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Research Article

Mathematics Teachers' Technological Pedagogical and Content Knowledge and their Capacity for Differentiated Instruction

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ABSTRACT

The primary goal of this study was to determine the trainings in the teachers' learning and development for differentiated instruction to enhance the instructional strategies of the elementary school teachers in North Butuan District of the Division of Butuan City, Agusan del Norte. The participating teachers completed the TPACK survey which consisted of the demographic profile of teachers and the TPACK components namely: Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technology Pedagogy and Content Knowledge (TPACK) and Differentiated Instruction survey instrument about mathematics. In addition, both surveys were analyzed based on how the teachers performed in TPACK and differentiated instruction and percentage of the capacity of teachers based on the two different methods of teaching. Among the four components of TPACK, the technological knowledge, content knowledge, pedagogical knowledge, and pedagogical content knowledge, pedagogical knowledge had the highest mean. The level of differentiated instruction of the participants in terms of lesson design and implementation revealed that learning activities are varied got the highest mean. In addition, the differentiated instruction in terms of lesson design and implementation, content, procedures, communication and learning were found to have the highest mean. Teachers teaching elementary mathematics may be requested to attend webinars on TPACK or related seminars/webinars to enhance their knowledge in dealing with the content in mathematics specifically word problems and their concerns on differentiated instruction.

Keywords: *descriptive research, differentiated instruction, mathematics education, math teaching, TPACK.*

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Introduction

Teaching is a difficult career. It does, in fact, need some effort, devotion, hard work, classroom management, a love of children, and the participation of school workers, the administrator, the community, and other stakeholders. Traditional methods of educating our children are becoming outmoded, especially among 21st century learners who are constantly involved with technology. Teachers, on the other hand, should have alternative ways of hooking our students based on their learning patterns. Pupils, on the other hand, have always desired a choice of activities that might suit their learning demands. Differentiating instruction in the classroom is a difficult endeavour. Furthermore, providing a variety of activities, in addition to technology, would be beneficial.

Differentiated teaching is complex and flexible since it combines a variety of classroom activities and pupils' levels of interactivity, comfortable settings, social interaction requirements, prior experience, interests, and deficiencies in pupil learning, as well as technologies they have been exposed to and understand how to use effectively (Blaz, 2016). For many elementary teachers, cultivating a differentiated classroom is a natural and intuitive response (Doubet & Hockett, 2017). Most teachers believe they are differentiating instruction whenever they allow pupils to participate to read or do homework if they finish a school assignment quickly, assess those pupils somewhat harder or tougher on an assignment focuses on pupils' overall time and creativity, or encourage pupils to respond questions (Tomlinson, 2017), yet, not everyone perform differentiation the same way. Hence, there are significant misconceptions about what actually constitutes defensible differentiated instruction (Doubet & Hockett, 2017). Rogayan (2019) averred that rather than designing a lesson for all and then retrofitting for a few, a differentiated approach requires planning for a range of grouping experiences, materials, and methods for receiving information and demonstrating mastery.

Furthermore, the innovation system is so complex and diverse that it can take generations for innovations to mature into their new forms, and they are rarely the product of a single person's efforts (Hewitt & Tarrant, 2015). At record, there has been a significant trend of improvement in primary and secondary education teaching methods (Stéphan, Joaquin, Soumyajit & Gwénaël, 2019). In addition, the use of various innovations in the classroom is often related to creative practice (Hewitt & Tarrant, 2015). Although technological advancement is not always linked to educational practices, the availability of computers and the use of ICT in students' schoolwork have been powerful drivers of change over the last decade (Stéphan, Joaquin, Soumyajit & Gwénaël, 2019). As a result, educational advancement initiatives must continue to diversify, strengthen, and become more targeted (Stéphan, Joaquin, Soumyajit & Gwénaël, 2019).

Fullan and Langworthy (as cited by Millen & Gable 2016) advised teachers and policymakers against relying solely on technologies in order to successfully integrate innovations of effective practice throughout public systems. They stressed the importance of deep learning techniques offered by modern teaching methods that are technologically assisted. The most efficient strategy for development in the public education system is to increase professional development programs in new learning environments rather than technology itself (Fullan, as cited by Millen & Gable, 2016).

As a result, when differentiated instruction (DI) steadily entered mainstream education in the early 2000s, the majority of educators viewed it as innovative (Robinson; Tomlinson & Imbeau, as cited by Millen & Gable, 2016). It addressed the achievement, performance, training, gender, and racial disparities that remain in today's classrooms (Tomlinson & McTighe, as cited by Millen & Gable, 2016). While empirical data is still being gathered, it has been shown that DI improved pupil participation, performance (Hall, Strangman, & Meyer; Tomlinson, as cited by Millen & Gable, 2016), and created the ability to close achievement barriers for disadvantaged groups (Stavroula, Leonidas, & Mary, as cited by Millen & Gable, 2016). Teachers, according to Tomlinson and Imbeau (as quoted as cited by Millen & Gable 2016), are not adopting this approach because it is too difficult to implement given the number of students on the work load, the number of goals to cover, and the need to keep up with other teachers. Casey (2011) noticed that teachers do not have a common grasp of the principle of differentiated instruction.

According to Kahn (as cited by Millen & Gable 2016), as this was happening in school systems, an increase in technological innovations outside of school drawn significant learning available to those with digital access. In comparison, despite widespread belief that educational technologies would make it easier for teachers to differentiate, only a limited amount of improvement has resulted in public education (Kahn;Fullan;Rosen & Beck-Hill;Tomlinson, as cited by Millen & Gable 2016). According to Prensky (as cited by Millen & Gable 2016), pupils can overcome the challenges that are attempting to keep targeted learning outside from classrooms.

The Philippine Basic Education Program recognizes Kindergarten, and it takes 12 years to build its Basic Education Program. This decision was made due to the lower quality of Philippine Basic Education, as shown by weak academic achievement of Filipino pupils in the National Achievement Test as well as the international test identified also as Third International Mathematics and Science Study (TIMSS) (Tatsuoka, Corter, & Tatsuoka; DepEd. 2012, as cited by Magayon, 2016). About the poor results of Filipino learners and the complexity of Philippine classroom conditions, some studies show the bright side of low-performing Filipino pupils, such as the fact that Filipino pupils love studying science the most (Shena & Tamb, as cited by Magayon, 2016). Filipino students, according to Felipe (2006), are cognitively ready to learn competencies assigned by teacher education makers, and their commitment to learn will help them develop their mathematical abilities (Sangcap, 2010). Some research findings about the use of Filipino as the first language of mathematics pupils in the Philippines raised concerns because the results were unfavorable. According to Bernardo's research (as cited by Magayon 2016), solving worded problems in Mathematics using the first language (Filipino) first has the same result as using the second language (English).

There is also a comparison between problem solving and learning methods, according to Ong et al., (2009), and problem exercises written in the first language can improve learning. This occurs as a result of students being given problem-solving tests written in their native language, Filipino, and using more learning strategies. This suggests that they can dedicate more brain power to problem-test comprehension rather than language comprehension while solving mathematical questions.

Though there are established effective models, practices, and effective ways used in mathematics learning developed by various mathematicians and scholars; and studies on diverse areas in teaching activities are boundless; and surveys on differentiated instruction is now continuing to spread, primarily on its methodologies, the study on pupils' expectations about their learning mathematics is still lacking (Magayon, 2016).

Hence, technology integration in education enhances teaching and learning, pupils' motivation, instruction, and encourages communication and the sharing of knowledge (Becta, as cited by Bingimlas, 2009). Teachers, according to Bingimlas (2009), were extremely motivated to incorporate ICT into classroom activities. In reality, these teachers are beginning to incorporate technology into their lesson plans, teaching methods, and software programs (Swan & Dixon, 2006). Aside from that, teachers were sent to training on the use of technology in the classroom, as shown by the Department of Education's various guidelines and strategies, as evidenced by DO 121, s. 2010; DO 113, s. 2009; DO 105, s. 2009; DO 78, s. 2009; DO 62, s. 2009; DO, 28, 2009.

Furthermore, in order to improve teacher training in the use of technology in the classroom and to comply with the Department of Education's modernization agenda, technological competence for teacher-applicants is a fundamental prerequisite for recruitment (DO 37, s. 1997, as cited by Malubay, & Daguplo, 2018). Despite the Department of Education's efforts, a large percentage of mathematics teachers remain hesitant to use technology in the classroom due to personal and technological obstacles, as stated by Bingimlas (2009).

With these, the current study seeks to conduct learning and development for differentiated instruction in rural schools with the use of Technological Pedagogical Content Knowledge (TPACK) in intermediate mathematics of the elementary school teachers.

Methods

Research Design

This study utilized quantitative research approach in which the researcher used survey questionnaires and the participating teachers completed the TPACK survey which consists of their demographic profile and the TPACK components namely, Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technology Pedagogy and Content Knowledge (TPACK) and Differentiated Instruction survey instrument in mathematics. In addition, both the surveys were analyzed based on how the teachers performed in TPACK and differentiated instruction that was addressed on the survey, as well as the percentage of the capacity of teachers based on the two different methods of teaching. Survey is a type of quantitative research that is concerned with 'sampling questionnaires, questionnaire design, and questionnaire administration' in order to collect information from the group/population under study and then analyze it in order to better understand their behavior/characteristics (Sukamolson, 2007). In this case, the independent variable is the mathematics teachers, while the dependent variables are TPACK components namely, Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technology Pedagogy and Content Knowledge (TPACK) and Differentiated Instruction.

Participants of the Study

This study was conducted in North Butuan District, Division of Butuan City, Agusan del Norte, Caraga Region in the academic year 2019-2020. Caraga is bounded by the Surigao Strait, Leyte Gulf, Philippine Sea, Davao Region, Northern Mindanao, Butuan Bay, and the Bohol Sea, clockwise from the north.

The participants involved in this study were 102 elementary teachers from the Division of Butuan City who were included for consultation through questionnaire on the teachers' knowledge of the technological pedagogical content knowledge (TPACK) and differentiated instruction.

Purposive sampling was employed in this study since all elementary school teachers from the seven (7) public elementary schools in the North Butuan District, Division of Butuan City are chosen for the information in this research.

Research Instrument

The researcher utilized one (1) set of instruments which is composed of three (3) different questionnaires. The first part of the instrument includes the profile of the participants in terms educational attainment, teaching experience, training on mathematics teachers, and gender. The second part is the questionnaire to measures the teachers' TPACK, which is adapted from the instrument designed by Schmidt, Baran, Thompson, Mishra, Koehler & Shin (2009). However, the researcher modified some of the contents of the instrument in order to get the necessary data. This was validated first by the experts.

The instrument purposefully based on elementary school teachers' self-assessment of the TPACK framework's seven knowledge domains. These knowledge domains are as follows: Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK). The third component of the instrument is designed to obtain the teaching theory of differentiated instruction.

Data Gathering Procedure

The participant's permission to participate in the analysis was granted by the researcher in a letter. The researcher would look for trends in the partly completed surveys and react to those that are returned. A consent request was submitted to participants for the following surveys for the first construct: Pre-service Teachers' Knowledge of Teaching and Technology and the TPACK for Meaningful Learning Survey. In addition, questions from the Study of Beginning Teachers' Perceived Preparedness and Efficacy for Differentiating Instruction were added to the updated survey (Casey, 2011).

Data Analysis

To determine the degree of the instrument's validity and reliability, the study employed quantitative research methods. Moreover, the following descriptive and inferential statistical tools were used in this study to analyse and interpret the quantitative data gathered.

Frequency count and percentage. These were used to determine the profile of the elementary school teachers as to educational attainment, teaching experience, and gender. This was used to answer problem no. three (3).

Mean. This was used to determine the extent and level of knowledge of the participants on Technological Pedagogical Content Knowledge (TPACK). The qualitative data that were gathered from the remarks and insights by the teacher participants, which was used to corroborate the results of the quantitative analysis. This was used to answer problem no. one (1) and two (2).

Results and Discussion

Level of technological pedagogical content knowledge of participants

Table 1 presents the level of Technological Pedagogical Content Knowledge of participants in terms of Technological Knowledge (TK). It reveals that Pedagogical Knowledge has the highest mean of 3.9 which means that participants had a high-level Pedagogical Knowledge but the content knowledge with a mean of 3.5 is the lowest among the four (4) components mentioned in this table and still meant that the participants had obtained a high level of Content Knowledge. Hence, the participants obtained a high level of knowledge of the four (4) components of TPACK.

It implies that teachers had developed different strategies and approaches and as their experiences increase, they are able adapt to different types of learners. In addition, their level of Pedagogical Knowledge (PK) increases if they are fully equipped with seminars and trainings regarding K-12 curriculum and its pedagogical approaches. This observation is similar to Kini & Podolsky's (2016) research, which found that teaching experience is favorably correlated with student achievement acquired during a teacher's career.

Table 1. Level of TPACK of the participants in terms of Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), and Pedagogical Content Knowledge (PCK)

Indicator	Mean	Interpretation
Technological Knowledge (TK)		
1. I know how to solve technical problems related to technology.	3.50	High
2. I can learn technology easily.	3.80	High
3. I can keep up with new technologies.	3.90	High
4. I frequently manipulate the technology.	3.60	High
5. I know about a lot of different technologies.	3.30	Moderate
Overall Mean	**3.60**	**High**

Content Knowledge (CK)			
6.	I have sufficient knowledge about mathematics.	3.40	Moderate
7.	I can use a mathematical way of thinking.	3.60	High
8.	I have various ways and strategies of developing my understanding of mathematics.	3.60	High
9.	Understand mathematics knowledge structures and approaches.	3.60	High
10.	Know the Grades 4-6 Curriculum competence indicators.	3.30	Moderate
Overall Mean		**3.50**	**High**
Pedagogical Knowledge (PK)			
11.	I can adapt my teaching based-upon what students currently understand or do not understand.	3.90	High
12.	I can adapt my teaching style to different learners.	3.90	High
13.	I can use a wide range of teaching approaches in a classroom setting (collaborative learning, direct instruction, inquiry learning, problem/project-based learning etc.).	3.90	High
14.	I am familiar with common student understandings and misconceptions.	3.80	High
15.	I know how to organize and maintain classroom management.	4.00	High
Overall Mean		**3.90**	**High**
Pedagogical Content Knowledge (PCK)			
16.	Use appropriate figures and tables to explain mathematical concepts.	3.70	High
17.	Use special mathematics knowledge to identify students' mistakes in solving math problems.	3.50	High
18.	Identify the rationale when students try new ways to solve mathematics problems.	3.50	High
19.	Explain the rationale behind the mathematics problem-solving process for students.	3.60	High
20.	Use appropriate examples to explain mathematical concepts.	3.80	High
Overall Mean		**3.80**	**High**

Legend: Parameter: 4.50-5.00 (strongly Agree), 3.50-4.49 (agree),2.50-3.49 (neutral), 1.50-2.49 (disagree), 1.00-1.49 (strongly Disagree)

Gains in teacher effectiveness correlated with maturity are greatest in the early years of a teacher's career, but they appear to be important as teachers enter the second, and sometimes third, decades of their careers. Teachers' pupils not only achieve faster, as determined by standardized examinations, but they are also more likely to do well in other metrics of achievement, such as school enrollment, as they accumulate experience. More advanced teachers promote increased student learning for their coworkers, the school as a whole, and their own pupils.

On the other hand, since teachers who are in the elementary level are generalists, meaning they teach all subjects (straight teaching), they often have moderate knowledge about mathematics especially in its curriculum competence indicators. This further means that teachers who are equipped with seminars and trainings on the new k-12 curriculum in mathematics would be able to widen their level of Content Knowledge (CK). This observation is similar to Kaur et al. (2017)'s report, which found that in order to refresh their knowledge of mathematics teaching and learning, teachers need assistance from individuals who have access to the most recent research and standards. A knowledgeable other's essential responsibility is to assist classroom teachers in deepening their comprehension of the material, instruction, concepts behind textbooks, and pedagogical ideas. Teachers must read classroom tools such as teaching guides, current journal papers, and instructional content, as well as closely review the school's textbooks, to expand their knowledge of mathematics teaching and learning.

Table 2 shows the three (3) components of TPACK, the Technological Content Knowledge, Technological Pedagogical Knowledge, and Technology Pedagogy and Content Knowledge.

Table 2. Level of TPACK of the participants in terms of Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technology Pedagogy and Content Knowledge (TPACK)

Indicator	Mean	Interpretation
Technological Content Knowledge (TCK)		
21. Know the problems that students might encounter when they use technology in learning.	3.60	High
22. Use appropriate technological tools to teach mathematics and allow students to apply mathematics knowledge in their daily life.	3.70	High
23. Guide students to use ICT to engage in collaborative learning.	3.70	High
24. Guide students to use ICT to evaluate their understanding and obstacles.	3.70	High
25. Reflect on how ICT might impact my teaching.	3.80	High
Overall Mean	**3.70**	**High**
Technological Pedagogical Knowledge (TPK)		
26. I can choose technologies that enhance the teaching approaches for a lesson.	3.90	High
27. I can choose technologies that enhance students' learning for a lesson.	3.90	High
28. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	3.80	High
29. I am thinking critically about how to use technology in my classroom.	3.80	High
30. I can adapt the use of the technologies that I am learning about to different teaching activities.	3.90	High
Overall Mean	**3.90**	**High**
Technology Pedagogy and Content Knowledge (TPACK)		
31. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.	3.70	High
32. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.	3.90	High
33. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.	3.70	High
34. I can choose technologies that enhance the content for a lesson.	3.80	High
35. Evaluate student learning outcomes based on mathematics content, instructional methods, and technology.	3.80	High
Overall Mean	**3.80**	**High**

Legend: Parameter: 4.50-5.00 (strongly Agree), 3.50-4.49 (agree), 2.50-3.49 (neutral), 1.50-2.49 (disagree), 1.00-1.49 (strongly Disagree)

It reveals that Technological Pedagogical Knowledge has the highest mean of 3.9, which means that participants had a high level Technological Pedagogical Knowledge but the Technological Content Knowledge with a mean of 3.7 is the lowest among the three components mentioned in this table and still meant that the participants had obtained a high level of Technological Content Knowledge. Hence, the participants obtained a high level of knowledge of the three (3) components of TPACK.

This observation was confirmed by the findings of Ghavifekr & Rosdy (2015), who believed that technology-based teaching and learning is more successful than conventional classroom teaching and learning. This is because the use of ICT instruments and resources would pave the way for a more engaging and efficient active learning experience for both teachers and students.

Tamoria (2016) found out that mathematics teacher educators (MTEs) reported high levels of TPACK and common reasons for integrating technology in their BSEd Math classes. This indicates that the MTEs consider themselves highly confident and knowledgeable about content, methods, and technologies in teaching mathematics (Tamoria et al., 2018).

Table 3 shows the level of differentiated instruction of the participants in terms of lesson design and implementation. It reveals that learning activities are varied and has the highest mean of 3.3 but the instructional strategies and activities respect pupils' prior knowledge and the preconceptions inherent therein, the focus and direction of the lesson are often determined by ideas originating with pupils, and the best way to assess knowledge is by paper and pencil tests with a mean of 2.8 are the lowest among the eight (8) indicators mentioned in this table, thus participants had obtained a high level of lesson design and implementation. Hence, the participants obtained a high level of lesson design and implementation of the eight (8) indicators of differentiated instruction.

Table 3. Level of Differentiated Instruction of the Participants in Terms of Lesson Design and Implementation

Lesson Design and Implementation	**Mean**	**Interpretation**
1. The instructional strategies and activities respect pupils' prior knowledge and the preconceptions inherent therein.	2.80	High
2. The lesson was designed to engage pupils as member of a learning community.	3.10	High
3. Your lessons encourage pupil to seek and value alternative modes of investigation or problem solving.	3.00	High
4. The focus and direction of the lesson are often determined by ideas originating with pupils.	2.80	High
5. Assessment and instruction are inseparable.	3.00	High
6. The best way to assess knowledge is by paper and pencil tests.	2.80	High
7. Learning activities are varied.	3.30	High
8. Pupil achievement data and pupil work samples are analyzed to make instructional decisions.	3.10	High
Overall Mean	**3.00**	**High**

Legend: Parameter: 3.50-4.49 (rarely occurs), 2.50-3.49 (sometimes occurs), 1.50-2.49 (often occurs), 1.00-1.49 (very frequently occurs)

It implies that teachers are adept in designing and implementing varied activities to pupils with respect to their knowledge, experiences, readiness, and abilities.

This finding is supported by Noreen and Rana's (2019) study, which found that the experimental group's success improved following the trial. The use of exercises in mathematics has a positive effect on learner success. When games are used in Mathematics, students are more engaged in the class. The information given by events is brief and to the point. With the aid of activity-based education, complex theories can be easily learned. Activity-based instruction piques the learners' attention while still making the message plain. Activity-based learning was discovered to be effective for optimizing learner efficiency. Using events to complement the study content is beneficial. The use of exercises allows teachers to quickly illustrate the subject matter. Mathematics becomes more enjoyable, engaging, and fruitful as a result of activities. It was concluded that activity-based instruction has a positive effect on the development of cognitive skills of elementary-level mathematics pupils. Activity-based learning is also more successful in developing students' higher order reasoning skills.

Table 4 shows the level of differentiated instruction of the participants in terms of content. It reveals that the lesson involves fundamental concepts of the subject has the highest mean of 3.1 but the I individualize instruction as much as possible with a mean of 2.8 is the lowest among the eight (8) indicators mentioned in this table. This means that the participants had obtained a high level of content in differentiated instructions. Hence, the participants obtained a high level of content of the eight (8) indicators of differentiated instruction.

Table 4. Level of Differentiated Instruction of the Participants in Terms of Content

Content	Mean	Interpretation
9. The lesson involves fundamental concepts of the subject.	3.10	High
10. I anticipate problems that might arise when teaching the curriculum.	3.00	High
11. The lessons promote coherent conceptual understanding.	3.00	High
12. I have a solid grasp of the subject matter content inherent in the lessons.	3.00	High
13. I individualize instruction as much as possible.	2.80	High
14. I am comfortable with the content that I teach.	3.00	High
15. I connect learning to the various academic disciplines through integrated curriculum.	3.00	High
16. Instructional strategies focus on meaning.	2.90	High
Overall Mean	**3.00**	**High**

Legend: Parameter: 3.50-4.49 (rarely occurs), 2.50-3.49 (sometimes occurs), 1.50-2.49 (often occurs), 1.00-1.49 (very frequently occurs)

It implies that teachers are well versed in the curriculum that enables them to deliver the lesson to its simplest form that will anticipate arising problems in teaching and learning.

The findings of this study are also consistent with the findings of Porter (2019), who claims that participating elementary teachers did not feel qualified to teach the math content expected of third, fourth, and fifth grade students. The study's results also suggest that the participating elementary teachers encounter math anxiety when attempting to educate their students and learning the more difficult concepts. Although this research was not intended to yield generalizable findings, it is fair to believe that teachers with identical qualifications and experiences could encounter similar shortcomings and anxieties. One potential course of action would be to enroll elementary teachers at all skill levels in a coaching and mentoring curriculum that would help them fill in holes in their math content and also reducing their overall math anxiety. Teachers must be taught a wide range of approaches for teaching all math material in order to reach all of their pupils. A coaching and mentoring program, such as the one described here, could also provide teachers with additional assistance while preparing new classes, remediation for pupils, and increasing their confidence in the classroom.

Table 5 shows the level of differentiated instruction of the participants in terms of procedure. It reveals that I know my pupils' learning profiles has the highest mean of 3.4 but the I use power point presentations for pupil's notes with a mean of 2.5 is the lowest among the eight (8) indicators mentioned in this table. This still meant that the participants had obtained a high level of procedure. Hence, the participants obtained a high level of procedure of the eight (8) indicators of differentiated instruction.

It implies that teachers use their best methods when delivering classes to their students. Furthermore, they know their students well, which allows them to provide diverse activities that reach every learner.

Table 5. Level of Differentiated Instruction of the Participants in Terms of Procedure

Procedure	Mean	Interpretation
17. I know my pupils' learning profiles.	3.40	High
18. I display pupil's work.	2.90	High
19. I know pupils are engaged when the classroom is quiet.	3.00	High
20. I use power point presentations for pupil's notes.	2.50	High
21. I use activity sheets.	3.00	High
22. I use cooperative learning.	3.10	High
23. Peer tutoring is used.	3.00	High
24. My teaching practices match the needs of the pupils.	3.10	High
Overall Mean	**3.00**	**High**

Legend: Parameter: 3.50-4.49 (rarely occurs), 2.50-3.49 (sometimes occurs), 1.50-2.49 (often occurs), 1.00-1.49 (very frequently occurs)

This discovery is linked to Ling, Sam & Kee (2017)'s research, which 238 students were diagnosed with 18 different knowledge states. The findings revealed that primary students encountered varying degrees of difficulty when learning about time and dates. This method of diagnosis, in the form of awareness states, offered accurate details about the students' abilities and shortcomings in the basic attribute of Time containing dates. This data offered multilevel input that mathematics teachers and students will use for a variety of purposes.

Mathematics teachers could assess their teaching efficacy by learning the students' awareness states. Teachers may determine whether or not the intended learning outcomes have been met by inspecting the mastery level of attributes in students' knowledge states. Based on the hierarchy of the non-mastered attributes, teachers could assign remedial work. The specifically identified hierarchical attributes include information, method, and skills that not only direct teachers in designing remedial work but also emphasize the importance of addressing simple knowledge before abstract concepts.

Table 6 shows the level of differentiated instruction of the participants in terms of communication. It reveals that I believe in excellence and equity for my pupils, I believe pupils should have a voice in my classroom have the highest mean of 3.2 but the I have high expectations for all pupils with a mean of 2.7 is the lowest among the eight indicators mentioned in this table and still meant that the participants had obtained a high level of communication. Hence, the participants obtained a high level of communication of the eight (8) indicators of differentiated instruction.

Table 6. Level of Differentiated Instruction of the Participants in Terms of Communication

Communication	Mean	Interpretation
25. I give questions to pupils to trigger divergent modes of thinking.	3.10	High
26. The majority of discussion in my classroom is among the pupils.	3.00	High
27. Pupil ask questions and comments often determine the focus and direction of classroom discourse.	2.90	High
28. I have high expectations for all pupils.	2.70	High
29. I expect pupils to respect each other and their opinions.	3.10	High
30. I believe in excellence and equity for my pupils.	3.20	High
31. I use small groups for instruction.	3.00	High
32. I believe pupils should have a voice in my classroom.	3.20	High
Overall Mean	**3.00**	**High**

Legend: Parameter: 3.50-4.49 (rarely occurs), 2.50-3.49 (sometimes occurs), 1.50-2.49 (often occurs), 1.00-1.49 (very frequently occurs)

It implies that teachers developed their pupils to be more independent in learning, encouraged them to be active participants ra-ther than passive, triggered their creativity and uniqueness through opening up their unsolved questions and problems regarding the lessons to the teachers.

This observation is similar to the research of Müllerke, Duchaine, Grünke & Karnes (2019), who investigated the impact of an Interactive Direct Instruction-based answer card intervention on the participation in classroom activities during math lessons of five (5) usually unengaged seventh graders with LD. The findings showed that as soon as the cards were added, the number of RtQs rose dramatically in all situations. Improvements from the baseline state to the treatment process were statistically significant in all five (5) cases, with non-overlap indices exceeding their highest value of 100 percent in all five (5) cases. When the answer cards were removed, the results losses were similarly dramatic. They have measured students' success levels at the start and end of each week. When the answer cards were used, the students learned more than if they were simply invited to engage by lifting their hands.

Table 7 shows the level of differentiated instruction of the participants in terms of learning. It reveals that I value what my pupils' belief about learning has the highest mean of 3.3 but the Pupils with disabilities should be included in regular education classrooms, I like an organized, but chaotic classroom environ-ment with a mean of 2.9 are the lowest among the eight (8) indicators mentioned in this table and still meant that the participants had obta-ined a high level of learning. Hence, the parti-cipants obtained a high level of learning of the eight (8) indicators of differentiated instruction.

Table 7. Level of Differentiated Instruction of the Participants in Terms of Learning

Learning	Mean	Interpretation
33. I am aware of developmental needs of elementary school pupils.	3.20	High
34. All pupils have the opportunity to succeed in my classroom.	3.20	High
35. Tutoring is used to reach struggling pupils.	3.10	High
36. I pre-assess regularly to know what pupils already know.	3.10	High
37. Pupils with disabilities should be included in regular education classrooms.	2.90	High
38. I like an organized, but chaotic classroom environment.	2.90	High
39. I value what my pupils' belief about learning.	3.30	High
40. I act as a resource person, working to support and enhance pupils' investigations.	3.20	High
Overall Mean	**3.10**	**High**

Legend: Parameter: 3.50-4.49 (rarely occurs), 2.50-3.49 (sometimes occurs), 1.50-2.49 (often occurs), 1.00-1.49 (very frequently occurs)

It is implied that teachers acted as a facilitator of learning. They managed and supported the pupils with their individualized learning style.

Ahmed (2015) found that when a teacher acts as a facilitator, students are more inspired. The majority of the participants feel inspired as they are facilitated after answering the 10 closed questions. As a result, their academic experience improved. However, in certain questions, participants were indifferent or partly accepted, but there was no dispute. One (1) closed question also included the question, "What does a teacher not do in the classroom that discourages you?" Most students mentioned some typical details, such as providing punishment, never allowing students to talk, implicitly rude, asking too many questions, monotonous class, and so on.

Conclusions and Recommendations

Elementary school teachers have high knowledge in terms of the seven (7) components of TPACK namely, the Technological Knowledge, Content Knowledge, Pedagogical Knowledge, Pedagogical Content Knowledge, Technological Content Knowledge, Technological Pedagogical Knowledge, and Technology Pedagogy and Content Knowledge with the Pedagogical Knowledge and Technological Pedagogical Knowledge as the highest and Technological Content Knowledge as the lowest.

As regards capacity level of teachers, they have high capacity in terms of lesson design and implementation as well as content. However, they have low capacity of procedure, communication and learning.

Teachers teaching elementary mathematics may be requested to attend webinars on TPACK or related seminars/webinars to enhance their knowledge in dealing with the content in mathematics specifically word problems and their concerns on differentiated instruction. Teachers teaching elementary mathematics may encourage to pursue graduate studies to develop their capability in handling pupils. They may also attend trainings on mathematics teaching to equip themselves with the skills and competencies to effectively bear instructions. If given an opportunity, it would be a good practice for teachers to pursue advance degrees like master's degree or even higher degrees.

Teachers may undergo training in their field of specialization to improve their level of technological knowledge.

It would be desirable for teachers to undergo training on lesson design and implementation, content, procedures and communication. The researcher is highly recommending to the Deped Butuan City Division to implement the proposed action plan of this study.

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