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CONTENT KNOWLEDGE OF TEACHERS AND ACADEMIC ACHIEVEMENT IN MATHEMATICS OF INDIGENOUS PEOPLE (IP) LEARNERS

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ABSTRACT

This study was conducted to determine the relationship between the content knowledge of teachers and the academic achievement in mathematics of Indigenous Peoples (IP) learners in the public elementary schools of Matanao II District, Davao del Sur. Grounded in Mishara's theory on content knowledge and Benbow's views on academic achievement Utilizing a non-experimental descriptive-correlational research design, data were gathered from 52 mathematics teachers and 280 IP learners through a researcher-made teacher questionnaire and a standardized mathematics test. Quantitative data analysis involved the use of mean and Pearson's correlation coefficient. Findings revealed that teachers exhibited very high content knowledge in planning and assessing learning and high knowledge in facilitating learning. IP learners' performance in mathematics was found to be at the "Approaching Proficiency" level. A significant positive correlation was identified between the teachers' content knowledge and the mathematics achievement of IP learners ($r = 0.667$, $p < 0.05$). Specifically, all three dimensions of content knowledge were individually and collectively associated with learners' performance, indicating that greater teacher expertise leads to improved student outcomes. It was concluded that strengthening teachers' content knowledge – especially in the context of culturally diverse classrooms – is essential for improving the academic performance of IP learners.

KEYWORDS: *Content Knowledge, IP Learners, Mathematics Achievement, Teacher Effectiveness, Culturally Responsive Teaching, Student Assessment*

INTRODUCTION

It is widely recognized that various factors, including teacher-related variables such as expertise and specialization, influence student achievement. Teachers' content knowledge, particularly in mathematics, has been identified as a critical factor affecting learners' performance. This is especially significant for Indigenous Peoples (IP) learners, who often face unique challenges in accessing quality education. Research suggests that stronger teacher content knowledge not only enhances instructional delivery but also positively impacts student outcomes, particularly in mathematics, a subject closely tied to critical thinking and problem-solving skills.

On the other hand, a study by Umaña-Taylor (2024) shown that ethnic diversity positively influences pupils' academic performance. The findings indicated that ethnic variety enhances mathematical, social, and language skills while prolonging the duration of learners' study time.

However, a study by Sicat et al. (2020) on the mathematical performance of Indigenous learners indicated that conventional schools in the Philippines, where these learners are included, should offer additional support due to their cultural adaptation and disadvantages. The phrase indigenous people refer to any ethnic group that occupies a geographic area to which they have the earliest documented historical ties (Dungo, 2020). It was determined that Indigenous learners lagged one grade level behind their peers in fundamental mathematical computing skills. Cultural adaptation and socioeconomic disadvantage were the principal factors influencing the learners' performance in mathematics.

While learners' achievements may be affected by their background characteristics, it is equally essential to examine teachers' content understanding in their particular disciplines. Content knowledge, as defined by Bold et al. (2021), encompasses the knowledge base that guides instructors' choices about materials, instructional strategies, learner evaluation, and feedback, among other elements, which educators must command to be effective.

A quantitative case analysis by Sitaram et al. (2020) suggested that teachers with higher content knowledge have a greater impact on the math test scores of their students, an effect that is even more pronounced at the school level. They also suggested that allocating resources toward improving teacher content knowledge may be an important aspect of increasing academic achievement.

Both learners and teachers are affected by their subject matter expertise and individual dedication to education (Driscoll, 2020). Assuming responsibility for all learners, irrespective of their academic qualifications or social attributes, may facilitate a more equitable distribution of learning opportunities among them. Teachers who assume

personal accountability for the outcomes of their instruction perceive teaching and learning as a dynamic process, positioning learners as active participants rather than passive users of knowledge (Marshall et al., 2020).

In the Philippine context, studies have also highlighted the significant role of teachers' academic major and pedagogical content knowledge in influencing student outcomes. Research by Filipino scholars since 2020 has begun to emphasize the importance of teacher specialization in improving student achievement, particularly in mathematics. For instance, Delos Santos (2021) discussed how the alignment of teachers' academic preparation with their teaching assignments affects their confidence and effectiveness in delivering content.

Similarly, Rivera and Reyes (2022,) examined the influence of mathematics teachers' content knowledge on student performance, revealing that educators with superior test scores and specialized training generally yield enhanced outcomes for learners in public elementary schools. Moreover, recent research has highlighted the necessity to confront the particular obstacles encountered by indigenous learners in the Philippines. Cruz and Bautista (2023) contended that the amalgamation of culturally responsive teaching methodologies with robust topic expertise is essential for closing the achievement gap among Indigenous students.

In the Division of Davao Del Sur, particularly at Savoy Elementary School, where enrollment is dominated by IP learners, a prevailing problem is that these learners find difficulty in solving mathematical problems. The teacher cannot proceed to the next lesson in math as the majority of the learners need to undergo remediation. The researcher, being a teacher in mathematics to these IP learners, wanted to venture into researching how this prevailing problem can be resolved. While existing studies offer insight into the importance of teachers' characteristics, the scarcity of studies that specifically examine the effect of teacher content knowledge on Indigenous learners' achievement highlights the researcher's need to explore this relationship within the context of public elementary schools. Hence, this study.

LITERATURE REVIEW

Academic achievement is widely regarded as a pivotal factor in learners' subsequent career success. It is one of the facets used to evaluate learners' cognitive skills (Fandos-Herrera et al., 2023; Semeraro et al., 2020) and efficiency (Trazo & Abocejo, 2021), which are necessary to produce competent and productive human capital in the workplace.

On the other hand, mathematical knowledge serves as a means to enhance learners' problem-solving abilities and sound judgment developed through mathematical skills (Marquez, 2023; Baki & Kilicoglu, 2023). Therefore, a learner's proficiency in mathematics may indicate their potential in this domain of cognitive capability (Szabo et al., 2020; Mutawah et al., 2019). Moreover, numerous nations highlight the importance of learners' mathematical skills, recognizing their significance for national development and progress (Simamora & Saragih, 2021). Nonetheless, an interesting inquiry investigated in this study is whether mathematical performance significantly influences the overall academic success of students in a government-operated laboratory high school context.

Jardon et al. (2020) found in their study that teachers' content knowledge has a significant impact on learners' achievement in Math. Vigdor et al. (2020) argued, however, that there is no consensus on the importance of individual teacher attributes for student learning gains. For instance, some authors find that experience, test scores, and regular licensure are positively associated with student achievement (Ladd et al., 2021). In contrast, other studies show that teacher credentials have no predictive value on the variance of teacher effects (Loeb et al., 2020).

Teaching means adjusting to one culture, beliefs, and resources. Teaching mathematics in an Indigenous community requires finding ideas within the social context of the community and incorporating them into the subject area. The incorporation of indigenous knowledge into mathematics teaching can make learning more engaging and valuable, as it enhances learners' motivation to learn and reduces feelings of inequity (Darling-Hammond, 2021).

Teacher content knowledge gaps are a significant barrier to learning. This suggests that pre-service teacher education should begin with content area priorities and orientations (Venkat & Spaull, 2022). Furthermore, they must be trained to be adaptable, creative, and imaginative in order to promote lifelong learning among students in Indigenous communities.

Planning and instructional design for remote learning require the use of multiple new and adapted methods to engage students as active learners. Districts and schools should prioritize common planning time for those who teach the same grade and subject. When used effectively, common planning time is an excellent form of embedded professional development and a powerful, cost-effective strategy for nurturing adult learning and collaboration (Anderson, 2020).

Purposeful instructional design identifies the most suitable learning activities for synchronous or asynchronous delivery. Synchronous classes are conducted live, using real-time interactions and employing graphics like slide decks, video clips, or other media to enhance the learning experience, reinforce concepts, pose questions, and stimulate discussion. Asynchronous lessons are unsupervised activities that students can undertake at their own pace, including pre-recorded movies for independent viewing, followed by group discussions via virtual meetings or

online forums. A lesson that requires interactivity, does not necessitate discussion or inquiry, and would not gain from continuous assessments of comprehension may be appropriate for asynchronous instruction (Borich, 2022).

Effective instructional strategies go beyond those daily teacher-centric tips and tricks. They are those tried-and-true methodologies that help you, as an educator, reach your teaching and learning goals throughout the school year. When it comes to instructional design, teachers incorporate effective instructional strategies into their lesson plans. Many such learning strategies are steeped in research from educational psychologists, philosophers, and researchers such as Piaget, Freire, Dewey, and Papert (Marzano, 2021).

Statement of the Problem

This study aimed to determine the level of teachers' content knowledge and the level of achievement in mathematics of the IP learners. Specifically, it answers the following sub-problems:

1.What is the level of teachers' content knowledge in Mathematics in terms of:
1.1 planning and designing instructions
1.2 facilitating learning
1.3 assessing students' learning?
2.What is the level of academic achievement of IP learners in mathematics?
3.Is there a significant relationship between the content knowledge of teachers and the academic achievement of IP learners in Mathematics?

METHODOLOGY

Research Design

This study employed the non-experimental descriptive survey research design in investigating the research problem. The non-experimental descriptive survey research design was a method used to systematically collect and analyze data about characteristics, behaviors, or attitudes within a population without manipulating variables. It provided a structured approach to understanding the current status of a subject by using tools such as questionnaires, surveys, interviews, or observations. This design focused on describing phenomena as they exist naturally and was often employed to explore relationships between variables without establishing causation (Mertler, 2019; SurveyPlanet, 2023). It is descriptive because the data were presented in quantitative descriptions in the "Content Knowledge of Teachers and Academic Achievement in Mathematics of IP Learners." According to Good (2005), this method of research showed merely a description of tasks presenting the conditions regarding the nature of the group of persons or class of events that involved procedures of analysis, classification, and measurement. It involved varied information regarding the current or present condition (Deauna, 2005).

Research Respondents

This study was conducted in the elementary schools in Matanao II District. The respondents in this study were determined using the Slovin's Formula. The number of respondents was as follows: 8 teachers and 50 learners from Savoy Elementary School, 6 teachers and 30 learners from Tribal Filipino School of Datalfitak, 6 teachers and 30 learners from Colonsabac Elementary School, 6 teachers and 30 learners from Asbang Elementary School,8 teachers and 50 learners from Bangkal Elementary School, 6 teachers and 30 learners from Dongan Pekong Elementary School, 6 teachers and 30 learners from Saub Elementary School, and 6 teachers and 30 learners from Glot Towak Elementary School, for the total of 52 Teachers and 280 learners in Matanao II district. From a population of 60 teachers, the total number of teacher respondents was 52, and from a population of 940 learners, the total number of learner respondents was 280. The teacher respondents answered a checklist based on the indicators in the researcher-made questionnaire describing their content knowledge, while the IP learners took the mathematics test constructed by the researcher. This study makes use of the universal sampling procedure for the teacher-respondents considering the manageable mathematics teacher in the research locale, and a simple random sampling procedure was used in determining the IP learners to participate in the study.

Research Instrument

This study utilized the researcher developed questionnaire with items and indicators are focused on the content knowledge of teachers and a 35-item mathematics test for the IP learners. The teacher-respondents provided their responses to the items in the checklist while the IP learners took the test. Both the checklist and the test underwent pilot testing in a school that was not part of the research local to measure its validity and reliability.

Data Analysis

The following statistical tools were used in the analysis and interpretation of the responses in this study.

Mean represented the average value of a dataset, providing a single number that captured the central tendency of the data. In this study, it was used to describe the level of content knowledge of the teachers and the academic achievement in mathematics of the IP learners.

Pearson r, also known as the Pearson correlation coefficient, was used to assess the strength and direction of the linear relationship between two continuous variables. This study determined the significant relationship between the content knowledge of teachers and the academic achievement in mathematics of IP learners.

RESULTS AND DISCUSSION

Conclusion

Based on the findings of the study, the following conclusions were drawn:
The level of content knowledge of teachers was found to be very high in terms of planning and designing instructions, high in terms of facilitating learning, and very high in terms of assessing students' learning. The academic achievement of IP learners in mathematics was rated as approaching proficiency. A statistically significant relationship was identified between teachers' content knowledge and the academic achievement of IP learners in mathematics, suggesting that stronger teacher knowledge positively influenced student outcomes.

These findings aligned with the Pedagogical Content Knowledge (PCK) Theory proposed by Lee Shulman (1986), which emphasized that effective teaching requires not only subject matter expertise but also the ability to present content in ways that are understandable to learners. In the context of IP learners, teachers were required to use culturally relevant strategies and contextualized examples to promote understanding and engagement.

Additionally, the results were supported by the Technological Pedagogical and Content Knowledge (TPACK) Framework developed by Mishra and Koehler (2006), which highlighted the importance of integrating technological tools into instruction alongside pedagogical and content knowledge. For IP learners, the use of digital resources that reflected their cultural background helped make learning mathematics more meaningful and engaging.

Recommendations

In the light of the findings drawn out by the researcher in this study, the following recommendations are offered:
It was recommended that DepEd officials must enhance teachers' content knowledge through professional development programs focused on culturally responsive pedagogy. Training should deepen teachers' understanding of mathematical content while addressing the unique needs of IP learners. These programs should include the integration of indigenous knowledge systems, development of contextualized instructional materials, and use of differentiated teaching strategies that align with learners' cultural backgrounds. Furthermore, DepEd was encouraged to support collaborative research involving educators, researchers, and indigenous communities to develop and evaluate teaching strategies that are effective for IP learners.

Furthermore, DepEd was also advised to strengthen teacher support systems by providing high-quality teaching resources, continuous mentorship, and access to culturally appropriate assessment tools. Establishing partnerships with indigenous communities and experts would enable the development of learning models that honor IP learners' identities and track academic growth effectively. Such efforts would promote equity and excellence in mathematics education while preserving indigenous cultures.

School administrators were urged to play a proactive role in improving teachers' content knowledge and supporting IP learners. This included organizing regular workshops, training sessions, and collaborative research projects that focus on integrating indigenous perspectives into mathematics instruction. School heads were encouraged to support the adaptation of instructional materials to reflect the cultural contexts of IP learners, making learning more relatable and engaging.

It was also recommended that school heads build partnerships with local indigenous communities, research institutions, and education experts to implement sustainable programs. By promoting peer mentoring and professional learning communities, they could foster collaboration and shared responsibility for improving instruction. Advocating for the provision of adequate resources, such as culturally inclusive teaching aids and assessment tools, would further support academic success among IP learners.

Teachers were advised to continuously engage in professional development focused on culturally responsive teaching and to integrate Indigenous knowledge and contextually relevant materials into their instruction. This approach would help IP learners connect mathematical concepts to real-life situations, enhancing their engagement and understanding.

Moreover, teachers were encouraged to collaborate with peers and researchers to explore effective teaching practices, use differentiated instruction, and apply culturally inclusive assessments that accurately measure learning progress. By cultivating a supportive and inclusive classroom environment, teachers could help IP learners develop confidence and competence in mathematics while valuing their cultural identities.

It was recommended that future studies explore innovative research methodologies to understand further the relationship between teachers' content knowledge and IP learners' academic performance in mathematics. Combining qualitative and quantitative methods could yield deeper insights into effective instructional practices. Researchers were encouraged to work collaboratively with educators, communities, and policymakers to produce evidence-based solutions that promote culturally responsive education. Such research would contribute to a more inclusive educational system that supports both academic excellence and the preservation of indigenous knowledge systems.

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