Content-based problem solving instruction of Grade 2 learners towards a plan of action

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Abstract

Problem-solving is a complex process that is helpful in our day-to-day life and is also crucial in the teaching and learning process related to Science and Mathematics fields. This study aimed to assess the effectiveness of content-based problem solving instruction in Mathematics among the Grade 2 learners with the end view of crafting a plan of action based on the findings. The specific questions answered consisted that of the extent the teachers used content-based instruction approach in teaching problem solving in Mathematics in terms of theme-based approach, team-teach approach, and skill-based approach, the extent the learner demonstrates content-based problem solving skills in Mathematics, the extent of effectiveness of content-based instruction in Mathematics problem solving, and the plan of action proposed on the use of content-based problem solving instruction in Mathematics. This study employed the use of descriptive quantitative research method with questionnaire as the main data gathering instrument. The population utilized in the study are the Grade 2 Mathematics teachers from Malvar District Division of Batangas public elementary schools. A total of 113 Grade 2 Mathematics teachers were asked to participate in the study. Findings consisted that of the teachers use content-based instruction in teaching problem solving in Mathematics in terms of theme-based approach, team-teach approach, and skill-based approach to a high extent, learners demonstrate content-based problem solving skills in Mathematics to a high extent, the The effectiveness of the use of content-based instruction is very satisfactory as evident with the academic performance of the learners, and the output of the study which is a proposed plan of action is crafted based on the findings of the study. Recommendations included that for the Mathematics teachers may be able to look for the best practices in the use of content-based instruction to find out what works best for the learners when it comes to problem solving in Mathematics, and for the future researchers may validate the output of the study which is a proposed plan of action in using the content-based instruction in Mathematics.

Keywords: content-based instruction; theme-based approach; team-teach approach; skill-based approach; proposed plan of action

1. Introduction

Problem-solving is a complex process that is helpful in our day-to-day life and is also crucial in the teaching and learning process related to Science and Mathematics fields. Particularly, mathematics teachers commonly use problem-solving so as to teach and assess students' learning. This shows the importance of problem-solving to a mathematics instruction. The two types of knowledge required for solving technical problems are procedural and conceptual knowledge. The knowledge, skills and tools which are necessary for solving problems are known as conceptual knowledge. On the other hand, the process skills used in solving problems are procedural knowledge. Problem-solving process occurs when students' need to resolve a situation where they do not know a specific set of actions to follow so as to reach to a solution.

However, for efficiently helping students, researchers and educators need more information about problem solving process. If problem solving skill is a cognitive activity then, improving problem solving skill through education should be a valuable goal. To support the development of problem-solving skills, it is

crucial to have tools that can measure the difference between novice and expert problem-solvers performance in classrooms. The main difference between the two was on how they use and organize their knowledge when solving problems. Expert problem solvers are individuals who use the problem-solving strategies effectively and consciously whereas novice problem solvers are those who cannot use it sufficiently. Experts use more qualitative reasoning and arguments in detail before using mathematical equations while novices rush into finding the result without understanding the conceptual base of the problem.

In order to highlight the role of conceptual knowledge in problem solving, students should be encouraged to incorporate a qualitative strategy when solving problems. A reform in problem-solving instruction that emphasizes on instruction that encourages qualitative reasoning should be in placed. There are many problem-solving strategies that show the process from low to high complexity. It is indeed difficult for the students to develop an understanding of the conceptual nature of solving problems quantitatively.

Therefore, understanding of concepts as a result of context-based instructional approaches may lead to the generation of new procedures and new problem-solving skills. The gap that this present study intends to fill is on the effect of context-based instructional approaches on Grade 2 learners' problem-solving skills in Mathematics will be investigated. Students have difficulties and misconceptions about the fundamental concepts of problem solving in mathematics in which the present study intends to investigate.

1.1. Background of the Study

The Department of Education (DepEd) Order No. 12 series of 2015 was issued in line with the Ten Point Basic Education Agenda which states that every child should be a reader by Grade 1 and strengthening its reading and numeracy program through the Early Language, Literacy, and Numeracy Program. This program aims to improve reading and numeracy skills of Kinder to Grade 3 pupils, following K to 12 Basic Education Curriculum, and to establish a sustainable and cost-effective professional development system for teachers.

As such, DepEd acknowledges that learning to read, write, and count is critical to a child's success in school and later in life. One of the best predictors of school success is the level of a child's progress in these foundational skills. Although reading, writing and numeracy abilities increase as children grow, the early childhood years, from birth to age eight, comprise the most important period for language, literacy, and numeracy development. The ability to read, write, and count does not develop naturally, or without careful planning and instruction. The availability and accessibility of age-appropriate and culturally-sensitive materials for children are extremely important to encourage the regular practice of reading and counting.

Here, DepEd strengthens its literacy and numeracy programs through the Early Language, Literacy and Numeracy Program from Kinder to Grade 3, the first Key Stage of the K to 12 Basic Education Program. The components of the early language, literacy and numeracy program are establishment of baseline data such as teacher and pupils' profile, language used by learners, existing and functional reading and numeracy program, and support mechanisms at the ground level, materials development, development of classroom-based formative assessment protocol for literacy and numeracy skills, and professional development of teachers and school heads. Hence, this study to be undertaken will greatly help the DepEd realize its early literacy and numeracy program.

2. Literature Review

The following are the findings of the related studies reviewed by the researcher.

2.1. Content-Based Problem Solving Instruction in Mathematics

Content-Based Instruction (CBI) has become increasingly popular as a means of developing

linguistic ability. It is the teaching of content or information in the language being learned with little or no direct or explicit effort to teach the language itself separately from the content being taught (Richards & Rodgers, 2019). It is a powerful innovation in acquiring and enhancing a language. In its best form, language lessons are blended with stimulating content. The students focus on the subject matter than the language learning process. Supporting students' success by engaging them in challenging and informative activity helps them learn complex skills. The students learn language automatically. Keeping the students motivated and interested in the language training is the profound advantage of content-based instruction.

When students are interested and motivated in the material they are learning, they make greater connections to life situations, learning language becomes a fun and easy activity, information is retained for long time. It supports contextualized learning; students are taught useful language that is embedded within relevant discourse contexts rather than as isolated language fragments. Hence students make greater connections with the language and what they already know. This enhances the practical usability for the students. Content-based instruction has been described as a new paradigm in language education, centered on fostering student competence in a second or foreign language while advancing in the knowledge of a subject matter (Gall, 2019).

In the study conducted by Arianto (2019), the research aims at describing the implementation of content-based instruction in Mathematic teaching and learning process. Based on the study of the implementation of content-based instruction in Mathematics teaching and learning process, it can be concluded that: the implementation of content-based instruction in teaching and learning process can be seen in three learning steps, they are: opening, main activity and closing. In the opening, content-based instruction is implemented well. On the contrary, during main activity the teacher face some problems on implementing content-based instruction. These difficulties can be solved by applying some methods and uses some media. While in the closing, the teacher can implement content-based instruction well; the difficulties found in teaching and learning process viewed from students' perspective are: lack of vocabulary in mathematics concept, feeling nervous in expressing their idea orally and difficult in clarifying teacher's instruction. Then, the difficulties viewed from teacher's perspective are: lack of grammar and fluency, lack of authentic material and classroom management; proposed solutions by the teacher to overcome the problem are: provide some teaching media that accommodate content-based instruction, find another source as the authentic material, and join some training to improve the concept of mathematics in English. Based on the finding of the research, the writer would like to give the suggestion for the teacher and the students. It is important for the teacher to improve the ability on delivering the material in English. Furthermore, the teacher also needs to understand the students' ability well. And for the last, the teacher needs to find more the authentic material in order to make the materials closer to the students' daily life. Therefore, the students are motivated in joining the class and increasing their mastery in mathematics concept as well as English. For the students, they should practice and study more on the concept of mathematics in English. Moreover, they should not be afraid and nervous to present their ideas in English. They should be more active and confidence in showing their ideas orally even though they are not the native speaker.

Moreover, Amiri (2020) found out in his investigation to see if there was any significant difference between the students' achievement when taught through Content-based Instruction or Grammar-translation Method. Next, he explored the difference between the students' Language Learning Orientation before and after treatment via content-based Instruction and Grammar-translation Method. It was discovered that the content-based instruction group outperformed the grammar-translation model one. Thus, based on the findings, several conclusions can be drawn, and accordingly some implications can be put forward. At first, the content-based instruction proved to be much more influential in light of the students' performance in the final achievement test. So, it is recommended that it can be more practiced and implemented in classes if English for as Foreign Language teachers want their students to be successful learners in terms of learning the foreign language and consequently regarding their performance in examinations.

Secondly, since there was a change in the students' orientation and attitude toward learning English

using content-based instruction, it can be concluded that group work, cooperative learning, student involvement, providing comprehensible input, and teaching at the right level are the things more needed and welcomed by the students; and the students could achieve better scores. And finally, content-based instruction, if adopted carefully and well-planned, can provide the students with comprehensible learning tasks and activities stimulating both problem solving and critical thinking, resulting in more achievement in linguistic and content areas, as well as higher language learning orientations.

Additionally, the findings reported in the study of Maasum & Maarof (2021) revealed that there are many challenges faced by teachers when implementing the content-based instruction in the students' second language. This is more so when the students have varying level of English language proficiency. In a diversified second language literacy context, teachers must be well equipped with effective English language proficiency to cope with the students' varying level. Since English is used as a medium of instruction in this context, these teachers should have a certain level of effective English language proficiency in order to deliver the content subject matter, Mathematics and Science. Although many of the teachers responded that they need general English language skills, certain specific language aspects such as instructional vocabulary and phrases are important to facilitate learning. In addition, many of these teachers reported that they also require English for information search and for assessment purposes.

Specific language aspects for assessment is a crucial need as teachers are required to assess their students' level of understanding and comprehension of the content taught to them. As teachers and agents of change, they agree that English language proficiency is important to help them absorb and understand information and also deliver or transfer knowledge to students in the best possible manner. Without effective language skills, teachers are going to face many challenges in their pedagogical skills, such as to deliver the relevant content knowledge to the students. Based on the reported findings, the authors can say that these teachers face many challenges in teaching content subject matter such as Mathematics and Science in English if they are not well equipped with the appropriate level of language proficiency and relevant language aspects. The implications from this investigation is that more tailor-made in-service courses pertaining to English language proficiency should be offered to enhance their command of the language. By enhancing their language proficiency, teachers will be more confident and able to deliver their lessons in English more effectively.

2.2. Theme-Based Approach

It refers to the method of education that treats learning very differently from traditional subject-based learning. It considers the application of academic skills as a necessity. Language arts, mathematics and the fine arts are skills that can be applied to any theme regardless of the topic. It allows real-world application in the way that the learning takes place. This means that the child is empowered to use their education to make real-life changes to themselves, their community and perhaps even the world (Romani, 2022).

Moreover, in the study conducted by Chronaki (2020), she explores two mathematics teachers' ways of employing theme-based resources in their lessons. Based on the theme of art such as Roman Mosaics and decorative patterns that can exemplify aspects of symmetry, a set of activities was devised and offered to teachers for use. Teachers' ways of implementing these resources were charted through a long-term ethnographic study. Classroom observation, transcripts of classroom talk and interviewing were the main tools used to seek teachers' views and to characterize teaching. Analysis of data provides a detailed look at how teachers of diverse pedagogic orientations use thematic contexts in their teaching of mathematics. Specifically, the extent to which teachers' pedagogic styles influence their ways of placing theme and maths in lessons is being explored and discussed.

In the context of this paper by Chronaki (2020), it is important to ask what might be the effects of teaching in creating a space for all pupils to experience mathematics as part of the thematic context and thus enabling them to make and become aware of linkages between expressions of formal and informal

mathematical activity. Teacher-pupil interaction and other social interactions in the classroom such as whole class and group discussions entail opportunities for talking about mathematics within a thematic context and for constructing attitudes and understandings about subject content. Making good use of these opportunities seems to be not simply a matter of pedagogic style but also a matter of epistemological positioning. Teachers' and pupils' dispositions both in terms of epistemology and pedagogy can influence greatly the ways they manage ongoing discourse in their lessons organizing the curriculum, lessons and tasks, asking questions, talking with pupils.

In addition, the study conducted by Bobis (2019) has shown that teaching mathematics thematically is not easy. It is rather, a difficult pedagogical task due to its complexity and lack of structure. This seems to be particularly true, when low-achieving students in mathematics are the target group. Although teachers' responses showed a general appreciation for the humanistic goals of teaching thematically, they disagreed with the mandatory teaching requirements because of pressures originating from a range of instructional, curricula and organizational factors that affected their implementation of a thematic approach to teaching mathematics in secondary schools. In general, it seemed that despite the mandatory requirement to teach the course thematically, teachers typically utilized more traditional methods. That is, they taught via topics and tended to focus on procedural approaches based on rules and formula. The overarching aim of the study was to explore secondary mathematics teachers' beliefs and practices about the teaching and learning of mathematics thematically. The findings reported here provide insights into the barriers and challenges teachers face teaching mathematics, and in particular, teaching mathematics thematically. A limitation of the study lies in the self-report nature of teachers' beliefs and practices which cannot be immediately verified. Therefore, it is recommended that further research should be conducted to compare and supplement this information through observational methods. Such research would shed light on how teachers are actually enacting the thematic approach in their classrooms from a naturalistic perspective.

Meanwhile, Pomeroy (2021), in his study, used a pragmatic, mixed methods design to examine the relationship between thematic teaching and student engagement with two classes of low-achieving senior students in a New Zealand secondary school. It examined which student characteristics appeared to be related to whether students engaged with thematic teaching, and the reason students gave for their preferred teaching styles. Students experienced four thematic lessons with the theme of the human settlement of the Pacific Islands and four non-thematic lessons during a coordinate geometry topic. Each student's engagement was assessed every lesson using questionnaires and observations, and students were interviewed in order to elicit their views on thematic teaching. Collectively, no difference was found between student engagement in thematic and non-thematic teaching. However, many individual students found either thematic or non-thematic teaching more engaging. English language learners tended to prefer non-thematic teaching, some reporting that they found the theme an unhelpful complication. Students did not engage in learning when they did not understand the mathematical content, even when they were interested in the theme. The study augments the thematic mathematics teaching literature by examining variability in the apparent effects of thematic teaching, and articulating students' experiences of thematic teaching. It gives guarded support for the current policy emphasis on teaching mathematics contextually and reveals some potential pitfalls associated with teaching mathematics thematically.

Consequently, the purpose of the study conducted by Baskinger (2020) was to explore how teachers in Grades 3-8 in one New Jersey school district perceive theme-based lessons on student level of engagement and teaching pedagogy when using their own initiatives to develop a theme-based approach. The study found that all teachers were open to using theme-based lessons but felt the need for professional development and training to appropriately implement theme-based lessons. It was also found that all teachers perceived students as actively engaged during theme-based lessons and noted these experiences as positive. Findings suggest that theme-based lessons can create positive learning experiences and student outcomes but require a districtwide initiative led by the administration. This study identified a need for a problem-based learning initiative that offers professional development and training that supports a theme-based lesson approach for

the district.

2.3. Team-Teach Approach

It refers to teaching approach involving a group of instructors working purposefully, regularly, and cooperatively to help a group of students of any age learn. Teachers together set goals for a course, design syllabus, prepare individual lesson plans, teach students, and evaluate the results. They share insights, argue with one another, and perhaps even challenge students to decide which approach is better (Beggs, 2021).

The team-teaching approach allows for more interaction between teachers and students. Faculty evaluate students on their achievement of the learning goals; students evaluate faculty members on their teaching proficiency. Emphasis is on student and faculty growth, balancing initiative and shared responsibility, specialization and broadening horizons, the clear and interesting presentation of content and student development, democratic participation and common expectations, and cognitive, affective, and behavioral outcomes. This combination of analysis, synthesis, critical thinking, and practical applications can be done on all levels of education, from kindergarten through graduate school. Working as a team, teachers model respect for differences, interdependence, and conflict-resolution skills. Team members together set the course goals and content, select common materials such as texts and films, and develop tests and final examinations for all students. They set the sequence of topics and supplemental materials. They also give their own interpretations of the materials and use their own teaching styles. The greater the agreement on common objectives and interests, the more likely that teaching will be interdependent and coordinated (Buckley, 2018).

Teaching periods can be scheduled side by side or consecutively. For example, teachers of two similar classes may team up during the same or adjacent periods so that each teacher may focus on that phase of the course that he or she can best handle. Students can sometimes meet all together, sometimes in small groups supervised by individual teachers or teaching assistants, or they can work singly or together on projects in the library, laboratory, or fieldwork. Teachers can be at different sites, linked by video-conferencing, satellites, or the Internet. Breaking out of the taken-for-granted single-subject, single-course, single-teacher pattern encourages other innovations and experiments. For example, students can be split along or across lines of sex, age, culture, or other interests, then recombined to stimulate reflection. Remedial programs and honors sections provide other attractive opportunities to make available appropriate and effective curricula for students with special needs or interests. They can address different study skills and learning techniques. Team teaching can also offset the danger of imposing ideas, values, and mindsets on minorities or less powerful ethnic groups. Teachers of different backgrounds can culturally enrich one another and students (Davis, 2019).

Team teaching is where a group of lecturers works together to plan, conduct, and evaluate the learning activities of the same group of students in the same classroom. According to Francis (2020) team teaching is perceived as a pedagogical technique that shifts the role of instruction from the individual to a team provides students with the opportunity to take a more active role in learning. It can be a classroom instruction in which several teachers combine their individual subjects into one course which they teach as a team to a single group of students. In other words, brings together two or more colleagues working together, but sometimes also working with professional and or administrative colleagues to plan, conduct and evaluate the unit of study, including assessment, for the same group of students.

By its nature, team teaching assumes appropriate involvement of all colleagues in the team and good communication between them. It involves a group of instructors working purposely, regularly, cooperatively and complimentarily to teach a group of students. Teaming teachers together set goals for a course, design a syllabus or prepare lesson plan or guide, teach students and together evaluate the result. The concept of team teaching which is considered by Bessette (2018) as one of the distinct instructional models of co-teaching can best be made cleared with the prior -knowledge of co-teaching framework.

The term coteaching has attracted some teachers to treat it in different ways. In a different

description, Cook & Friend (2019) argue that a co-teaching system has two or more teachers to mutually convey substantive instruction to a heterogeneous group of pupils in one class. In other words, a co-teaching system has been established on highly substantial approaches and features that distinguish it from such a traditional interpretation.

A community of peers is important not only in terms of support, but also as a crucial source of generating ideas and criticism. It is assumed that teaching is one of the complicated processes taking place in schools and educational institutions (Darma, 2018). In the current and relatively traditional teaching model, one teacher is responsible for supervising all lessons over a specific time. The plan of the teaching process, its practice, and the expected evaluation are carried out by the same teacher. In other words, teaching is not critically reflected on by anyone except the lead teacher of the classroom.

The arrival of new strategies of teaching, issues of motivation, the satisfaction of students and academics' needs and other factors contributing to successful teaching activities all look forward to the creative genius of a single teacher. The seeming difficulty of addressing all these elements simultaneously by a single pedagogue appeals for a new alternative in the method of teaching (Nkechi, Lilian & Ngozy, 2019). They have shown that team teaching is an effective way of constructing deep learning of concepts while learning alternative ways to teach the same subject-matter. Developing co-generative dialoguing occurs to further develop existing understandings of the teaching situation.

Knowledge is collaboratively constructed between individuals from where it can be appropriated by each individual. Team teaching gives teachers the opportunities to act on their ideas and reflect in and upon their actions. Their understandings evolve through a meaning negotiation process, in which they discuss their own ideas and consider the ideas of others. Team teaching is different from single teacher teaching because it involves two or more teachers each with distinctive roles, sharing responsibilities for planning, presentation and evaluation of lessons for the same group of students. According to Brandenbury (2020) team teaching exposes students to a variety of teaching styles and approaches, which increases the potential for the team to meet the various learning styles of students. However, while team teaching may prove advantageous for many students, some may feel frustration and discontentment about having more than one teacher. But with proper collaboration and cohesiveness within a team, there are vital benefits for those willing to adopt team teaching approach especially for undergraduate classroom.

Hence, Hughes & Murwaski (2021) remarked that collaboration, cooperation and interaction distinguish team teaching from single teacher teaching. Beyond the advantages of creating, additional time for other academic activities and supportive environment it equally augments the opportunity for intellectual growth, increases students' teacher interaction, overcome isolation that is the norm in the conventional single teaching approach. For the students, team teaching in can open a student's eyes to accepting more than one opinion and to acting more cooperatively with others. It may even provide educational benefits such as increasing the student's level of understanding and retention, in addition to enabling the student to obtain higher academic achievement.

2.4. Skill-Based Approach

It refers to teaching a student a specific skill. It does not only allow educators or parents to teach a student how achieve the correct answer but also helps them to achieve the correct answer in every instance they see the same skill (Michel, 2021). It seeks to develop the ability of the learner to use a set of assets to solve a complex real-life situation, produce an expected result or face challenges. These assets can be cognitive: knowledge, technical skills, methodological skills, relational skills, emotional resources, etc., but also external: books, tools, documents, or a network of experts. We will see below what are the interests of this approach for the learner and for the organization.

Teaching and learning causes the student to acquire special knowledge and skills in building a new solution scheme inaccessible to his experience, new ways of acting and thinking. The foreground is not only

the actualization of previously acquired knowledge and already established methods of action, but also the promotion of the hypothesis; the idea is to formulate and develop an original plan for solving the problem, to find new independently discovered connections of solution verification and search, using the information provided and dependencies between the applicant, known and unknown. In the process of searching for knowledge and creating new ways of performing actions, the future specialist receives specific results in the form and new facts (Pascual et al., 2021).

Thus, already in the learning process, the future specialist rises to new levels of intellectual and personal development. As a third condition, the design of the content of the discipline in the formation of mathematical competencies was chosen. According to Verbitsky & Larinova (2019) adapting the notion of the teaching triangle in mathematics, placing teachers education content including the mathematical and didactical elements to be learned by prospective teachers and role of educator about previously occupied knowledge subject to be taught. An important question when choosing the training content is the question of how to establish a reasonable balance between the fundamental nature and professional orientation of mathematical training, without which it is impossible to achieve its high quality. Various means of vocational guidance training allow you to model the elements of the future professional activity of a specialist. These include, for example, business games. However, the specificity of mathematics is such that the most important means of modeling the mathematical product of future professional activity is the solution of professionally oriented problems.

In the Philippines, given the shift of language of instruction in the education curriculum today, it is important for teachers in mathematics education to consider in their research the consequences of this shift to the teaching and learning scape. It has been eight years when the K to 12 Basic Education Curriculum was implemented in the country and Mother Tongue-Based – Multilingual Education (MTB-MLE henceforth) was inherent to its enactment. During this period, many issues have been raised concerning its overall impact specifically on the learning and acquisition of one of the most challenging content areas, the mathematical skills of each learner. It has been a notion that mathematics education is not a stand-alone learning content in the curriculum but by its nature inter-disciplinary, and language as a learning tool plays a crucial aspect to consider for teaching and learning to be successful.

As teachers and frontlines of this new curriculum have many challenges met at hand that must be addressed systematically. Barwell & Clarkson (2019) recommend that research for mathematics must bring about information on the practices of teaching mathematics in multilingual classroom. Research into multilingualism within mathematics education has drawn on a variety of theoretical perspectives including bilingual education, theories of cognition and approaches to sociolinguistics. Investigation on these areas leads to identify theories relevant to work in mathematics education, application of these theories in mathematics education, the challenges which arise from working with theories from other disciplines and the different implications to mathematics teaching that focused on the role of the teacher in supporting mathematics learning in multilingual mathematics classrooms.

Although, the demands in research have become too challenging, it is but right to initially look at ‘ground zero’ of implementing mathematics education via MTB-MLE in the local setting. Despite the many claims on the effectiveness of using mother tongue as medium of instruction in the primary years, the problem on language proficiency as an obstacle to learning mathematics via the learner’s mother tongue is a challenge. Basically, many mathematical terms in English language have no specific translations in Bikol-Sorsoganon that caused great difficulty if the learner’s mother tongue is to be used exclusively to teach mathematical concepts.

In the study of Burton (2020), she included academic language as one difficulty in translating academic terminologies to Bikol. It pointed out that data consistently showed mathematics as well as science terms as the most difficult areas for using the mother tongue. The curriculum requires pupils to use Bikol numbers but in fact by itself is a challenge. In the classroom observation conducted by this study, pupils first counted objects in English spontaneously and then gave the final sum in Bikol as a mere translation of their

answers. Teachers insisted this as by itself a problem because the problem was on learning the numbers in Bikol rather than learning the concepts being taught. Likewise, this challenge has arisen because of a disjointed language pipeline in which pupils have learned key mathematical concepts in English at home and Bikol in school might really be confusing. Mathematics education begins in language; it advances and stumbles because of language, and its outcomes are often assessed in language. This statement captured the important role of language as a resource in the teaching and learning of Mathematics. There are also varying context in mathematics classroom brought about by the complicating factors concerning individual teachers as well as the different languages of communication used by pupils and teachers, and how both of them view and use them. It is useful to begin by looking deeply into teacher's role in situations and more researches are needed to clarify the roles that teacher may play.

Additionally, Setati & Adler (2020) discussed the language practices of teachers in some primary schools in South Africa where students' normal out-of class talk is in a non-English language, but the official teaching language is English. They were interested in the code-switching behavior of teachers suggested that it makes a lot of sense for teachers to encourage students to code-switch, and use this as a teaching strategy too, although there are challenges in this practice that cannot be overlooked.

For Gorgorio & Planas (2021), it is hard to separate the social, cultural and linguistic aspects of mathematics teaching and learning. They disclosed that a critical issue was the way teacher used precise and extended mathematical language in her verbal discourse with her class and promoted an expectation that the students would also use such language. The results of the investigation suggested that students did in the end use the formal mathematical language promoted by this teacher because the students were witnesses to deliberate examples of such discourse. Meanwhile, the Philippine context for teaching mathematics through MTB-MLE needs to be looked into because the country is yet conceiving the academic and life-long effects of this new language policy to the numeracy skills of every Filipino. In the prevailing language policy of the country, the MTB-MLE shall be implemented into two modes: as a learning/subject area and as a medium of instruction. The learner's Mother Tongue (L1) shall be used as the medium of instruction (MOI henceforth) in all domains/learning areas from Kindergarten through Grade 3 except Filipino (L2) and English (L3).

To comply with the guidelines, Mathematics as a specific learning area is taught using the pupil's L1 from Kindergarten to Grade 3. As earlier mentioned, there are still grey areas for further investigation as to the implementation of MTB-MLE not only as a subject but as MOI. Specifically, for Mathematics which basic terms are in English language and Bikol as a language has limited and no exact translation or if there may be, are not familiar to pupils because their home languages are no longer the 'now archaic Bikol' but are being used as MOI. Also, more of the primary pupils are raised with Bikol, Filipino and English used all together in everyday conversation at home, with friends and other people in the community due to the proliferation of social media, people's mobility, marriage, employment and the like that makes people vulnerable to learning different languages and unknowingly use them interchangeably. From this real scenario, teachers are faced with pupils whose L1 is not the Bikol variations that they expect their pupils to speak and their pupils come from varied home languages and culture.

2.5. Effectiveness of Content-Based Instruction in Mathematics

According to Wesche (2019) content- based language teaching claims that students both gain content knowledge and increased language proficiency. The action research was conducted by Adhikary (2021) to find out the strengths and weaknesses of content-based instruction on teaching reading. After the completion of teaching, a post-test was administered. The results of both the tests were compared to determine the effectiveness of content-based instruction on teaching reading. Content-based instruction was found to be effective in teaching reading.

In recent years, especially in the last decade, increasing numbers of language teachers have turned to content-based instruction to promote meaningful student engagement with language and content learning.

Through content-based instruction, learners develop language skills while simultaneously becoming more knowledgeable experts in a chosen academic field. In this method, professional teachers tend to create vibrant learning environments that require active student involvement, stimulate higher level thinking skills, and give students (Brinton, Snow & Wesche, 2020).

Education is becoming more international, multilingual, and multicultural. More students are spending time learning through another language: reading a textbook, a newspaper, or a journal in another language, having some or all their curriculum taught in another language, accessing foreign language material on the Internet, communicating in a foreign language with native speakers in other parts of the world, learning about another culture through musical lyrics in a foreign language, acting out some parts of dramas or musicals in their second language, and so on. These essential goals in our new century can be attained with the method of content-based instruction. Three fundamental assumptions support these attainable and desirable achievements such as language is a matter of meaning as well as of form, discourse does not just express the meaning of the notion but can help to create meaning in the mind, and as we acquire new areas of knowledge, we acquire new areas of language and meaning (Stoller, 2021).

As the content-based instruction uses a well-defined content and as it is the base of this method of language teaching, all content-instructors should check and evaluate the level of knowledge. The most important factor to decide and determine what exactly should be tested. Language acquisition or content, obviously, neither the separate parts of language acquisition nor the knowledge of the content-centered subject can play a dominant role in testing. The entire complex competency of problem solving has the priority when the instructors correct and evaluate the academic performance of their students (Swain, 2021).

Content-Based Instruction contextualized learning; students are taught useful language that is embedded within relevant discourse contexts rather than as isolated language fragments. Hence students make greater connections within the language and what they already know. This enhances the practical usability for the students. Content- Based Instruction has been described as a new paradigm in language education, focused on fostering students' competence in a second or foreign language while advancing the knowledge of a subject matter. This approach is widely used in an extensive number of contexts and educational settings all over the world in a variety of models. (Duenas, 2021).

Realizing the classroom members are non-native speakers, the teaching and learning process is sometimes quite difficult to implement both for the teachers and the students, especially in delivering the non-English Subjects such as Mathematics and Sciences. The difficulties even appear at the lowest level of delivering the material of teaching and learning process, such as questioning. The role of questioning in teaching and learning process is very important for teachers and students. It is widely accepted that questioning is a basic skill that teachers are obliged to have in the classroom (Gall, 2019).

The role of the foreign language teacher is central to the learning process. The teacher must be able to create a situation where students like and respect learning. This requires teacher's creativity. Moreover, the teacher must bring about changes or modification in behavior, habits, attitudes, or skills in unfamiliar me dium requiring additional or different psychological activity. The main view of Content-Based Instruction is not clearly focused on language learning, some students may feel confused or may even feel that they are not improving their language skills. Sticht (2021) provided a perspective from cognitive science that emphasizes the importance of both content and processes in human cognitive activity, including literacy then he discussed a program of research on content-based instruction which has been considered influential for workplace, health, and family literacy programs that integrate content with basic skills instruction. This research was to apply concepts from both behavioral and cognitive science to the development and evaluation of an entire, operational adult literacy program.

Rochmandani (2021) reported about Content Based Instruction (CBI) approach to improve students' speaking ability. It also aims to give general description about the implementation of CBI in the classroom and about the things happening in the class when it is implemented. The result of the research shows that Content Based Instruction can improve students' speaking skill. Besides, their test achievement during the

research is better than their score in the teacher's note before the actions were implemented.

In addition, a study conducted by Arianto (2021) also reported about the implementation of CBI in Mathematic teaching and learning, he further investigated difficulties faced by the teacher and offered problem solving towards the difficulties. The result of his study showed that the implementation of Content-Based Instruction on Mathematics teaching and learning process gives new paradigm on learning English through content itself. This study focused on the effect of implement Content-Based Instruction for young learners, concerning on how Content-Based Instruction implemented in the fifth grade of Madrasah International Class Program.

Bojonegoro (2020) and also investigates to what extent does Content-Based Instruction give an effect to the students' English development. The name International Class Program means that this school offers different ways in their teaching and learning. This school applied Cambridge Curriculum with all the materials of the subjects are served in English except Indonesian Language. The interaction both the teachers and the students and also between the students were using English in the teaching and learning process. It was very interesting to investigate the approach implemented and the effect for the students.

2.6. Synthesis

The review of related literature provided the researcher a deeper insight of the variables under investigation which is on the content-based instruction in Mathematics learning area. The authors like Richards & Rodgers (2019), Gall (2019), Arianto (2019), Amiri (2020), and Maasum & Maarof (2021) expounded on the content-based instruction approaches. This is followed by explanations and research-based findings on theme-based approach from authors like Romani (2022), Chronaki (2020), Bobis (2019), Pomeroy (2021), and Baskinger (2020). In addition, team-teach approach is discussed in the findings of Beggs (2021), Buckley (2018), Davis (2019), Francis (2020), Bessette (2018), Cook & Friend (2019), Darma (2018), and Nkechi, Lilian & Ngozy (2019). Skill-based approach is stressed in the findings of Michel (2021), Pascual et al (20210, Verbitsky & Larinova (2019), Barwell & Clarkson (2019), and Burton (2020).

Meanwhile, the effectiveness of content-based instruction in Mathematics is discussed in the findings of the authors like Adhikary (2021), Brinton, Snow & Wesche (2020), Stoller (2021), Swain (2021), and Duenas (2021). These reviewed related literatures were found to be similar to the present study for they all focused on the content-based instruction and its effectiveness as an approach in teaching Mathematics. However, the related literature reviewed were different from the present study since the latter delves only on the selected group of respondents who are the Grade 2 pupils from the Fourth Congressional District of Batangas public elementary schools.

2.7. Theoretical Framework

The review of the theoretical frameworks provided the researcher to select which framework is the most appropriate one. All the reviewed frameworks are considered appropriate for the study. However, the researcher chose the Content-Based Language Teaching or CBLT designed by Brinton, Snow & Wesche in 1989. This teaching theory is designed to provide second-language learners instruction in content and language. It is considered an empowering approach which encourages learners to learn a language by using it as a real means of communication from the very first day in class. The idea is to make them become independent learners so they can continue the learning process even outside the class.

The benefits of the use of content-based approach in teaching mathematics included learners are exposed to a considerable amount of language through stimulating content. Learners explore interesting content and are engaged in appropriate language-dependent activities. Languages are not learned through direct instruction, but rather acquired naturally or automatically. It supports contextualized learning; learners are taught useful language that is embedded within relevant discourse contexts rather than presented as isolated

language fragments. Hence students make greater connections with the language and what they already know. Complex information is delivered through real life contexts for the students to grasp easily, thereby leading to intrinsic motivation. In content-based instruction information is reiterated by strategically delivering information at the right time and through situations compelling the students to learn out of passion. Greater flexibility and adaptability in the curriculum can be deployed as per the student's interest.

Finally, the goal of content-based instruction approach is to prepare the students to acquire the language while using the context of any subject matter so that students learn the language by using it within the specific context. Rather than learning a language out of context, it is learned within the context of a specific academic subject. Hence, this theory is applicable to the objectives and variables of this present study.

2.8. Conceptual Framework

This study uses the interrelatedness of the variables of the study as its conceptual framework.

There are three boxes in the initial conceptual framework that carry the variables being investigated in the present study. The first one is on the extent of the teachers' use of content-based instructions approach in teaching problem solving skills in Mathematics for Grade 2 learners. These include the theme-based approach, team-teach approach, and the skill-based approach. This assessment leads to the variable on the extent of learners' demonstration of the content-based problem-solving skills in Mathematics as an offshoot of their teachers using to them the approaches. In doing so, the learners will be able to show the effectiveness of the content-based instruction in Mathematics as shown in their academic performance in the said learning area.

With all of these variables interacting each other and then affecting each one of them, the researcher will be able to craft a proposed action plan on the use of the content-based problem-solving instruction in Mathematics. The findings of the study based on the data gathered will be used as input to the action plan to be crafted.

Figure 1 shows the conceptual framework of the study.

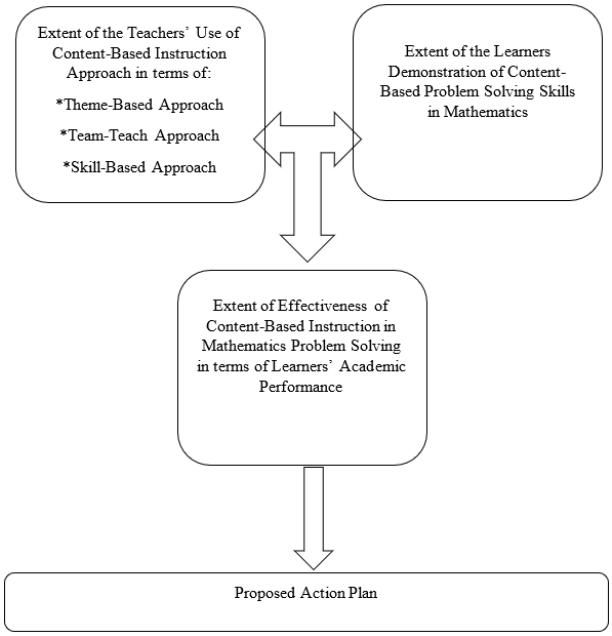

Figure 1. The Conceptual Framework

2.9. Statement of the Problem

This study aimed to assess the effectiveness of content-based problem solving instruction in Mathematics among the Grade 2 learners with the end view of crafting a plan of action based on the findings.

Specifically, the following are the questions answered.

1. To what extent has the teachers used content-based instruction approach in teaching problem solving in Mathematics terms of:

1.1 theme-based approach;

1.2 team-teach approach; and

1.4 skill-based approach?

2. To what extent has the learner demonstrates content-based problem solving skills in Mathematics?

3. What is the extent of effectiveness of content-based instruction in Mathematics problem solving in terms of the learners' academic performance in the learning area?

4. Based on the findings, what plan of action may be proposed on the use of content-based problem solving instruction in Mathematics?

2.10. Hypothesis

1. The use of content-based instruction in teaching problem solving skills has no significant effect to the academic performance of the Grade 2 learners.

2.11. Significance of the Study

This study on the effectiveness of content-based problem-solving instruction is significant to the following.

The Schools Division of Batangas. The output of this study, which is the proposed plan of action on the use of content-based problem-solving in Mathematics may help the administration in looking at institutionalizing the content-based instruction in Mathematics for the schools division.

The Mathematics Teachers. They will be helped by the proposed action plan on the use of content-based instruction in problem-solving in Mathematics which they can use as an approach to teaching the learners.

The Elementary Learners. Instruction in Mathematics specifically the problem-solving skills will be made easy for them using the content-based instruction. This will also help them gain improved academic performance in Mathematics.

The Researcher. This scholastic endeavor will enable the researcher to contribute positively to the teaching of the learning are wherein she is one of the teachers.

The Future Researchers. They will benefit from this study and may use this topic to replicate in their own locale.

Scope and Limitations

The scope of this study consisted of the location which is the Fourth Congressional District of Batangas. The respondents were the Grade 2 Mathematics from the public elementary schools of the Fourth Congressional District of Batangas. The area of the study is the Mathematics subject in the elementary curriculum specifically Grade 2.

As for the limitation of the study, the proposed action plan crafted by the researcher was based only on the assessments to be made by the Mathematics teachers who were the respondents of the study. The researcher further assumed that the respondents gave their most honest assessment of the variables of the present study.

2.12. Definition of Terms

The following are the terms used in the study and hereby defined operationally.

Academic Performance. The numerical mark or grade obtained by the Grade 2 learners in Mathematics in a given quarter based on the specified grading system by the DepEd.

Action Plan. It is the output of the study which the researcher will be crafting based on the findings of the study. It aims to help the Mathematics teachers improve the problem-solving skills in Mathematics by the Grade 2 learners.

Content-Based Instruction. The Grade 2 Mathematics teachers teach the English language using the content of the problem-solving topic in Mathematics.

Effectiveness of Content-Based Instruction. Grade 2 learners are able to gain content knowledge and increased language proficiency.

Problem-Solving Instruction. The Grade 2 Mathematics teachers teach the learners to solve worded problems in Mathematics in which the problems are expressed in English.

Skill-Based Approach. The Grade 2 Mathematics teachers teaching the Grade 2 learners a specific skill such as the problem-solving skills.

Team-Teach Approach. The Grade 2 Mathematics teachers work purposely, regularly an cooperatively as a group to help the Grade 2 learners in problem-solving in Mathematics.

Theme-Based Approach. A content-based instruction used by the Grade 2 Mathematics teachers wherein real-world.

3. Research Methodology

This chapter presents the overall picture of methods and procedures that were used in the study. It includes the research design, population and sampling technique, instrumentation, data gathering procedures, and statistical treatment of data.

3.1. Research Design

This study employed the use of descriptive quantitative research method with questionnaire as the main data gathering instrument. Baraceros (2019) expounded that descriptive research design is a type of research design that aims to obtain information to systematically describe a phenomenon, situation, or population. It helps answer the what, when, where, and how questions regarding the research problem rather than the why. Moreover, quantitative research is a way of making any phenomenon or any sensory experience clearer or more meaningful by gathering and examining facts and information about such person, thing, place, or event appealing to senses. It seeks to find answers to questions starting with how many, how much, how long, to what extent, and the like. Answers to these questions come in numerals, percentages, and fractions among others (Russell, 2020).

In addition, the use of questionnaire as the main data gathering helped the researcher obtain the needed data for the completion of the study. A questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. A research questionnaire is typically a mix of close-ended questions and open-ended questions. The use of questionnaire allows for the researcher to gather a lot of data in less time. The responses can be compared with the historical data and understand the shift in respondents' choices and experiences (Goodwin & Goodwin, 2020).

Hence, the researcher decided to use the descriptive quantitative research design and survey questionnaire as a means of data gathering in order to attain the objectives of the study. Most of the past researches and writings about the use of content-based problem-solving instruction among Grade 2 pupils adopted a quantitative approach (Adhikary, 2021; Brinton, Snow & Wesche, 2020; Stoller, 2021; and Swain,

2021).

3.2. Population, Samples and Sampling Technique

The population utilized in the study were the Grade 2 Mathematics teachers from Malvar District Division of Batangas public elementary schools. A total of 113 Grade 2 Mathematics teachers were asked to participate in the study. According to Bhandari (2022), a population is the entire group that the researcher want to draw conclusions about.

Moreover, the samples or the specific group that the researcher wants to collect data from. In this study, the researcher will utilize the total population sampling method from which the samples are derived from the Grade 2 Mathematics teachers. According to Lavrakas (2018), total population sampling is a type of purposive sampling where the whole population of interest is studied. It is most practical when the total population is of manageable size such as a well-defined subgroup of a larger population. Hence, this study utilized as its respondents the total population of Grade 2 Mathematics teachers from the selected public elementary schools in the Fourth Congressional District of Batangas.

3.3. Research Instrument

A survey questionnaire is the main data gathering research instrument to be used in this study. In the construction of the questionnaire, the researcher used simple words that can be easily understood by the respondents. The questionnaire will be consisted of three (3) parts with ten (10) items about the extent has the teachers used content-based instruction approach in teaching problem solving in Mathematics in terms of theme-based approach, team-teach approach, and skill-based approach. Another ten (10) items will were on the extent has the learner demonstrates content-based problem solving skills in Mathematics. These items will be taken from the related literature reviewed by the researcher. The last was on the extent of effectiveness of content-based instruction in Mathematics problem solving in terms of the learners' academic performance in the learning area. The respondents will provide the First Quarter grades in Mathematics of their Grade 2 learners.

Validity Test. The questionnaire constructed was validated by the research evaluator, the researcher's school head who have vast and wide experience in the filed of teaching and learning and education, and language or grammarian for the technical aspect of the questionnaire. After the approval of the study, the instrument was validated using the responses of ten (10) non-sample respondents. The questionnaire was considered valid once the t-test is significant, that is, the respondents were in an agreement with the construction of the questions.

Reliability Test. The reliability of the constructed questionnaire was subjected to Cronbach Alpha test to find its reliability. The result of 0.70 or greater marked that the constructed questionnaire is reliable.

3.4. Data Gathering Procedure

The questionnaire was distributed to the target respondents who are the Grade 2 Mathematics teachers from the public elementary schools in Malvar District. The researcher conducted an in-person administration of the questionnaire to the selected public elementary schools. She wrote a letter of permission addressed to the Public Schools District Supervisor (PSDS) of the said district. This was also to inform the said office that the researcher is one of the teachers from the Malvar district. The signed letter was then forwarded to the school heads of the selected schools for their approval. Once permitted, the researcher proceeded to asking the Grade 2 Mathematics teachers to answer the questionnaire. Informed consent from the teachers was sought prior to the administration of the questionnaire.

Participation in the survey was voluntary and participants were given the opportunity to withdraw at

any time during the conduct of the research. Data privacy and anonymity of the participants were assured. Any offensive, discriminatory or unacceptable language will be avoided in the creation of the questionnaire. The research also underwent review and approval ensuring the safety of the participants of the study, hence, in-person data gathering will be done. All personal data of participants were obtained through informed consent with the assurance that they were handled following data privacy guidelines.

3.5. Statistical Treatment

The following are the statistical measures used in the study.

Percentage. This was used to determine the number of times a response is chosen by the respondents.

Ranking. This was used to understand respondents' assessment to rank a set of items according to a certain preference criterion.

Mean. This was used to assess the responses on the extent of the study's variables. This was used to answer problem statement number one (1), two (2), and three (3).

Standard Deviation. This was used to determine if the data has a normal curve of other mathematical relationship.

Likert Scale. The Likert scale of the following points, range, and adjectival equivalent was used.

Data Points	Range	Adjectival Equivalent
5	4.50 – 5.00	very high extent
4	3.50 – 4.49	high extent
3	2.50 – 3.49	some extent
2	1.50 – 2.49	low extent
1	1.00 – 1.49	very low extent

4. Results and Discussions

This chapter presents the data gathered from the respondents which are further analyzed and discussed herein.

1. Teachers' Use of Content-Based Instruction in Teaching Problem Solving in Mathematics. The following tables present the data gathered.

1.1 Theme-Based Approach. Table 1.1 presents the data gathered on the use of teachers of the content-based instruction in teaching problem solving in Mathematics in terms of theme-based approach.

Table 1.1
Teachers' Use of Content-Based Instruction in Teaching Problem Solving in Mathematics in terms of Theme-Based Approach

Indicators	Weighted Mean	Verbal Interpretation	Rank
The Mathematics teacher…			
1.1 allows pedagogic styles to influence their ways of placing theme in lessons.	3.86	high extent	9
1.2 creates a space for all pupils to experience mathematics as part of the thematic context.	3.92	high extent	2
1.3 enables pupils to make and become aware of linkages between expressions of formal and informal mathematical ability.	3.91	high extent	5

1.4 allows interaction in the classroom such as whole class and group discussions to talk about mathematics within a thematic context.	3.90	high extent	7.5
1.5 creates positive learning experiences and student outcomes.	3.91	high extent	5
1.6 combines teaching and learning so much more effective by making learners happy and confident.	3.92	high extent	2
1.7 harnesses curiosity to motivate learning by starting on a journey of collecting ideas and information.	3.90	high extent	6.5
1.8 becomes a learning manager and not anymore a learning provider by guiding pupils in their learning.	3.83	high extent	10
1.9 makes children to think for themselves by following a thread of topic to explore and discover more.	4.00	high extent	1
1.10 draws the parents more easily to become partners in learning around a theme.	3.92	high extent	2
Composite Mean	**3.91**	**high extent**	**5**

The table presented shows that the teachers' use of content-based instruction in teaching problem solving in Mathematics in terms of theme-based approach is as seen to a high extent. This is reflected by the composite mean of 3.91 that the indicators obtained. It implies that the Mathematics teachers utilized theme-based instruction in problem solving among the Grade 2 learners.

Additionally, the highest rated indicator is on makes chidren to think for themselves by following a thread of topic to explore and discover more. This obtained a mean of 4.00 which makes it the rank one (1). It means that the use of theme-based instruction helps the Grade 2 pupils to think for themselves and that they follow a thread of topic to explore and discover more.

According to Romani (2022), language arts, mathematics and the fine arts are skills that can be applied to any theme regardless of the topic. It allows real-world application in the way that the learning takes place. This means that the child is empowered to use their education to make real-life changes to themselves, their community and perhaps even the world

But then, the least rated among the indicators is on becomes a learning manager and not anymore a learning provided by guiding pupils in their learning. This obtained a mean of 3.83 which means as seen to a high extent. But then this was rated the least among the indicators. It means that this has to be taken into consideration by the teachers teaching Mathematics.

This finding is supported by Chronaki (2020), who posited that it is important to ask what might be the effects of teaching in creating a space for all pupils to experience mathematics as part of the thematic context and thus enabling them to make and become aware of linkages between expressions of formal and informal mathematical activity. Teacher-pupil interaction and other social interactions in the classroom such as whole class and group discussions entail opportunities for talking about mathematics within a thematic context and for constructing attitudes and understandings about subject content.

Making good use of these opportunities seems to be not simply a matter of pedagogic style but also a matter of epistemological positioning. Teachers' and pupils' dispositions both in terms of epistemology and pedagogy can influence greatly the ways they manage ongoing discourse in their lessons organizing the curriculum, lessons and tasks, asking questions, talking with pupils.

1.2 Team-Teach Approach. Table 1.2 presents the data gathered on the use of teachers of the content-based instruction in teaching problem solving in Mathematics in terms of team-teach approach.

Table 1.2
Teachers' Use of Content-Based Instruction in Teaching Problem Solving in Mathematics in terms of Team-Teach Approach

Indicators	Weighted Mean	Verbal Interpretation	Rank
The Mathematics teacher…			
2.1 has more time to interact with the pupils.	3.83	high extent	10
2.2 gives a more focused teaching with the pupils when they team up.	4.00	high extent	4.5
2.3 improves the quality of teaching as various teachers approach the same topic from different angles.	4.00	high extent	4.5
2.4 encourages more active class participation and independent thinking from students.	3.92	high extent	7.5
2.5 reduces student-teacher personality problems due to the presence of another teacher.	3.92	high extent	7.5
2.6 allows pupils to learn new perspectives and insights, techniques and values from watching one another.	4.08	high extent	2
2.7 encourages pupils to move beyond communicating facts to tap into their life experience.	4.07	high extent	3
2.8 is able to attend to problem of the pupils while the class goes on.	3.98	high extent	6
2.9 enhances the quality of learning in mathematics.	4.28	high extent	1
2.10 encourages pupils to flourish in a highly structured environment that favors repetition.	3.90	high extent	9
Composite Mean	**4.00**	**high extent**	

The table presented shows the teachers' use of content-based instruction in teaching problem solving in Mathematics in terms of team-teach approach. It could be gleaned from the table presented that the use of team-teach approach in teaching problem solving among the Grade 2 pupils is to a high extent. This is evident with the composite mean of 4.00 that the indicators obtained.

Consequently, the highest rated indicator is on enhances the quality of learning in Mathematics with a mean of 4.28 and a rank of one (1). This means that the use of team-teach approach helps in enhancing the quality of learning in mathematics. Teachers together set goals for a course, design syllabus, prepare individual lesson plans, teach students, and evaluate the results. They share insights, argue with one another, and perhaps even challenge students to decide which approach is better.

According to Davis (2019), teaching periods can be scheduled side by side or consecutively. For example, teachers of two similar classes may team up during the same or adjacent periods so that each teacher may focus on that phase of the course that he or she can best handle. Students can sometimes meet all together, sometimes in small groups supervised by individual teachers or teaching assistants, or they can work singly or together on projects in the library, laboratory, or fieldwork. Teachers can be at different sites, linked by video-conferencing, satellites, or the Internet.

On the other hand, the least rated indicator is on has more time to interact with the pupils. This obtained a mean of 3.83 and as seen to a high extent. But then, since it placed into the least rank then it

needed to be looked into. Davis (2019) suggested that students can be split along or across lines of sex, age, culture, or other interests, then recombined to stimulate reflection. Remedial programs and honors sections provide other attractive opportunities to make available appropriate and effective curricula for students with special needs or interests. They can address different study skills and learning techniques. Team teaching can also offset the danger of imposing ideas, values, and mindsets on minorities or less powerful ethnic groups. Teachers of different backgrounds can culturally enrich one another and students.

This finding is also supported by Brandenburry (2020) who posited that team teaching exposes students to a variety of teaching styles and approaches, which increases the potential for the team to meet the various learning styles of students. However, while team teaching may prove advantageous for many students, some may feel frustration and discontentment about having more than one teacher. But with proper collaboration and cohesiveness within a team, there are vital benefits for those willing to adopt team teaching approach especially for undergraduate classroom.

1.3 Skill-Based Approach. Table 1.3 presents the data gathered on the use of content-based instruction in Mathematics problem solving in terms of skill-based approach.

Table 1.3
Teachers' Use of Content-Based Instruction in Teaching Problem Solving in Mathematics in terms of Skill-Based Approach

Indicators	Weighted Mean	Verbal Interpretation	Rank
The Mathematics teacher…			
3.1 helps learners not only to achieve the correct answer but also in every instance they see the same skill.	4.28	high extent	1
3.2 develops among the learners the ability to use a set of assets to solve a complex real-life situation and produce an expected result or face challenges.	3.53	high extent	3
3.3 causes the learners to acquire special knowledge and skills in building a new solution scheme.	3.52	high extent	4
3.4 allows learners to solve wide range of didactic problems through skill training.	3.36	high extent	7
3.5 allows students to solve real-world and mathematical problem involving the four operations with rational numbers.	3.14	high extent	9
3.6 helps students apply and extend previous understandings of operations to solve problems using addition, subtraction, multiplication and division of rational numbers.	3.00	high extent	10
3.7 fills in the gaps to meet the needs of the learners.	3.18	high extent	8
3.8 diagnoses the skill problem of the learners in mathematics.	3.42	high extent	6
3.9 is able to personalize the recovery plan for each learner.	3.56	high extent	2
3.10 supports learners with special needs in the class.	3.45	high extent	5
Composite Mean	**3.44**	**high extent**	

Table 1.3 shows that the use of content-based instruction in Mathematics problem solving in terms of skill-based approach is to a high extent. This is reflected by the composite mean of 3.44 that the indicators obtained. It implies that the pupils are able to gain skills in problem solving in Mathematics by means of the skill-based approach content-based instruction.

Additionally, the highest rated indicator is on helps learners not only to achieve the correct answer but also every instance they see the same skill. This obtained a mean of 4.28 which means to a high extent. This implies that the use of skill-based approach in teaching problem solving helps the learners to achieve the correct answer as well as in the same skill.

Teaching and learning causes the student to acquire special knowledge and skills in building a new solution scheme inaccessible to his experience, new ways of acting and thinking. The foreground is not only the actualization of previously acquired knowledge and already established methods of action, but also the promotion of the hypothesis; the idea is to formulate and develop an original plan for solving the problem, to find new independently discovered connections of solution verification and search, using the information provided and dependencies between the applicant, known and unknown.

On the other hand, the least rated indicator is on helps students apply and extend previous understandings of operations to solve problem using addition, subtraction, multiplication and division of rational numbers. This obtained a mean of 3.00 which placed it in rank 10. This means that the Mathematics teachers are able to help students apply and extend previous understandings of operations to solve problem using addition, subtraction, multiplication and division of rational numbers to a high extent. Yet there is a perceived need to enhance this indicator among the Grade 2 learners.

Mathematics education begins in language; it advances and stumbles because of language, and its outcomes are often assessed in language. This statement captured the important role of language as a resource in the teaching and learning of Mathematics. There are also varying context in mathematics classroom brought about by the complicating factors concerning individual teachers as well as the different languages of communication used by pupils and teachers, and how both of them view and use them. It is useful to begin by looking deeply into teacher's role in situations and more researches are needed to clarify the roles that teacher may play.

This finding is supported by Setati & Adler (2020) who discussed the language practices of teachers in some primary schools in South Africa where students' normal out-of class talk is in a non-English language, but the official teaching language is English. They were interested in the code-switching behavior of teachers suggested that it makes a lot of sense for teachers to encourage students to code-switch, and use this as a teaching strategy too, although there are challenges in this practice that cannot be overlooked.

2. Learners Demonstration of Content-Based Problem Solving Skills in Mathematics. Table 2 presents the data gathered on the learners demonstration of content-based problem solving skills in Mathematics.

Table 2
Learners Demonstration of Content-Based Problem Solving Skills in Mathematics

Indicators	Weighted Mean	Verbal Interpretation	Rank
The learners…			
1.1 look at two number set side-by-side inside a box and separated by a dotted line, circle the one that is less or both numbers if they are the same.	3.65	high extent	2
1.2 see a three-number sequence, with one number missing, and write the missing number in the blank.	4.26	high extent	1
1.3 look at pictured stacks of hundreds, tens, and ones up to 999, then write the number that shows how many.	3.54	high extent	3

1.4 look at 40 addition and subtraction problems on a page, compute and write the answer below each problem.	3.40	high extent	5
1.5 respond to 40 items that asses a broad array of mathematics concepts and skills.	3.29	high extent	7
1.6 identify and explain the operational signs in problems.	3.41	high extent	4
1.7 write number sentences and equations for addition and related subtraction number combinations.	3.34	high extent	6
1.8 identify and apply counting and cognitive strategies for types of problems.	3.25	high extent	8
1.9 use models, properties of operations, and strategies to solve two-digit addition with and without regrouping.	3.19	high extent	9
1.10 use model, properties of operations, and strategies to solve two-digit subtraction with and without regrouping.	3.20	high extent	10
Composite Mean	**3.45**	high extent	

The table presented shows that the learners demonstrated content-based problem solving skills in Mathematics to a high extent. This is evident with the composite mean of 3.45 that the indicators obtained. This means that the learners are able to demonstrate their problem solving skills to a high extent.

On top of the indicators is on the learners see a three-number sequence, with one number missing, and write the missing number in the blank. This obtained a rating of 4.26 and a rank of one (1). This means that the learners are able to demonstrate this skill as an offshoot of the approach of content-based instruction. Content- based language teaching claims that students both gain content knowledge and increased language proficiency.

According to Swain (2020), language acquisition or content, obviously, neither the separate parts of language acquisition nor the knowledge of the content-centered subject can play a dominant role in testing. The entire complex competency of problem solving has the priority when the instructors correct and evaluate the academic performance of their students.

However, the least rated indicator is on learners use model, properties of operations, and strategies to solve two-digit subtraction with and without regrouping. This obtained a mean of 3.20 which made it to the last rank of 10. This means that although the indicator obtained a high extent there seems to be a need for the teachers to enhance on this indicator.

Content-Based Instruction contextualized learning; students are taught useful language that is embedded within relevant discourse contexts rather than as isolated language fragments. Hence students make greater connections within the language and what they already know. This enhances the practical usability for the students. Content- Based Instruction has been described as a new paradigm in language education, focused on fostering students' competence in a second or foreign language while advancing the knowledge of a subject matter.

This finding is supported by Gall (2019) who posited that the role of questioning in teaching and learning process is very important for teachers and students. It is widely accepted that questioning is a basic skill that teachers are obliged to have in the classroom.

3. Effectiveness of Content-Based Instruction in Mathematics Problem Solving in terms of Learners' Academic Performance in the Learning Area. Table 3 presents the academic performance of the

Grade 2 pupils in terms of the effectiveness of content-based instruction in Mathematics problem solving.

Table 3
Effectiveness of Content-Based Instruction in Mathematics Problem Solving in terms of the Learners' Academic Performance in the Learning Area

Final Grade in Mathematics	f	%
93 -100 (Excellent)	35	33.01
87 - 92 (Very Satisfactory)	48	45.28
81 - 86 (Satisfactory)	23	21.71
75 - 80 (Fair)	0	0
70 - 74 (Poor)	0	0
Total	**106**	**100.00**
	Mean Grade = 88.80 (Very Satisfactory)	

The data presented shows that there is a very satisfactory academic performance by the Grade 2 learners as evidence by the effectiveness of content-based instruction in Mathematics problem solving. This is reflected by the mean grade of 88.80 that the academic performance of the learners obtained. This implies the effectiveness of the use of content-based instruction in Mathematics problem solving.

It can be deduced further that a large number of the pupils obtined a very satisfactory academic performance as reflected by the 48 or 45.28 percent who obtained the grades of 87-92. This is followed by 35 or 33.01 percent who obtained grades of 93-100 or excellent academic performance. Last is the satisfactory academic performance or 81-86 grades with 23 or 21.71 percent. This implies that the academic performance of the learners are towards the upper level.

Moreover, there is no learner who obtained academic performance of fair and poor. This attested to the effectiveness of content-based instruction in Mathematics problem solving in terms of learners' academic performance in the learning area.

According to Arianto (2021) implementation of Content-Based Instruction on Mathematics teaching and learning process gives new paradigm on learning English through content itself.

In addition, Rochmandani (2021) also found out that Content Based Instruction can improve students' speaking skill. Besides, their test achievement during the research is better than their score in the teacher's note before the actions were implemented.

4. Proposed Plan of Action on the Use of Content-Based Problem Solving Instruction in Mathematics. Table 4 presents the output of the study which is a proposed plan of action.

Table 4
Proposed Plan of Action on the Use of Content-Based Problem Solving

Areas of Concern	Objectives	Strategies/ Activities	Person/s Involved	Resources and Budgetary	Time Frame/ Target Date	Expected Outcome
Use of Content-Based Problem Solving in Mathematics • Pre-Implementation Phase • Implementation Phase • Post Implementation Phase	To orient teachers about the use of Content-Based Problem Solving in Mathematics	Orientation to Mathematics teachers about the use of Content-Based Instruction	Researcher Mathematics Teachers School Head	Php 500 per teacher MOOE Self-help	LAC Session for the First Quarter of SY 2023-2024	Teachers are oriented and equipped with the background knowledge about Content-Based Instruction
	To guide teachers in the use of the Content-Based Instruction in Mathematics	Demonstration Teaching on the use of each approach in Content-Based Instruction	Researcher Mathematics Teachers School Head	Php 500 per teacher MOOE Self-help	LAC Session for the Second Quarter of SY 2023-2024	Teachers are able to practice the use of the approaches of Content-Based Instruction
	To gather feedback about the best practices in the use of Content-Based Instruction in teaching Mathematics	Conduct of feedback gathering through Professional Learning Community or PLC, a meeting of Mathematics Teacher to gather best practices	Researcher Mathematics Teachers School Head	Php 500 per teacher MOOE Self-help	LAC Session for the Third Quarter of SY 2023-2024	Teachers are able to learn from other teacher in the use of Content-Based Instruction

The following are the activities that can be used in teaching Mathematics problem solving using Content-Based Instruction.

4. **Theme-Based Approach**

- Counted the number of wheels on a car and compared it to that of other vehicles (Math)
- Made a axle and wheel model with TP rolls and chopsticks and explored why round wheels are better (Science, Math, Design)
- Made a graph of the different colored cars we see in a carpark (Math)
- Read countless books on cars (Literacy and Language)
- Designed and created a garage from a cardboard box (Art, Design)
- Matched letters written on the top of toys cars to letters written on parking lots in his cardboard garage (Literacy)
- Painted with cars (Art & Sensory Play)
- Sang the Zoom Zoom Driving in the Car song (Music, Literacy)
- Researched where petrol comes from (Science, Geography)

B. Team-Teach Approach

- Think, pair and share
- Brainstorming
- Buzz session
- Exit slips
- Misconception check
- Circle the questions

- Ask the winner
- Pair-share-repeat

C. Skill-Based Approach

- Drawing Activity
- Silent Discussion Boards Activity
- Skype Debates
- Pictionary Style Activities
- Collaborative Concept Mapping

5. Summary, Conclusion and Recommendation

This chapter presents the summary, conclusions arrived at, and the recommendations borne out of the findings of the study.

5.1. Summary

Problem-solving is a complex process that is helpful in our day-to-day life and is also crucial in the teaching and learning process related to Science and Mathematics fields. This study aimed to assess the effectiveness of content-based problem solving instruction in Mathematics among the Grade 2 learners with the end view of crafting a plan of action based on the findings. The specific questions answered consisted that of the extent the teachers used content-based instruction approach in teaching problem solving in Mathematics in terms of theme-based approach, team-teach approach, and skill-based approach, the extent the learner demonstrates content-based problem solving skills in Mathematics, the extent of effectiveness of content-based instruction in Mathematics problem solving, and the plan of action proposed on the use of content-based problem solving instruction in Mathematics.

This study employed the use of descriptive quantitative research method with questionnaire as the main data gathering instrument. The population utilized in the study are the Grade 2 Mathematics teachers from the Malvar District Division of Batangas public elementary schools. A total of 113 Grade 2 Mathematics teachers were asked to participate in the study.

The following are the findings.

1. Teachers' Use of Content-Based Instruction in Teaching Problem Solving in Mathematics. The following are the data gathered.

1.1 Theme-Based Approach. The teachers' use of content-based instruction in teaching problem solving in Mathematics in terms of theme-based approach is as seen to a high extent. This is reflected by the composite mean of 3.91 that the indicators obtained.

1.2 Team-Teach Approach. The teachers' use of content-based instruction in teaching problem solving in Mathematics in terms of team-teach approach is to a high extent. This is evident with the composite mean of 4.00 that the indicators obtained.

1.3 Skill-Based Approach. The use of content-based instruction in Mathematics problem solving in terms of skill-based approach is to a high extent. This is reflected by the composite mean of 3.44 that the indicators obtained.

2. Learners Demonstration of Content-Based Problem Solving Skills in Mathematics. The learners demonstrated content-based problem solving skills in Mathematics to a high extent. This is evident with the composite mean of 3.45 that the indicators obtained.

3. **Effectiveness of Content-Based Instruction in Mathematics Problem Solving in terms of Learners' Academic Performance in the Learning Area.** There is a very satisfactory academic performance by the Grade 2 learners as evidence by the effectiveness of content-based instruction in Mathematics problem solving. This is reflected by the mean grade of 88.80 that the academic performance of

the learners obtained.

4. **Proposed Plan of Action on the Use of Content-Based Problem Solving Instruction in Mathematics.** The proposed plan of action consists of the phases of implementation such as pre-implementation, implementation and the post-implementation phases that will help teachers to use content-based instruction effectively.

5.2. Conclusions

The following are the conclusions arrived at based on the findings.

1. Teachers use content-based instruction in teaching problem solving in Mathematics in terms of theme-based approach, team-teach approach, and skill-based approach to a high extent.

2. Learners demonstrate content-based problem solving skills in Mathematics to a high extent.

3. The effectiveness of the use of content-based instruction is very satisfactory as evident with the academic performance of the learners.

4. The output of the study which is a proposed plan of action is crafted based on the findings of the study.

5.3. Recommendations

The following are the recommendations borne out of the findings of the study.

1. The Mathematics teachers may be able to look for the best practices in the use of content-based instruction to find out what works best for the learners when it comes to problem solving in Mathematics.

2. The learners may be given more avenues to demonstrate their skills in problem solving in Mathematics through the use of content-based instruction.

3. The Mathematics teachers may use other ways of assessment of the academic performance of the learners in Mathematics problem solving.

4. The future researchers may validate the output of the study which is a proposed plan of action in using the content-based instruction in Mathematics.

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