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Real-World Context in Mathematics Teaching: Teachers' Insights

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Abstract: The 2022 Programme for International Student Assessment (PISA) painted a concerning picture of mathematics education in the Philippines, revealing that Filipino students ranked among the lowest-performing groups worldwide. There are 12 Grade 7 Mathematics teachers from the 12 secondary schools in Castilla who are the key informants of this research. A questionnaire and interview guide were utilized to gather data which was analyzed for common themes. The results revealed that all the mathematics teachers commonly perceive the benefits of the integration of Real-World Context (RWC) in the students' learning and have diverse perceptions regarding their capacity to integrate RWC into their lessons. The perceived strategies that emerge are direct, indirect, experiential and interactive instruction. There are also uncontrollable challenges as perceived by the teachers such as curriculum alignment, prerequisite knowledge of the students and limited resources while lesson planning falls under the controllable challenge. There are five (5) proposed lesson exemplars highlighting the integration of RWC using a variety of strategies considering the perceived challenges. This study has positive implications for the insights of teachers regarding the integration of RWC into the lessons and to provide them with additional resources to plan and design their lesson.

Keywords: *Real-World Context Integration; Grade 7; Strategies; Lesson Exemplars.*

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I. INTRODUCTION

In 2015, the new seventeen (17) Sustainable Development Goals (SGDs) and 169 targets was decided during the meeting at United Nations Headquarters in New York. Among the 17 sustainable development goals, the fourth one aims the quality education by providing equal learning opportunities to all people regardless of their status or situation in life. This goal targets everyone to achieve numeracy and literacy. This sets the scale and unified course of action for the pursuit of global development.

➢ *Mathematics Instruction in the Global Setting*

Mathematics instruction in the global context varies across different countries as approaches, methods and standpoints are influenced by cultural, social and economic factors. The Japanese Mathematics instruction uses the approach of lesson study where teachers lead a four-step mutual learning process cycle: planning, teaching, reflecting and revising the lessons [1]. The Finnish national mathematics curriculum emphasizes the development of the student's mathematical thinking through modeling skills that enhances the structure of their knowledge in learning [2]. Singaporean Mathematics instruction emphasizes on prioritizing the students' mastery of concepts rather than the content coverage [3]. Taiwan's Mathematics curriculum nurtures future citizens by following the global trend of its development ensuring the appropriateness of the content, theories and essence in mathematics learning [4].

➢ *Mathematics Instruction in the Philippines*

Mathematics in the K to 12 curriculum focuses on the five content areas namely Numbers and Number Sense, Measurement, Geometry, Patterns and Algebra, and Probability and Statistics. The K-10 mathematics is a skills subject which provides a solid foundation for Grades 11 to 12 as it targets the necessary concepts and life skills as they continue to progress as citizens of the Philippines. The learning area standard aims learners to showcase their understanding and appreciation of key concepts and principles of applied mathematics in real life [5].

The MATATAG Agenda was launched in 2023 as the recalibrated K to 12 of the Department of Education (DepEd) towards improving the quality of basic education in the country. The MATATAG Curriculum, also known as "Bansang Makabata, Batang Makabansa," aims to prioritize the mastery of literacy and numeracy skills among learners while decongesting the existing curriculum to focus on foundational skills [6]. The curriculum reduces the number of competencies and highlights the development of numeracy, literacy, and socio-emotional skills among kindergarten to

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grade 10 learners. Compared to the K to 12 curricula, one of its main features is the reduction of the focused seven (7) learning areas to five (5) which includes the foundational skills in Language, Reading & Literacy, Mathematics, Makabansa and GMRC. There is also the decongestion of learning competencies from 11,738 to 3,664 where it highlights the reduction of Mathematics competencies from 740 to 494 [7].

The DepEd Order no. 42 s. 2016 or policy guidelines for daily lesson preparation in the K to 12 Basic Education Program in the Philippines explains that a teacher may use a strategy or combination of strategies in their lesson. An instructional strategy is what a teacher uses to achieve the objectives of a lesson in the classroom. It is a teaching approach influenced by different educational philosophies, while an educational method is the specific activity that teachers and learners will do in the classroom [5]. This includes direct instruction, indirect instruction, interactive instruction, experiential instruction and independent study. In this study, the four strategies except independent study were used in reference to the specific instructional methods identified by the teacher respondents.

- *Issues and Challenges in Mathematics Education*

Even before the Implementation of the MATATAG Curriculum, the Philippine Education System particularly in Mathematics education faced various challenges as reflected in the poor performance of the students in the classroom as well as in different local, national and international assessments. The Programme for International Student Assessment, gives light to the issues and challenges with regards to mathematics education in the Philippines, revealing that Filipino students ranked among the lowest-performing groups worldwide [8]. In Philippines, 16% of students attained at least Level 2 proficiency in mathematics, significantly less on the Organization for Economic Cooperation and Development countries average which is 69% [9]. There were barely any top performers in mathematics in the Philippines, meaning that they haven't attained level 5 or 6 in the PISA mathematics test (OECD average: 9%). Students were unable to mathematically model complex situations, wherein the strategies in problem solving are not properly selected, compared and evaluated. The main problem is the low performance of students in class, especially in the subject of mathematics, due to various reasons or factors. Unfortunately, it is not only the students who encounter different challenges in the teaching and learning process in mathematics but also the teachers.

Despite the goals of the MATATAG Curriculum to provide quality education, there are various challenges encountered during its pilot runs implementation such as the need for appropriate implementation approaches, technical problems in implementation, and inadequate government policies for inclusive education [10]. Moreover, other issues affecting the rollout of the curriculum are infrastructural limitations, lack of access to information resources, and teachers' readiness [11]. Among these challenges, two of the major and connected concerns are the issues of teacher readiness in teaching mathematics and infrastructural limitations. The pivotal role of teachers in curriculum implementation underscores the importance of ensuring that educators are adequately prepared to navigate new curriculum frameworks [12]. However, inadequate training, limited resources, and resistance to change among teachers pose significant obstacles to the successful rollout of the MATATAG Curriculum. The level of a teacher's readiness has a direct impact on their teaching performance and the performance of their students.

- *Initiatives in Mathematics Instruction*

The different issues, concerns, and factors affecting the performance of the students in mathematics led to the various initiatives to continuously improve the mathematical instruction through the development of learning materials. The use of valid and appropriate instructional material contributes to the attainment of quality learning [13]. This led them to develop and validate off-line Web Quest as an instructional tool for teaching fundamental operations on integers. It was also revealed that it was effective on both cognitive and intrinsic motivation of the students. The use of this instructional tool aids the teaching-learning process to effectively achieve the goals by utilizing innovations.

In a spiral progression curriculum, all learning competencies at every grade level must be completely covered within a school year [14]. The study revealed that the utilization of LASs is widely used by the teachers to addresses the concern about the identified competencies that are not fully covered in the given timeline due to varied reasons. This led them to develop complementary learning resources (CLeaR) in Grade 8 Mathematics which has 12 self-directed worksheets intended for the 12 uncovered learning competencies for the learners to acquire all the competencies in Grade 8 Mathematics.

The game-based learning instruction Kwatro which is a mathematical card game designed to develop the students' mastery on the topics related to addition of integers that focuses on their computational skills [15]. The results showed that after the utilization of the game the performance of the twenty-five least performing 7th-grade students from San Roque National High School increased from DNME (Did Not Meet Expectation) to FS (Fairly Satisfactory). Kwatro reveals that it improved the level of performance of the students involved in adding integers which can also be used with the supervision of teachers and parents in a blended learning setting.

There are other initiatives in improving mathematics instruction which involves the contextualization of lessons. The poor academic performance of students in Marawi City Division on Measurement was evident in the conducted summative tests [16]. This perennial problem was addressed by developing contextualized problem in measurement with a contextualized lesson plan in Mathematics as the students displayed positive responses on the activities and improved their performance in the achievement test. The identified learning gaps of the Bachelor of Secondary Education major in mathematics students in Calculus with Analytic Geometry was addressed by utilizing developed contextualized learning

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modules [17]. Their initiative promotes independent learning through the integration of real-world concepts and situations that features the province of Sorsogon in the Philippines.

➢ *Integration of Real-World Context in Mathematics*

The Regional Memorandum no. 22 of Cagayan Valley defined contextualization as the educational process of relating the curriculum and/or learning resources to a particular setting, situation or area of application to make the competencies relevant, meaningful and useful to the learners [18]. This covers the idea of real-world context (RWC) which is defined as a design of learning where students solve problems and perform activities that represent tasks in the real-world [19]. The context is the aspect of an individual's world in which the problems are placed [8]. One of these is the personal context where problems focus on the activities of ones' self, family or peers. Another is the occupational context that is centered on the world of work at any level, ranging from unskilled to professional work. Also, the societal context focuses on the perspective of one's community in local, national or global setting which individuals may be involved personally. Lastly, the scientific context where all aspects are intra-mathematical relates to the application of mathematics to the natural world, issues and topics that is related to science and technology. In this study, the integration of RWC refers to the process of providing the learners with problems or situations that allows them to perform tasks in the real-world may it be in a personal, occupational, societal or scientific context to make the competencies relevant, meaningful and useful to the learners.

A study revealed that it enhances the level of appreciation for mathematics among eighth-grade students through the incorporation of real-life applications into the lessons [20]. There was a statistically significant difference observed between the levels of appreciation before and after the implementation of the intervention. Interestingly, it was observed that students exhibited a degree of appreciation for mathematics when taught traditionally, but this appreciation could be further enhanced when the subject matter was presented and applied in real-life contexts. This suggests that incorporating real-life scenarios into mathematics instruction has the potential to significantly elevate students' appreciation and understanding of the subject.

The study explained that college algebra students have preference when it came to tackling word problems with real-life applications [21]. The findings demonstrated that students exhibited a significant preference for problems falling under the I (intriguing) and R (relatable) categories, as opposed to those categorized as U (unspecified). This indicates that, given a choice, students are more inclined to engage with word problems that possess a clear real-life application or those that pique their interest.

Another study also delves into the growing recognition within mathematics education of the significance of linking mathematical concepts to students' everyday experiences [22]. The study highlights a lesson on fractions, where the teacher employed the context of preparing soup for her family. This approach served multiple purposes, including (1) using personal stories to gain deeper insights into students, (2) transcending mere numerical operations to foster genuine comprehension, (3) bolstering students' confidence in mathematics, and (4) creating room for students to establish connections between mathematical ideas. These findings offer valuable insights into the potential impact of incorporating RWCs in mathematics education, potentially enhancing students' overall understanding of mathematical concepts.

The transformation of classroom pedagogy and content among rural mathematics teachers participating in a year-long professional development initiative centered on mathematical modeling [23]. The outcomes of the study demonstrated a notable shift in teaching approaches, as teachers displayed a newfound openness to depart from conventional lecture-based instruction and rote learning. Instead, they incorporated more collaborative group tasks, and alternative assessments, and even took the initiative to devise their mathematical modeling problems that were directly pertinent to their students' real-life experiences. This suggests a substantial positive impact of the professional development project on the teachers' instructional practices and content delivery methods.

The importance of contextualizing mathematics education is aligned with the dual objectives of promoting problem-solving skills and critical thinking [24]. This pedagogical approach proves to be more effective in facilitating learning by anchoring mathematical concepts within specific settings, situations, or practical applications. The findings suggest that, in the context of contextualizing mathematics, Surigaonon teachers leveraged available resources such as indigenous materials and curriculum packages, actively involved stakeholders within their reach, made effective use of technologies and models, adapted their approaches to align with curriculum standards, and employed integrative, collaborative, and reflective teaching strategies. This comprehensive analysis sheds light on the diverse strategies employed by teachers in Southern Philippines to contextualize mathematics education, ultimately enhancing the effectiveness of mathematical instruction.

➢ *The Frameworks of the Study*

The theoretical framework of the study wherein Reciprocal determinism explains that the Teachers' interaction between personal, environmental and behavioral factors is connected to the social cognitive theory of Albert Bandura which considers teachers' direct experiences and perception on the different context. Also, Constructivism theory of Lev Vygotsky highlights the Zone of Proximal Development (ZPD) which provides the concept wherein teachers are considered as a knowledgeable other that gives assistance on learning which is carried out through their instructional practices or strategies that is beneficial in the learning process of the students to accomplish their tasks. All these factors may contribute to the integration of RWC into their lessons.

The contextual framework involves the consideration of the different variables in the study and represents its

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relationship to each other to assist in addressing the aims of the study. The utilization of the process flow helps in creating a visual representation of the ordered sequence of steps taken in the study. It starts with identifying the perceptions of teachers regarding the integration of RWC into their lesson through the teachers' responses in the indicators in the questionnaire with their reasons. This stage of the study deals with the teachers' viewpoints and experiences, providing valuable insights regarding the impacts of RWCs in the teaching and learning process. The arrow shows the next process in the conduct of extracting the identified strategies of the teachers in effectively incorporating RWCs into their lessons through interviews as well as reinforcing it with the analysis of the gathered lesson plan. The interview gives light to the challenges encountered by the teachers, recognizing it as a factor that influences the integration process. Through this, the study will gain a comprehensive understanding of how Grade 7 Mathematics teachers navigate the integration of RWCs, ultimately enhancing the effectiveness of mathematics instruction at this grade level by proposing lessons exemplars in Mathematics 7 with the integration of RWCs considering the factors identified in the study.

➢ *The Present Study*

The studies of Javier and Padillo et al. give information about the different issues and challenges associated in mathematics education. This provides valuable insights for both educators and policymakers in improving the quality of education for the learners. Thus, various initiatives in mathematics instruction emerged such developing Off-line Web Quest [13], complementary Learning Resources (CLeaR) [14], mathematical card game Kwatro [15], contextualized problem with a contextualized lesson plan [16] and the descriptive-developmental research through contextualized learning modules [17]. In line with these initiatives, the integration of RWC in mathematics in studies is made to enhance student appreciation [20]. The student's preference of students in intriguing and relatable word problems in connection with growing insights in linking math concepts to real life poses positive impacts in the improvement of student performance [21][22]. Classroom pedagogy and contextualization in mathematics education was given focus [23][24].

The current study bridges a significant gap in the existing body of research by focusing specifically on Grade 7 Mathematics teachers' perspectives in the process integrating RWCs. While previous studies have provided valuable insights into the impact of real-world applications on student learning outcomes. There has been a relative dearth of research that delves into the pedagogical decisions and considerations of teachers themselves in this context. This study addresses this gap by offering a comprehensive understanding of the Grade 7 Mathematics teachers as it covers only the perceptions and not the actual and observed practices of the key informants with regards to the integration of RWCs in the lessons of the first and second quarter in the K to 12 curriculum. By focusing on this specific cohort of educators, the study provides a specialized contribution that can lead to more effective and contextually relevant mathematics instruction for Grade 7 students.

This study intends to determine the perceptions of mathematics teachers on the integration of real-world context in their lessons. Specifically, it aims to 1) determine the mathematics teachers' perceptions on: a) the integration of real-world contexts into their lessons, b) the strategies identified by mathematics teachers to integrate real-world contexts into their lessons, c) challenges Mathematics teachers in the integration of real-world contexts into their lessons, and 2) Propose lesson exemplars in Mathematics 7 with the integration of real-world contexts.

II. METHODOLOGY

➢ *Research Design*

Descriptive qualitative research design is characterized by creating a systematic, accurate and factual description of the topic of the research [25]. This type of research is used when exploring a different perspective of a previously studied topic to gain better understanding and insights in the process [26]. The qualitative component deals with the more subjective aspects of the research questions. This involves in-depth interviews with a subset of Grade 7 Mathematics teachers. This allows for a deeper exploration of the teachers' perception, strategies and challenges encountered in their integration practices. Through open-ended questions and probing, rich narrative data can be collected. Thematic analysis or content analysis can then be applied to identify recurring themes, patterns, and insights within the qualitative data.

➢ *Key Informants*

The primary sources of data were the responses of the teachers in surveys and interviews. The study uses purposive sampling. Purposive sampling involves intentionally selecting key informants based on specific criteria that align with the research objectives and the characteristics of the target population. Total enumeration, often referred to as a census approach, involves collecting data from the entire population of interest which are the secondary school in Castilla District, Sorsogon Division, ensuring that every Grade 7 Mathematics teacher within the target group is included in the study.

➢ *Data Collection Procedures*

Before commencing the data collection process, it is essential to meticulously plan and prepare. The questionnaires were distributed, and one-on-one interviews were conducted face-to-face based on the available time and date of the key informants in their respective schools. The questionnaires and available lesson plans were collected.

➢ *Data Analysis*

Descriptive analysis was utilized in interpreting the data collected in the study. The researcher used frequency and percentage to quantify the responses of the teachers under consideration regarding the perception indicators in the given questionnaire to support the thematic analysis and illustrate patterns that may emerge in the process. Thematic analysis was utilized in the perceptions of the teachers regarding the integration of real-world context (RWC) as well as the challenges they encountered as themes surfaced naturally and free from preexisting frameworks.

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On the other hand, a framework stated in DepEd order no. 42, s. 2016 known as the policy guidelines on daily lesson preparation for the K to 12 Basic Education Program was utilized as a guide to categorize the strategies identified by mathematics teachers incorporating RWCs and identifying the strategies in the collected Lesson Plans. The integration of RWC in the collected lesson plans was analyzed using the PISA framework. One of which is the personal context which focuses on the activities of ones' self, family or peers. Another is the occupational context that is centered to the world of work at any level, ranging from unskilled to professional work. The societal context highlights the perspective of one's community in a local, national or global setting which individuals may be involved personally. Lastly, the scientific context where all aspects are intra-mathematical relates to the application of mathematics to the natural world, issues and topics that are related to science and technology. The challenges encountered by the respondent in the integration of real-world context into their lessons were also analyzed through thematic analysis. The subjected responses paved the way for emerging narratives directly form the data. This captures the challenges of the key informants in relation to what the study aims to determine.

III. RESULTS AND DISCUSSION

The integration of Real-world Context (RWC) in Mathematics lessons may be a powerful tool which can possibly reinforce the teaching and learning process. Teachers' insights regarding the integration of RWC may help in providing a more personalized teaching as it serves as a baseline for their chosen instructional strategies with a goal to improve the students' learning outcomes while considering and addressing the challenges that comes along with it.

- *The Perceptions of Mathematics Teachers in the Integration of Real-World Context into their Lesson*

After analyzing the responses of the 12 mathematics teachers, the researcher obtained the key informants' perceptions along with the integration of Real-World Context (RWC) in their lessons, their identified strategies in integrating RWC in their lessons, and the challenges in integrating RWC in their lessons.

Table 1 Perceived Reasons for Integrating Real-World Context in Mathematics Lessons.

Themes	Perceptions	Frequency *f*	Percentage %
Benefits to Students' Learning	Adhere to curriculum standards	12	100%
	Concretize abstract mathematical concepts		
	Enhance students' cognitive skills		
	Address students' challenges		
	Apply various strategies in promoting Real-World Context		
	Enhance students' performance		
Teachers' Capacity to Integrate Real-World Context	Easy access to a diverse range of real-world examples	8	67%
	Attendance to seminars or trainings about the importance of integrating real-world context		
	Engagement in discussions with other educators to share strategies and resources	9	75%
	Confidence in ones' ability to integrate real-world contexts		

All of the key informants perceive that integrating RWC into their lesson has benefits to the students' learning. The key informants perceive that they adhere to the curriculum by integrating RWC in their lesson as it prepares the students for the real-world. This implicates that teachers as implementers of the curriculum must plan their lessons according to the mandates of the Department of Education. Key informant J, a 26-year-old male with 1-year teaching experience said that *"The curriculum aims to prepare students into actual world. Thus, integrating RWCs is very important to achieve the curriculum goals and standard".* The DepEd's General Shaping paper emphasizes under the pedagogical approaches discussion that schools should prioritize making the students think critically and provide a meaningful learning experience by connecting it with real-world problems. The MATATAG curriculum highlights the humanized approach to learning as it prepares students for real-world challenges [27]

The key informants believe that concretizing the concepts of the lessons improves students understanding as it connects the abstract concepts to the real-world making the students see the relevance and value of mathematics. This implies that when students understand the lessons, they will be motivated to learn which is strengthened by Key informant E, a 31-year-old male with 7 years of teaching experience who stated that *"Student take a lesson as abstract and relating it to real-world increase understanding. Lessons by itself is abstract, thus using concrete examples simplifies".* The common pedagogical approach for supporting learning of declarative concepts involves presenting students with concrete examples that illustrate how the abstract concepts can be instantiated in real-world situations [28].

It was commonly perceived that using RWC in their instruction enhances the students' cognitive skills as it promotes critical thinking. This suggests that analyzing the relevance of the concepts they are learning to their own lives stimulates deeper connection and increases retention of concepts, thus increasing effectiveness of teaching wherein Key informant E, 26 years old with 1-year teaching experience shared that *"When the lesson is supported by real-life applications, the retention of the lesson/concept is*

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deepened, the students view the lesson not as pure mathematics but as an applied one". Realistic Mathematics Education is improving the students' problem-solving abilities as relatable and realistic applications in real-life develop deeper understanding and critical thinking that contributes to the engagement of students and confidently approach complex problems [29].

Another perception identified by the key informants is that promoting RWC in their Mathematics lessons helps in addressing students' challenges in learning mathematics as it promotes meaningful learning. It implies that RWC may help in shifting the students' negative thoughts to appreciation of the subject, which is explained by Key informant A, a 30-year-old female with 7 years of teaching experience *"Mathematics has always been named as the hardest subject by my students. Through promoting real-world contexts in every math lesson will let the students appreciate the importance of the subject.".* When students are interested in an academic topic, they are more likely to go to class, pay attention, become engaged, take more courses, as well as process information effectively and ultimately perform well [30].

All of the key informants affirm that they apply various strategies in promoting real world context in their lesson as it increases student engagement. This leads to the implication that the teachers strive to explore and innovate various strategies to present concepts in order to catch the students' attention and effectively gain understanding of the concepts of the lesson that may increase the quality of learning such as problem solving and cooperative learning of Key informant C, a 27-year-old female with 3 years of teaching experience which emphasized personal context. Key informant I, a 35-year-old female with 14 years of teaching experience emphasized that *"By incorporating various strategies in promoting real-world context in my math lessons, I can create engaging and meaningful lessons that promote the application of mathematics concepts in real-world context, enhancing my students understanding and appreciation of the subject"*. The practice of the innovative and creative strategies for classroom instruction that allows the students to explore and understand knowledge by engaging in real-world, promotes high-quality education [31]. It was observed that students' degree of appreciation for mathematics could be further enhanced when the subject matter was presented and applied in real-life contexts [20].

The integration of RWC in their mathematics lesson enhances the students' performance as it increases student's motivation as perceived by all of the key informants. It implies that the increase of motivation of students leads to the enhancement of their performance in mathematics. Key informant H, a 27-year-old male with 4 years of teaching experience strengthens this implication with his statement that *"Integration of real-world context increases motivation and interest in mathematics. It makes the students participate more in class discussions".* The activities in problem solving use real-life scenarios increased the performance of the students involved in the achievement test [16].

Teachers continuously strive to provide quality education to the learners to shape their abilities as they progress into a globally competitive citizen. Their perceptions regarding the benefits of integrating RWC into the lessons serve as motivation to their instructional practices. The teachers being placed in varying environments results to their diverse perceptions regarding their capacity to integrate RWC into their lessons.

The eight (8) or 66.67% of the key informants perceived that they have accessibility to a diverse range of real-world examples that they can integrate into their lessons while the four (4) or 33.3% of the key informants did not mention this. This indicates that the teachers' varying perception may be caused by their personal, geographic or environmental situations. One of the key informants stated that *"The Department of education continuously strive to provide teachers with easy access to these types of learning facilities. At present, learning and teaching materials such as books, modules and online portals are accessible for teachers."* The Department of education (DepEd) issued DepEd Order 76, s. 2011 known as the National Adoption and implementation of the Learning Resources Management and Development System (LRMDS). It is a web-based catalog and online repository of learning, teaching and professional development resources. Through LRMDS, different learning materials can be viewed and accessed. However, teachers who did not mention that they have easy access to these materials have the commonality of being assigned to schools that lack internet connectivity. It was revealed that teachers in schools in far flung areas need help to ease the problems they encountered in teaching due to limited resources, distance, and poor level of macro-skills in learners [32].

Eight (8) or 66.67% of the key informants have attendance seminars or training courses about the importance of integrating RWC in Mathematics lessons. This implicates that majority of the teachers are equipped in implementing the process like Key informant E, a 31-year-old male with 7 years of teaching experience stated that *"Seminars and trainings will help me how to deal with real –world context in math lessons and what strategies are effective to ensure that learning takes place when the lesson is real-world context based.".* He attended the Division Mass Training on Higher Order thinking skills Professional Learning Packages (HOTS-PLPs) in the year 2023 which incorporates RWC in mathematics lessons. They showed a positive relationship between the training and the teacher's performance, and it develops the teacher's skills and abilities to perform better in the classroom [33]. The study revealed that teachers who have certifications in their work have better approach and methods as this is highly influenced by their professional development [34]. Additionally, the schools of key informants are situated in areas that lack cellular connectivity. This may be because seminars are more prevalent online while actual training requires teachers to spend time and money. The barriers to professional development were primarily caused by financial and time constraints and a lack of teacher motivation and logistical support [35].

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Nine (9) or 75% perceived that they have engagement in discussions with other educators to share strategies and resources from integrating RWC in their mathematics lessons. This implies that when teachers engage, they are more likely to adapt strategies that are perceived to be effective. Key informant C, a 27-year-old female with 3 years of teaching experience stated that *"Lac session and school-based INSET. Cooperative discussions enrich my learnings by adapting unique teaching style and strategies that others find more effective".* Practicing collaboration among teachers increases efficiency as they compare and contrast the strategies that may be appropriate. It was concluded that communication should be effectively established between mathematics instructors as well as developmental mathematics instructors [36]. On the other hand, three (3) or 25% of the key informants who did not mention this have 10 or more years of teaching experience. It may be assumed that the minority of teachers who have longer teaching experience have lesser interest in engaging to other educators. The inhibitors to collegial professional interaction that are often noted in literature are the time constraints, fragmented visions, competitiveness, conflict avoidance and lack of administrative support [37].

- *Strategies Identified by Mathematics Teachers in Integrating Real-World Context*

The key informants in the recent study provided feedback regarding the teaching strategies they identified to integrate real-world contexts (RWC) in the teaching and learning process. When asked about the strategies employed in integrating RWC, all of the key informants identified the methods instead. Thus, these methods were mapped out with the corresponding strategies as provided in DepEd Order 42, s. 2016. All of the key informants identified problem solving that corresponds to Indirect Instruction strategy in integrating RWCs in their lessons.

Nine (9) or 75% perceived that they have confidence in their ability to integrate RWC in their lessons. This indicates that confidence is one's faith in their abilities. Teaching requires confidence in integrating RWC as this ability may affect the teaching-learning process. Key informant F, a 38-year-old male with 7 years of teaching experience asserts this with the statement *"I have to study the lesson especially when it comes to real life application of the lesson as challenging questions may arise and I have to be ready all the time to answer them."* The participants expressed their beliefs regarding an excellent teacher having confidence and certainty who makes decisions that enable them to become flexible, creative and prepared for any challenges or situation they may encounter [38]. It was concluded in the study that the increase of teachers' confidence is a result of building strengths that add to the teachers' experience of success [39].

Table 2 Strategies and Methods for Real-World Context Integration.

Strategies	Methods	Frequency	Percentage
		f	*%*
Indirect Instruction	Problem solving	12	100
Experiential Instruction	Games	8	75
	Modeling	2	16.67
Interactive Instruction	Cooperative Learning	8	66.6
Direct Instruction	Lecture	2	16.67

Majority of the key informants identified Games that aligns to experiential instruction strategy and Cooperative learning which matches Interactive Instruction strategy while the minority identified modeling mapped in the Experiential Instruction strategy and Lecture as a Direct Instruction strategy in integrating RWC in their lessons. The PISA Framework served as a basis for the categories of integrated RWC in the lesson [8].

The Utilization of Problem Solving in RWC Integration was a significant instructional method that was noted by all the participants in the integration of RWC is problem-solving. This indicates that mathematics teachers lean towards the utilization of problem solving in integrating RWC into their lessons as it encourages students to connect and grasp mathematical concepts to real-life scenarios. Key informant C, a 27-year-old female with 3 years of teaching experience stated that *"It is not enough that students know how to use the step-by-step process to solve a specific problem, students must also know how to identify the whole idea of the problem.* Problem solving as an indirect instruction strategy was revealed in the lesson plan provided by Key informant C, showed problem solving in integrating RWC. This motivational activity exhibits the real-world in the personal context as it involves situations of travelling from one place to another to eat which makes the lesson about absolute value more authentic. The problem-solving strategy is an important component of realistic mathematics education [40]. It allows students to analyze, understand and formulate the daily life problem into formal mathematics, such as problem-based specific context, real-life problem, and the problem itself.

Eight (8) or 75% of the key informants with 8 years and below of teaching experiences identified the use of games where they incorporate the RWC in mathematics class. This experiential instruction strategy catches and improves students' interest and motivation and enhances their understanding of mathematical concepts by experiencing and demonstrating how different principles apply to real-life situations. Key informant I, a 35-year-old female with 14 years of teaching experience stated that *"Incorporating real-world context in game-based learning is both challenging and exciting for me. I observed that students understand and appreciate the real-life applications while they are enjoying the learning experience"*. The lesson plan of Key informant

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C showed the focus of games to provide interaction and experiences to learners. However, there is an absence of the integration of RWC which indicates that not all games incorporate the elements of the real-world. This can encourage teachers to further improve the utilization of games. Game-based learning is an activity or a game that contains learning content derived from the essential life skills or school curriculum to enhance the learning experience which increases the understanding of learner upon delivered learning contents [41].

Two (2) or 16.67% of the key informants who are both female with 3 and 7 years of teaching experience identified modeling as an instructional strategy in integrating RWC into their lesson. Modeling allows teachers to provide understanding of mathematical concepts. This encourages student-centered learning where they are motivated to analyze connections of ideas and develop their creativity in presenting ideas. The minimal number of teachers who identified this indicates limited awareness in incorporating models in their lessons, which may be due to the scarcity of training in this field. The lesson plan of Key informant D, a 43-year-old female with 20 years of teaching experience showed the use of integer tiles to model the concept in the presentation of examples and development of new concepts as well as the discussion however, it did not utilize any problems or situations that reflects the context of the real-world. This shows that there may be limited resources in the use of modeling in the integration of RWC. Teachers want their lessons to have integration of modeling, but resources are insufficient [42]. The limited number of teachers who use modeling have limited experience in modeling practices and associated pedagogies [43].

There are eight (8) or 66.67 % of the key informants identified Cooperative Learning, which is an interactive instruction strategy in incorporating RWC into their lessons. This strategy involves active participation of students wherein they would share their perspective on how to accomplish a task. Students feel a sense of involvement as they can express their thoughts, opinions and experiences on a given situation. The results indicate that teachers encourage the interaction of the students to their classmates in their learning process. It also shows that teachers value student-centered learning environment. Key informant E, a 31-year-old male with 7 years of teaching experience stated that *"As a group mas naga dakol ang questions ninda and nakakaukod sinda magsocialize para magkasararo sinda sa simbag"* which translates to "As a group, they have more questions, and they learn to socialize to have unity in their answers. the lesson plan of Key informant C, a 27-year-old female with 3 years of teaching experience showed the integration of RWC as it involved the problem of conversion of units of measurement in a personal context such as the situation such as ones' health, recreation and travel. Cooperative learning benefits academic and social learning and may provide individualized learning experiences [44]. It allows meaningful disciplinary integration and ease of teaching [45].

There are two (2) or 16.67% of the key informants, both are male and have 1 to 2 years teaching experience who identified lecture as a direct instruction strategy in the integration of RWC into their lesson. This indicates that teachers with less experience tend to be traditional in their practices. This can be stemming from the idea that teachers are still getting used to the new environment and have limited background of the community. Direct teaching is viewed by constructivist teachers as very structured and fast pacing that limits the creativity of teachers since it highly emphasizes basic skills [46]. Teachers become more learner-centered as their experience increases [47].

- *Challenges Encountered by Mathematics Teachers in Integrating Real-World Context into their Lesson*

Integrating real-world contexts (RWC) through various teaching strategies is crucial because it helps the students understand different mathematical concepts better through more relevant and engaging lessons. However, despite its perceived benefits to the students' learning, the key informants revealed that they have also experienced challenges in integrating RWCs into their lessons.

Table 3 Roadblocks in Integrating Real-World Context into their Lesson

Themes	Challenges	Frequency	Percentage
		f	*%*
Uncontrollable	Curriculum alignment	10	83
	Prerequisite knowledge	6	50
	Limited Resources	4	33.3
Controllable	Lesson Planning	10	83

There are three (3) identified uncontrolled challenges experienced by mathematics teachers in integrating RWC in the delivery of mathematics instructions. Curriculum alignment with standard was identified by all the 10 key informants as one of the most difficult tasks in integrating RWC. Key informant G, a 33-year-old female with 7 years of teaching experience stated that *"Some of the topics po, mahirap integrate-an ng real-world context kasi hindi ko po naiisipan ung ibang topics na provided by the DepEd"* when translated gives the thought that some of the topics are hard to integrate with RWC, he can't think about (real-world context) in some of the topics provided by DepEd. The teachers perceive that some lessons or topics are too abstract that it is difficult to integrate RWC making it harder for them to incorporate RWCs that are relatable and relevant to the students. These challenges mathematics teachers to follow some standard content and pacing guide. Curriculum alignment as a term that sums up the relationship between content validity, content coverage and the opportunity to learn [48]. In other words, curriculum alignment is linking different elements to the students learning experience.

Six (6) or 50% of the key informants stated that the students' lack of prerequisite knowledge is a challenge in the

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integration of RWC into the lesson. Key informant F, a 38-year-old male with 7 years of teaching experience stated that *"challenge ang prerequisite skills na nakakalimutan ng mga bata, tinuro sa lower grade level, hindi nadadala sa upper grade level"*. Key informant F's statement emphasizes that it is a challenge when prerequisite skills of the students needed for the grade level are obtained but not retained. In addition to this, Key informant B, a 59-year-old female with 16 years of teaching experience stated that*"katulad sa polynomials, tatanungin ka ng mga bat ana ma'am bakit maraming x, maraming y ganyan, so kailangan muna ung basic bago ka makapaglesson ng polynomial"*. The translation of the statement states that in polynomials, students ask why there are many x (variable) or y (variable) so the basic (knowledge) is needed before giving a lesson about polynomials. This challenges the teachers to consider the students prerequisite knowledge when planning the lesson. This implies that teachers must ensure that the students' foundational knowledge and skills are enough to connect this to the new concepts they need to learn for the grade level. Several teachers felt that there should be mastery of mathematical concepts before the students connect them to the real-world [49]. Teachers must consider the prior knowledge of the students in order to make a meaningful discussion. Learners who can figure out how to make an association with different circumstances feel more arranged to the utilization of mathematical knowledge in different zones [50].

Four (4) or 33.3 % of the key informants identified limited resources as a challenge in the integration of RWC into the lesson. Key informant H, a 27-year-old male with 4 years of teaching experience stated that *"wala pong signal sa school namin kaya hindi ako maka-research ng maayos"*. The translation of the statement states that there is no signal (cellular connectivity) in their school, that is why he can't research properly. This implies that teachers need support in their attempts to improve their instructional practices. Teachers with schools situated in far flung areas need help to ease the problems they encountered in teaching due to limited resources, distance, and poor level of macro-skills in learners [32].

Ten (10) mathematics teachers or 83% of the key informants mentioned that they experience this controllable challenge in planning the lessons that integrate RWC as in requires deeper considerations of the student's prior knowledge, ensuring that the RWC integrated in the lesson are appropriate and relevant which also requires time. Key informant A, a 30-year-old female with 7 years of teaching experience stated that *"Time has always been a big factor in preparing lessons. Teachers have limited time in preparing lessons because of teacher-related tasks and ancillary task"*. This was also evident in the limited number of collected self-made lesson plans of the teachers. It can be argued that teachers need more time to focus more on their tasks as subject teachers. The preparation of lessons should not be underestimated as it requires time to have well-thought-out classroom activities and problems that show application in daily living [51]. "Lesson planning is the most important part of teaching, and of improving students learning" [52]. Implementing a good lesson plan will help students to be more engaged in the lesson, avoid wasting time and create a work-oriented classroom atmosphere during the lesson [53].

- *Proposed Lesson Exemplars in Mathematics 7*

One of the most essential strategies to make mathematical concepts more relevant and tangible to students is integrating RWC into their lessons. This also helps to engage students, improve their retention, help them understand the lesson better, and see the importance of mathematics beyond the classroom. However, teachers faced several challenges in integrating RWCs.

Table 4 Proposed Lesson Exemplars in Mathematics 7

Lesson No.	Topic	Strategy	Real World Context
1	Operations on Rational Numbers	Indirect Instruction & Experiential Instruction	Personal Context
2	Systems of Unit of Measure	Direct Instruction & Experiential Instruction	Scientific Context
3	Conversion of Units	Direct Instruction & Interactive Instruction	Personal Context
4	Sets	Interactive Instruction& Experiential Instruction	Societal Context
5	Multiplying and Dividing Integers	Indirect Instruction& Interactive Instruction	Occupational Context

The key informants perceived lessons that can be integrated with RWC and from that, the researcher removed the lessons that were already used from the collected lesson plans. Topics that were not integrated with RWC were considered by the researcher such as Operations on Real Numbers, Systems of Unit of Measure, Conversion of Units, Sets and Multiplying and Dividing Integers. The researcher developed lesson exemplars integrated with RWC based on the PISA Framework. The Lesson exemplars feature personal, societal, scientific and occupational contexts which adapt to the MATATAG Curriculum Lesson Exemplars format that can be seen on all its parts utilizing the different instructional strategies and methods stated on DepEd Order 42, s. 2016 to address the challenge of lesson planning encountered by the teachers in integrating RWC in their lessons

Lesson Exemplar Number One (1). This has the topic of Operations on Real Numbers which highlights the integration of personal context in allocating portions of food for the family and managing their finances. The context is featured through indirect instructional strategy in establishing the purpose and making generalization using the specific method of inquiry. It also utilized experiential instructional strategy through the methods of model building and simulation activity in the process of activating prior knowledge as well as in developing and deepening of understanding.

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Lesson Exemplar Number Two (2). This has the topic of Systems of unit of Measure that emphasizes the integration of scientific context as it involves the use of intra mathematics that utilizes the idea of quantifying the attributes of an object such as measurement. The experiential instructional strategy emphasized the context in activating prior knowledge as students engage in the hands-on activity of measuring objects. It is also employed along with the direct instructional strategy shown in establishing the purpose of the lesson, developing and deepening understanding and making generalization part of the lesson exemplar through the methods of compare and contrast, didactic questions, drill and practice as well as lecture.

Lesson Exemplar Number Three (3). This has the topic of Conversion of Units that features the personal context of one's health which involves BMI, exercise and lifestyle. This context is integrated through interactive instructional strategy using the method of brainstorming and cooperative learning in activating prior knowledge. Direct instructional strategy was used in establishing lesson purpose, developing and deepening understanding as well as making generalization through the methods of compare and contrast, lecture and drills.

Lesson Exemplar Number Four (4). This has the topic of Sets that highlights the societal context that creates categories or groups in demographics, entertainment and government focuses on one's community for both local and national level. This context is integrated through experiential instructional strategy using the method of games and model building in activating prior knowledge. Interactive instructional strategy was also utilized in establishing lesson purpose, developing and deepening understanding as well as making generalization through the methods of group discussion.

Lesson Exemplar Number Five (5). This has the topic of Multiplying and Dividing integers that shows the occupational context as it is usually seen in the different levels of workforce that are relatable to the students such as business, salakot making and construction. Interactive instructional strategy is utilized with its method of brainstorming on activating prior knowledge of the students. Indirect instructional strategy was used to integrate RWC through the method of concept formation, problem solving and reflective discussion in establishing lesson purpose, developing and deepening understanding as well as making generalization.

IV. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, it is perceived that there should be integration of RWC into the mathematics lessons because teachers believe that it will have benefits in the students learning and are capacitated to do so. They also believe that the RWCs can be integrated into mathematics lessons using a variety of strategies considering the different context such as personal, scientific, societal and occupational. However, despite all of these perceptions, teachers still encounter challenges in the process that are uncontrollable such as curriculum alignment, prerequisite knowledge of students and limited resources. On the other hand, the controllable challenge is lesson planning. Given all these, there is a need to propose lesson exemplars highlighting the integration of RWC.

It is recommended that the perceptions of the teachers should be put into action by practicing the integration of RWC into their lessons. Other strategies may be further explored and utilized in planning the specific methods to be used in all parts of their lesson plans. The challenges may be addressed by imposing the integration of RWC in their lessons and providing the appropriate resources along with it. The future researchers may validate the proposed lesson exemplars and test its effectiveness.

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