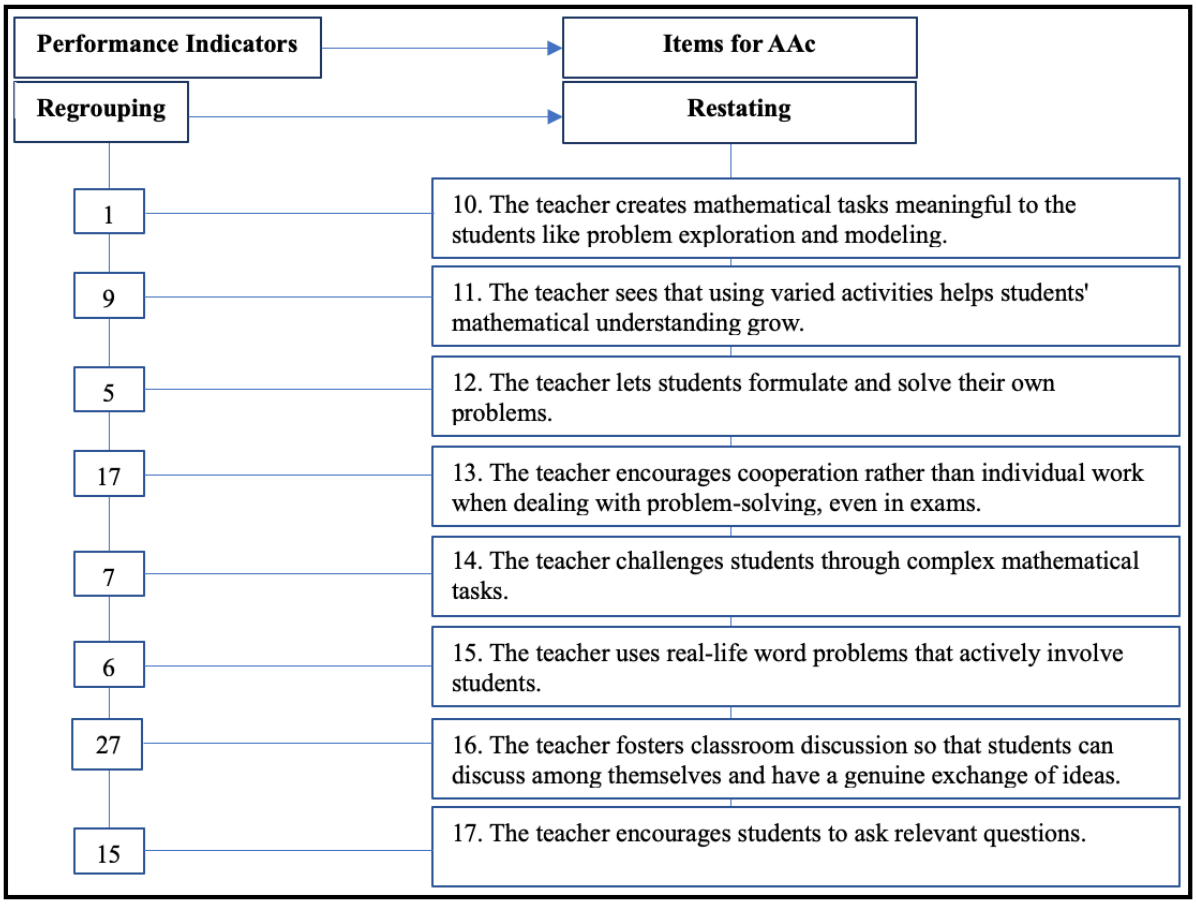

Figure 2. Regrouping and restating the items for authentic activities (AAc).

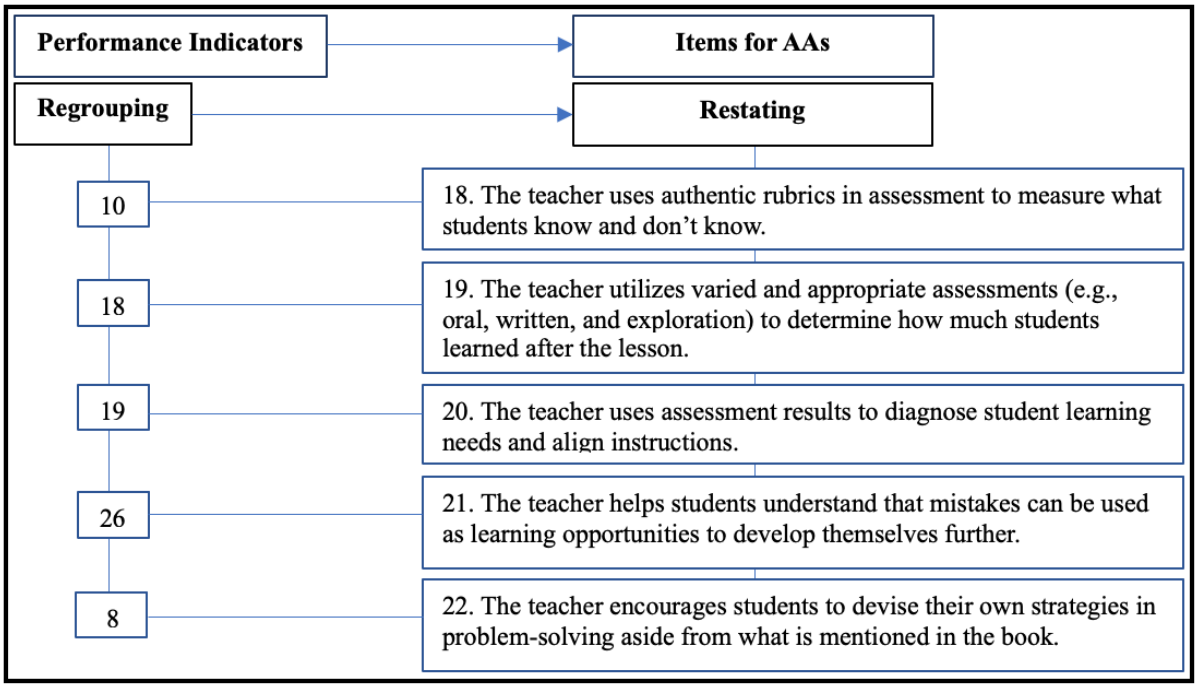

Figure 3. Regrouping and restating the items for authentic assessments (AAs).

After regrouping, merging, and restating the performance indicators, there were 22 questionnaire items accompanied by the response scale in Table 1 and Table 2. Table 1 was adapted from Buzick et al. (2019) as the options are concrete and imaginable—from every day to never, corresponding to different intervals and descriptions. Table 2, on the other hand, relates to the perceived difficulty level of the application of SLT in a mathematics classroom.

Table 1. ***Table of Interpretation Adapted from Buzick et al. (2019)***

Scale	Interval	Description
5	4.20-5.00	*I do this every day in my math class*
4	3.40-4.19	*I do this twice, thrice, or four times a week in my math class*
3	2.60-3.39	*I do this once a week in my math class*
2	1.80-2.59	*I do this once a month in my math class*
1	1.00-1.79	*I never do this in my math class*

Table 2. ***Table of Interpretation for the Perceived Difficulty Level***

Scale	Interval	Interpretation
5	4.20-5.00	Very difficult
4	3.40-4.19	Difficult
3	2.60-3.39	Moderate
2	1.80-2.59	Easy
1	1.00-1.79	Very easy

Step 4: Checking the validity and reliability of the questionnaire in accordance with the research goal

Content validity was established through experts' review (Fry et al., 2003), which included a research adviser and a group of graduate students. Contents of the questionnaire, including the 22 items, the response scale, and the included and excluded performance indicators, were checked and validated by them. Feedback included rewriting the items in first person so that teacher participants were invited explicitly to report on their own classroom practices.

After the development and dissemination of the questionnaire and organising the participants' responses, reliability was also computed using Cronbach's alpha (see Table 3), and all the alpha values for each characteristic were found to be reliable (Pallant, 2020).

Table 3. ***Reliability Test Using Cronbach's Alpha***

Characteristic	N	Items	Cronbach's alpha
Authentic Context	68	9	.816
Authentic Activities	68	8	.700
Authentic Assessment	68	5	.666

Note. Reliable if $\alpha > .5$

Step 5: Constructing the final questionnaire

The finalised set of statements, written in first person, were itemised in a Google Form and hosted online for the convenience of the participants. A cover page was included in the Google Form outlining the rationale of the study, a brief explanation of SLT, and the terms and conditions of their participation, including that the study sought voluntary responses. The second page was designed to gather demographic data, such as sex, age, years of experience, teaching level (i.e., elementary or secondary), as well as respondents' familiarity with SLT and the Framework. On the third page, the 22 questionnaire items were not presented in their domain groups: AC items were arranged in the Google Form as 1, 2, 5, 9, 13, 14, 17, 18, 20; AAc items as 3, 6, 7, 10, 11, 15, 19, 22; and AAs items as 4, 8, 12, 16, 21. This was to support participants to interpret and respond to each item as individual items, rather than to respond to overall patterns or themes in the items. The fourth page of the questionnaire asked two additional questions: (1) how hard is it to practice SLT inside the classroom? and (2) What kind of support do you need to practice successful implementation of situated learning inside the classroom? (see Appendix). Lastly, the fifth page acknowledged the voluntary participation of the mathematics teachers. All of these were administered using the English language.

Participants

After arranging the questionnaire through Google Forms, it was distributed to the participating teachers through a link using Facebook Messenger. Table 4 summarises the profile of the mathematics teachers who answered the online questionnaire.

Table 4. ***Participants' Profile***

Characteristics		*n*	%	*M*	*SD*
Gender	Male	23	34		
Female		45	66		
Teaching level	Elementary	17	25		
	Secondary	51	75		
Are you familiar with SLT?					
	Yes	19	28		
	No	49	72		
Are you familiar with the Framework for Philippine mathematics teacher education?					
	Yes	24	35		
	No	44	65		
	Age			31.12	8.71
Years of teaching experience				7.65	6.87

Overall, there were 68 mathematics teachers from the elementary and secondary levels who completed the online questionnaire. In the Framework, a "mathematics teacher" is defined as someone who teaches mathematics and not necessarily teachers who graduated as mathematics majors. That is why elementary teachers were invited to take part in answering, as they provide equally valuable responses as the secondary teachers.

Data analysis

Descriptive statistics were used to organise the data and determine the extent of the participants' SLT practices and their perceived difficulty level of SLT. The four assumptions permitting the use of parametric tests were examined: the normality test, equal variances, independence, and outliers. Next, an independent samples *t*-test was performed to determine if responses from two independent groups (i.e., male and female, elementary and secondary teachers, familiarity and non-familiarity with SLT and the Framework) were significantly different. This was followed by computing Pearson's r correlation to determine any relationship between the participants' demographic groups and their responses. The results of these statistical analyses were supported by considering participants' verbatim responses to the open-ended question, which were analysed using thematic analysis (Nowell et al., 2017). The two researchers collaboratively recorded and reviewed participants' open responses to get an overall view of the data. Then, codes were constructed based on the responses by highlighting sentences that were useful in answering the research questions, and these were described with short labels. Themes were then generated according to the similarities and central ideas of the different labels, and these were reviewed for how they addressed the research question about the needs of the mathematics teachers in relation to their SLT practice.

Results

This section outlines the result of the analysis presented in response to the four RQs outlined in Step 1. Furthermore, this section is subdivided into three subheadings corresponding to the three analyses performed: descriptive statistics, parametric tests, and the result of the thematic analysis.

Descriptive statistics

Frequency of mathematics teachers' SLT practice and their perceived difficulty level (RQ1: How frequently do mathematics teachers in the Philippines practise SLT in the classroom? RQ2: What is their perceived difficulty level?).

Table 5. ***Descriptive Results of Participants' SLT Practices and Perceived Difficulty Level***

Characteristic	Overall mean	SD	Median	Skewness
Authentic Context (AC)	3.82	1.04	4	-0.78
Authentic Activities (AAc)	4.21	0.87	4	-0.92
Authentic Assessments (AAs)	4.28	0.76	4	-0.93
Overall	4.05	0.91	4	-0.97
Perceived difficulty level	3.10	0.83	3	0.12

Based on the interpretations in Table 1, Table 5 shows that the practice of AC (M=3.82; SD=1.04) is frequently implemented two to four times a week, while AAc (M= 4.21; SD= 0.87) and AAs (M= 4.28; SD= 0.76) are frequently practised every day. Overall, the three characteristics of an SLT approach were found to be frequently practised "two to four times a week" (M= 4.05; SD= 0.91). On the other hand, SLT practices were generally reported to be "moderately difficult" to implement, which affected teacher preparation and implementation—particularly, based on the findings, in relation to using authentic contexts. Participant 2, a secondary mathematics teacher, stated, "Thinking of different situations and applications of higher math in real-life is difficult and it is also hard to integrate most of the topics in math into other situations."

Other teachers found SLT to be relatively easy to implement given their familiarity with the students' context and resources, such as participant 62 in the secondary level, who expressed, "Since I am a native of the locality, I am aware of the locals' culture and their regular activities. With that, it would be easy for me to think of appropriate activities to use for a particular math lesson."

Parametric tests: Significant differences between groups and correlations between findings

RQ3: Is there a significant difference between the teachers' practice and their demographic profile? What is their relationship?

The four assumptions of employing a parametric test were tested prior to proceeding with further interpretations. The data were approximately normally distributed ($p>.05$) and the z-scores of each item were within the acceptable region of $-3.29<z<+3.29$ (Kim, 2013); Levene's test of homogeneity of variances showed a non-significant result, hence equal variances were assumed, $F(1,65)=1.032$, $p=.383$; data were independent of each other; and there were no extreme outliers. Given that these assumptions for a parametric test were met, independent samples *t*-tests were calculated.

Table 6. ***Independent Samples t-test for Determining Significant Differences***

Characteristics		**n**	**Mean**	**SD**	***t*-comp**	***df***	**p**
Sex	Male	23	4.01	.519	-.291	66	.77
	Female	45	4.04	.409			
Level	Elementary	17	4.05	.516	.038	66	.97
	Secondary	51	4.04	.436			
Familiarity with SLT							
	Yes	19	4.26	.369	-2.56	66	.013
	No	49	3.96	.458			
Familiarity with the Framework							
	Yes	24	4.15	.393	-1.48	66	.143
	No	44	3.99	.476			

Table 6 shows that there was no significant difference between the groups based on gender (male and female mathematics teachers), teaching level (elementary and secondary), and familiarity or nonfamiliarity with the Framework of Philippine mathematics teachers. However, there was a significant difference between teachers' familiarity ($M= 4.26$; $SD= .369$) and non-familiarity ($M= 3.96$; $SD= .458$) with the SLT approach, $t(66)= 2.56$, $p= .013$. The descriptive statistics above allowed the researchers to conclude further that mathematics teachers who are familiar with the SLT approach implement the three characteristics (AC, AAc, AAs) more frequently compared to the teachers who are not familiar with it.

Table 7. ***Pearson's Correlation Coefficient Calculations***

	YTE	F-SLT	F-F	AC	AAc	AAs	PDL
Years of teaching experience (YTE)	-						
Familiarity with SLT (F-SLT)	-0.09	-					
Familiarity with the Framework (F-F)	-0.14	0.23	-				
AC	-0.17	0.31*	0.20	-			
AAc	-0.10	0.23	0.13	0.74*	-		
AAs	-0.14	0.25*	0.12	0.74*	0.74*	-	
Perceived difficulty level (PDL)	0.02	-0.16	-0.13	-0.28	-0.26*	-0.34*	-

Note: Statistically significant is a < .05

For Pearson's correlation coefficient, Table 7 reveals that "familiarity with SLT" is significantly and positively correlated with AC and AAs. This means that teachers who are more familiar with SLT are more likely to implement the use of authentic contexts and authentic assessments inside their classroom. Secondly, AC is significantly and positively correlated with AAc and AAs, which means that teachers who implement authentic contexts inside their classrooms are more likely to design authentic activities and assessments for their students. Lastly, "perceived difficulty level" is significantly and negatively correlated with AAc and AAs. This signifies that teachers who find it easier to implement SLT inside the classroom are more likely to design authentic activities and assessments. These findings are important for informing discussions about the SLT practices of mathematics teachers.

Thematic analysis: Mathematics teachers' needs to support an SLT approach

The evidence from the participating mathematics teachers' self-report data suggests that a key aspect influencing their SLT practice is their familiarity with SLT and their perceptions of difficulty implementing it. It is also evident that the majority of participants do not make use of authentic contexts on a daily basis, which affects their alignment with the SEI-DOST and MATHTED Inc. (2011a) Framework. To help address the gap, two themes were identified from participating teachers' responses to the open-ended RQ4: What do mathematics teachers need as support in their practice of SLT in the classroom? It is important to note here that most of the teachers provided more than one response regarding their needs to practise SLT. In total, there were 118 responses, 88 (74.6%) responses of which were categorised under "Training and Seminar" and 30 (25.4%) responses under "Resources and Funding".

1. Training and seminars

The participating teachers recognised that training and seminars are essential activities to develop skills related to teaching. Qualified trainers should demonstrate how the SLT approach is practised in the design of mathematics activities and assessments and, in turn, evaluate other teachers. Questions such as "How is it?" and "Why is it important?" should be addressed for them to fully understand the notion of SLT. Participant 9, with three years' experience teaching at the secondary level, indicated that

> training would be a nice way to properly show how situated learning is, especially if one does not know it yet, and to exhibit how it works inside the classroom. Experts and researchers play an integral role in training teachers.

Participant 11, a mathematics teacher at the secondary level and a master teacher who is tasked with evaluating teachers stated, "We teachers need training, especially on contextualisation of higher math at the secondary level. As a master teacher also, this will help me in evaluating my colleagues on what they need to improve in their practice."

Furthermore, participant 37, with 16 years' experience teaching at the secondary level, added that "providing seminars for teachers to have some time for sharing teaching expertise, details, and how the theory is executed in classrooms to really understand the concept behind the theory is needed."

2. Additional resources and funding

The teachers also asked for classroom resources as well as funding. The lack of teaching materials and funding limits their ability to design classroom environments that are driven by SLT. Participant 63, with five years' experience teaching at the secondary mathematics level, stated, "More than seminars and training, it would be helpful if instructional materials like worksheets that apply situated learning would be provided to serve as a basis for teachers."

Alongside a school's capability to provide the necessary resources, participant 47 at the elementary level added:

> Training is always the best support for teachers about this, but what is also important is the condition of the school. If the school is not ready for this kind of instruction, then resources should be provided to start with.

Discussion

This study sought to understand Philippine mathematics teachers' practices in relation to SLT by developing and implementing a questionnaire that brought together aspects of SLT and the Framework for Philippine mathematics teacher education (SEI-DOST & MATHTED Inc., 2011a). Harlacher's (2016) guide to developing a questionnaire was used to inform the questionnaire development process. Drawing on Herrington and Oliver's (1995) nine elements for designing an SLT learning environment, the researchers focused on teachers' implementation of AC, AAc, and AAs as reflections of an SLT approach. The findings showed a higher frequency of practising SLT despite the relatively low familiarity of the participants with both SLT and the Framework, which is about 28% and 35% of the total number of participating teachers, respectively. The low familiarity with the Framework suggests inadequate information dissemination to mathematics teachers, which affects their MCK, MPK, GPK&MS, and MD&DP—critical domains for Philippine mathematics teachers. Nonetheless, familiarity with the Framework, along with other demographic profiles (i.e., gender, years of teaching experience, primary or secondary level teaching), did not significantly affect their practice regarding SLT. On the other hand, participants' familiarity with SLT was positively correlated with SLT practice. These findings suggest that teachers' SLT knowledge is a crucial factor that should be considered when planning training and seminars and even designing teaching resources in mathematics that resemble the SLT approach. Funding should also be focused on, providing teachers with these needs for them to deliver authentic instruction that could bolster students' engagement in learning mathematics. Even though there may be a lack of familiarity with the Framework among the mathematics teachers, the dissemination of the questionnaire may have raised awareness of the Framework. This awareness is important as it informs them of what the Framework is seeking for Filipino mathematics teachers. It also contributes to the competent quality of teachers, such as designing appropriate instructional

materials and evaluating student performance as stipulated by Yang & Kaiser (2022), which are critical factors of teacher development.

The perceived difficulty of implementing SLT was correlated with the frequency of using authentic contexts inside a mathematics classroom. While the current study focused on the nature of teachers' experiences and their classroom practices, Fry et al. (2003) have demonstrated the benefits of SLT for students' learning. Potentially, SLT implementation could support Filipino students to form positive views about mathematics as a subject, develop better critical thinking skills, and take on career paths in mathematics, which are all the goals of mathematics at the basic education level (SEI-DOST & MATHTED Inc., 2011b). Limitations of the current study include the small sample size in relation to the total population of mathematics teachers in the country and the reliance on teachers' self-report data. Additional research could investigate the alignment between teachers' perceptions of their implementation of SLT, their actual practice, and the impact of SLT on students' mathematics engagement and achievement. Such research would build on this study's insights into the current state of SLT understanding and instruction of Filipino mathematics teachers and further inform a response to participating teachers' calls for more professional development and resources.

Conclusion

Given the abundant natural resources and the geographical locations of many schools in the Philippines, there are wide-ranging experiences and contexts to draw on in order to create authentic learning contexts. For example, teachers can use artefacts important within local cultures, such as traditional tools and houses, in exploring activities in mathematics. They may also ask students to identify mathematical elements as they explore their surroundings. Specifically in the Philippines, teachers can use traditional textiles (e.g., barong and saya) as an authentic context for investigating geometrical patterns, as these are visible in the designs. The incorporation of these culturally relevant contexts can improve the SLT practice of mathematics teachers in the Philippines and engage students to have a meaningful learning in the subject, helping them realise the importance and relevance of mathematics in their lives. As a consequence, a better image of mathematics might be formed by students, inspiring them to take on further courses related to mathematics.

The items drawn from the Framework are not just intended to respond to the goal of the study and answer the research questions, they also provide an avenue for teachers to reflect on their classroom practices, assess the needs of their students in relation to learning mathematics, and be informed about their duties as Filipino mathematics teachers. Furthermore, they provide mathematics educators with a basis for initiating programmes or revising existing programmes to address the needs of mathematics teachers, such as training, seminars, and resources related to SLT. Overall, the researchers recommend the use of the questionnaire to measure the SLT practices of other mathematics teachers or it can be adapted to measure the said practice in different subject areas.

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Appendix

Table 1. ***Final Questionnaire Written in the First Person Point of View and Frequency of Responses (n=68)***

Statements	**Responses (%)**					**Mean (SD)**
	5	4	3	2	1	
Authentic context						
1. I employ objects and situations within the students' context.	17 (25%)	30 (44.1%)	17 (25%)	4 (5.9%)	0	3.88 (0.86)
2. I incorporate the contributions of cultures and communities and historical advances in mathematics into our lesson.	7 (10.3%)	35 (51.5%)	20 (29.4%)	6 (8.8%)	0	3.63 (0.79)
3. I encourage the use of relevant technology, such as computers, tangible materials, models, images, diagrams, etc., to facilitate teaching and learning.	29 (42.6%)	28 (41.2%)	9 (13.3%)	2 (2.9%)	0	4.24 (0.79)
4. I promote the use of indigenous resources found in the locality.	16 (23.5%)	22 (32.4%)	20 (29.4%)	6 (8.8%)	4 (5.9%)	3.59 (1.12)
5. I invite resource speakers for learning activities when appropriate.	2 (2.9%)	9 (13.2%)	14 (20.6%)	25 (36.8%)	18 (26.5%)	2.29 (1.09)
6. I create my own contextualised teaching resources.	19 (27.9%)	26 (38.2%)	18 (26.5%)	5 (7.4%)	0	3.87 (0.84)
7. I design my lesson plan with real-life application and integration.	51 (75%)	16 (23.5%)	1 (1.5%)	0	0	4.74 (0.48)
8. I uncover the mathematics of students that they are unconsciously using and relate it to the lesson.	14 (20.6%)	38 (55.9%)	14 (20.6%)	2 (2.9%)	0	3.94 (0.73)
9. I encourage my students to draw links between mathematics and various disciplines like Science, English, Technology, etc.	14 (20.6%)	33 (48.5%)	15 (22.1%)	6 (8.8%)	0	3.81 (0.87)
Authentic activities						
10. I create mathematical tasks meaningful to my students like problem exploration and modelling.	37 (54.4%)	21 (30.9%)	10 (14.7%)	0	0	4.40 (0.74)
11. I see that using varied activities helps students' mathematical understanding grow.	44 (64.7%)	20 (29.4%)	4 (5.9%)	0	0	4.59 (0.60)
12. I let my students formulate and solve their own problems.	16 (23.5%)	30 (44.1%)	18 (26.5%)	4 (5.9%)	0	3.85 (0.85)

13. I encourage cooperation rather than individual work when dealing with problem-solving, even in exams.	14 (20.6%)	27 (39.7%)	17 (25%)	8 (11.8%)	2 (2.9%)	3.63 (1.04)
14. I challenge my students through complex mathematical tasks.	13 (19%)	32 (47.1%)	18 (26.5%)	5 (7.4%)	0	3.78 (0.84)
15. I use real-life word problems that actively involve students.	26 (38.2%)	32 (47.1%)	9 (13.2%)	1 (1.5%)	0	4.21 (0.78)
16. I foster classroom discussion so that students can discuss among themselves and have a genuine exchange of ideas.	31 (45.6%)	30 (44.1%)	6 (8.8%)	1 (1.5%)	0	4.34 (0.70)
17. I encourage students to ask relevant questions.	59 (86.8%)	8 (11.7%)	1 (1.5%)	0	0	4.85 (0.40)
Authentic Assessment						
18. I use authentic rubrics in assessment to measure what students know and don't know.	24 (35.2%)	27 (39.7%)	15 (22.1%)	2 (3%)	0	4.07 (0.83)
19. I utilise varied and appropriate assessments (e.g., oral, written, and exploration) to determine how much students learned after the lesson.	30 (44.1%)	31 (45.6%)	6 (8.8%)	1 (1.5%)	0	4.32 (0.70)
20. I use assessment results to diagnose student learning needs and align instructions.	33 (48.5%)	31 (45.6%)	4 (5.9%)	0	0	4.43 (0.61)
21. I help my students understand that mistakes can be used as learning opportunities to develop themselves further.	14 (20.6%)	27 (39.7%)	17 (25%)	8 (11.8%)	2 (2.9%)	4.59 (0.58)
22. I encourage my students to devise their own strategies in problem-solving aside from what is mentioned in the book.	20 (29.4%)	33 (48.5%)	11 (16.2%)	3 (4.4%)	1 (1.5%)	4.00 (0.88)

Additional questions:

1. On a scale of 1 to 5 (1 – very easy; 2 – easy; 3 – moderate; 4 – difficult; 5 – very difficult), how hard is it to practice SLT inside the classroom?

2. What kind of support do you need (e.g., training, seminars, funding, etc.) to practise successful implementation of situated learning inside the classroom?