

# NOTABLE ACCOUNTS OF THE PROFESSIONAL PRACTICE OF TERTIARY MATHEMATICS TEACHERS IN THE PHILIPPINES

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**ABSTRACT:** *Tertiary mathematics teachers in the Philippines play a crucial role in shaping the next generation of problem-solvers and innovators. This study explored and described the notable accounts of the professional practice of tertiary mathematics teachers in the Philippines. The participants of this case study qualitative research were five (5) Tertiary Mathematics Teachers with academic ranks of University Professor and Professor VI. Using thematic analysis, nine (9) themes emerged: (1) Professional Qualifications in Mathematics; (2) Professional Qualities in Mathematics; (3) Curriculum and Instruction in Mathematics; (4) Student Diversity and Learning Development in Mathematics; (5) Mathematical Research, Innovation, Sustainability, and Technology; (6) Educational Policy and Quality Assurance in Mathematics; (7) Professional Partnerships, Linkages, and Services in Mathematics; (8) Professional Ethics, Growth, Development, and Responsibility in Mathematics; and (9) Professional Philosophy, Milestones, and Fulfillment in Mathematics. These findings suggest that tertiary mathematics teachers are thriving holistically in their professional practice at the tertiary level. This study recommends for a quantitative analysis to test the generalizability of the themes leading to the development of professional standards for tertiary mathematics teachers in the Philippines.*

**Keywords:** Notable Accounts; Professional Practice; Tertiary Mathematics Teachers; Philippines; Case Study

## I. INTRODUCTION

Tertiary mathematics teachers in the Philippines play a crucial role in shaping the next generation of problem-solvers and innovators. Mathematics plays an integral part in the educational system of the Philippines, and tertiary mathematics education has been considered an important field of study.

There have been several studies conducted on the teaching of mathematics in the Philippines. Mathematics teachers in tertiary education in the Philippines employ various strategies in their professional practice in teaching mathematics. These strategies include the use of technology, active learning, problem-based learning, and other innovative methods [1].

Despite the use of innovative methods, there are still challenges that tertiary mathematics teachers face. One of the challenges is the lack of resources, such as textbooks and other learning materials. Another challenge is the limited professional development opportunities available to teachers, which may lead to a lack of confidence and competence in teaching mathematics [2].

Furthermore, there is a need for more research on the professional development of tertiary mathematics teachers in the Philippines. A certain study highlighted the importance of professional development in improving the teaching practices of mathematics teachers. They suggested that professional development should be continuous and sustained, and should focus on the improvement of content knowledge and pedagogical skills [3].

There is also a need for more research on the use of technology in teaching mathematics in the Philippines. In one study, technology can be an effective tool in teaching mathematics, but it requires proper training and support for teachers to fully utilize it. They recommended that mathematics programs should include courses on the integration of technology in teaching mathematics [4].

This study aims to provide a comprehensive analysis of the notable accounts of the professional practice of tertiary mathematics teachers in the Philippines. It addresses the challenges that teachers face, the need for professional

development, and the use of technology in teaching mathematics. This study contributes to the improvement of the teaching practices of tertiary mathematics teachers in the Philippines and ultimately enhances the quality of mathematics education in the country.

## II. METHODS

### Research Design

This study utilized a case study qualitative research method to explore and describe the notable accounts of the professional practice of tertiary mathematics teachers in the Philippines. A case study is a research methodology that explores a specific case, such as an individual, a situation, an organization, or a phenomenon, in order to gain insight into a larger group of cases [5]. The qualitative approach to case studies typically involves analyzing one to twelve instances, with the intention of using a unique context to inform broader inquiry [6].

### Research Participants

The participants of the study were the five (5) Tertiary Mathematics Teachers with academic ranks of University Professor and Professor VI. The researcher ascertained that the research participants have reached the peak of their professional career at the tertiary level with at least 20 to 60 years of teaching experience to capture notable accounts of professional practice in tertiary mathematics teaching. The study employed a purposive-expert sampling technique since this gleaned knowledge from individuals that have particular expertise [7]. Recruitment of the participants was voluntary with informed consent as proof of their voluntary participation.

### Data Collection and Analysis

In this study, the researchers served as the primary research instrument. The study utilized the data source triangulation method in collecting data based on the interview and document analysis [8]. The researcher developed an Interview Guide and used it in conducting face-to-face and virtual interviews.

**Table 1. Profile of the Participants**

| Participants | Academic Ranks                              | Academic Degrees   | Length of Service |
|--------------|---|--|-------------------|
| RP1          | University Professor<br>( <i>Emeritus</i> ) | PhD in Science Education <i>major</i> in Mathematics Education   | 59                |
| RP2          | University Professor                        | PhD in Mathematical Sciences <i>major</i> in Applied Mathematics | 27                |
| RP3          | University Professor                        | PhD in Research and Evaluation                                   | 41                |
| RP4          | Professor VI                                | PhD in Mathematics Education                                     | 40                |
| RP5          | Professor VI                                | PhD in Mathematics Education                                     | 41                |

The Interview Guide is composed of engaging, exploratory, and exit questions designed to explore and describe the notable accounts of the professional practice of tertiary mathematics teachers in the Philippines.

The gathered data were examined and categorized to find patterns and meanings embedded in the case study. The thematic analysis guided the analysis of participants' accounts, determination of implications, and construction of models. This study utilized five stages of data analysis. *Stage 1 Immersion tasks* include organizing the data set into texts, iterative reading of texts, and preliminary interpretation of texts to facilitate coding. *Stage 2 Understanding tasks* comprise identifying first-order constructs and coding of data. *Stage 3 Abstraction* emphasizes identifying second-order constructs and grouping second-order constructs into sub-themes. *Stage 4 Synthesis and Theme Development* accentuate a cluster of subthemes into themes and further elaboration of ideas. Lastly, *Stage 5 Illumination and Illustration of Phenomena* include linking the literature to the items identified, synthesizing the phenomenon, and developing the model [9].

### III. RESULTS AND DISCUSSION

The analysis generated nine (9) themes describing the notable accounts of the professional practice of tertiary mathematics teachers in the Philippines, namely: (1) Professional Qualifications in Mathematics; (2) Professional Qualities in Mathematics; (3) Curriculum and Instruction in Mathematics; (4) Student Diversity and Learning Development in Mathematics; (5) Mathematical Research, Innovation, Sustainability, and Technology; (6) Educational Policy and Quality Assurance in Mathematics; (7) Professional Partnerships, Linkages, and Services in Mathematics; (8) Professional Ethics, Growth, Development, and Responsibility in Mathematics; and (9) Professional Philosophy, Milestones, and Fulfillment in Mathematics.

### Theme 1: Professional Qualifications in Mathematics

This theme points out the relevant professional degrees, certifications or designations that demonstrate a level of expertise and knowledge in the field of mathematics. These qualifications are typically obtained through formal education, training, and professional experience, and are often required for certain positions or roles in the field. Data showed that professional academic pursuits and certification programs could help teachers to deepen content knowledge, which can in turn improve their ability to teach mathematics effectively [10].

*"Mathematics faculty in the tertiary level should have remarkable academic or professional degrees aligned or allied to mathematics, relevant mathematical knowledge, teaching experience, certifications, and licenses. They need also to advance their knowledge through attending training and pursuing research fellowships locally and internationally". [RP1; RP2; RP3; RP5]*

### Theme 2: Professional Qualities in Mathematics

This theme refers to the set of skills, characteristics, and attitudes that are necessary for success in the field of mathematics. These qualities include both technical and non-technical skills and are essential for mathematicians to excel in their work. It emphasizes that great mathematics teachers possess strong professional qualities, including the ability to establish positive relationships with their students, to listen actively, to teach flexibly, and provide meaningful feedback. The author further suggested that teachers who exhibit these qualities are more likely to engage students in mathematics and promote a positive attitude toward mathematics [11].

*"Tertiary mathematics teachers possess standard professional qualities and characteristics like mathematical expertise, technical quality in mathematics, creativity, resilience, flexibility, efficiency, leadership, professionalism, strong professional commitment to excellence and service, and work-life balance". [RP1; RP2; RP3; RP4; RP5]*

### Theme 3: Curriculum and Instruction in Mathematics

This theme refers to the design and implementation of educational programs that aim to teach mathematical concepts and skills to students at various levels of mathematics education. This includes the development of mathematics curricula, as well as the strategies and techniques used by teachers to deliver instruction.

Findings revealed that effective mathematics instruction should be grounded in a coherent and focused curriculum that is based on research and aligned with standards. NCTM emphasized the importance of providing students with opportunities to engage in meaningful mathematical tasks that promote conceptual understanding, procedural fluency, and application of mathematics to real-world problems [12].

*"Mathematics teachers in college must deliver content with an aid of effective and inclusive teaching strategies. They are also utilizing and developing curriculum materials in mathematics and employing various forms of assessments to foster excellent student performance. Another, mathematics teachers must condition the class to be student-centered for open communication and engagement". [RP1; RP3; RP4]*

#### **Theme 4: Student Diversity and Learning Development in Mathematics**

This theme refers to the recognition of the differences that exist among students in terms of their backgrounds, experiences, abilities, and learning styles and the steps taken to support their learning and growth in mathematics.

In a diverse classroom, students may come from different cultures and speak different languages, have different learning styles and abilities amidst academic difficulties [13], and require different levels of support [14]. Teachers need to understand these differences and adapt their teaching methods to meet the individual needs of each student to make mathematics relevant to their daily lives [15].

*“Tertiary mathematics teachers put importance on inclusivity, wellness, skills, ethics, and student learning development in mathematics. They are responsible also to be sensitive to different cultural backgrounds and gender differences of students including the post-graduate preparation, financial literacy as a real-life application of mathematics”.* [RP2; RP3; RP4; RP5]

#### **Theme 5: Mathematical Research, Innovation, Sustainability, and Technology**

This theme is viewed as interconnected components of a larger system of mathematical progress in the area of research, innovation, sustainability, and technology. Mathematical research provides the foundation for innovation and technological advancement, while sustainability ensures that mathematical progress is achieved in a way that preserves the environment and benefits society in the end.

Innovation and technology, in turn, can help to accelerate mathematical research by providing new tools, techniques, and applications for mathematical concepts. With advanced technology and innovative approaches, mathematical research can lead to sustainable solutions to real-world problems and contribute to the overall progress of society [16].

*“College mathematics teachers should embrace research and innovation in mathematics. They need to have strategic foresight of the future of mathematics to promote sustainability in the field. Through that, technology must be leveraged for humanized teaching at the tertiary level”.* [RP2; RP3]

#### **Theme 6: Educational Policy and Quality Assurance in Mathematics**

This theme refers to the development and implementation of policies and practices that promote high-quality mathematics education at all levels of education. It involves setting standards, guidelines, and regulations that ensure that students receive a rigorous and comprehensive education in mathematics, enabling them to develop the necessary skills and knowledge to succeed in their future studies and careers.

Educational policy and quality assurance in mathematics can be applied at various levels, from national and state-level policies to institutional-level practices and procedures. It involves establishing clear learning objectives and expectations, designing effective curricula and assessments, and providing professional development opportunities for teachers and educators. Policymakers should support ongoing teacher learning and development, including opportunities for

collaboration, reflection, and learning about effective practices [17].

*“Mathematics teachers in the tertiary are guided with institutional quality culture and educational policies as initiatives for continuous teaching quality in the field of mathematics. Aside from that, they will not just be imprisoned by the local mathematics standards, mathematics teachers should also consider the global quality measures in mathematics teaching”.* [RP1; RP2; RP3; RP4; RP5]

#### **Theme 7: Professional Partnerships, Linkages, and Services in Mathematics**

This theme refers to collaborations between individuals, institutions, and organizations in the mathematics community to enhance and support mathematics education and research. These collaborations can take many forms, including partnerships between academic institutions, collaborations between educators and researchers, and partnerships between industry and academia.

Professional partnerships in mathematics can be established to promote joint research projects, exchange programs for students and faculty, and the development of new mathematical tools and technologies. These partnerships can also be used to enhance teacher-training programs, develop new curricula, and provide professional development opportunities for educators [18].

*“Tertiary mathematics teachers should be involved in mathematics professional organizations, forge linkages to other colleges and universities locally and internationally, like being involved in resource sharing and collaborative efforts in providing different professional services like mentoring to other member schools”.* [RP2; RP3; RP4]

#### **Theme 8: Professional Ethics, Growth, Development, and Responsibility in Mathematics**

This theme refers to the ongoing process of acquiring new knowledge, skills, and experiences that enable mathematicians to enhance their expertise, advance their careers, and make significant contributions to the field. Professional growth and development opportunities in mathematics can take many forms, including education and training, research collaborations, mentorship, and professional networking.

One important aspect of professional growth and development in mathematics is education and training. Mathematicians can engage in formal education and training programs to acquire new skills and knowledge or to deepen their understanding of a particular area of mathematics. This may involve pursuing advanced degrees, attending workshops and seminars, or participating in online courses [19].

*“Tertiary mathematics teachers should have ethical principles in teaching mathematics. Mathematics teachers are also encouraged for relevant professional development, social responsibilities, and moral commitments”.* [RP1; RP2; RP3; RP4; RP5]

#### **Theme 9: Professional Philosophy, Milestones, and Fulfillment in Mathematics**

This theme refers to all related concepts that involve an individual's personal and professional goals, values, and aspirations in the field of mathematics.

Professional philosophy refers to an individual's overarching beliefs and values about the nature and purpose of mathematics and the mathematics teacher's role as a professional in the field. This can include ideas about the importance of mathematical research, teaching, or applications, as well as personal beliefs about the role of mathematics in society [20]. Milestones in mathematics refer to significant achievements or accomplishments in an individual's professional journey, such as completing a degree program, publishing a paper, or receiving a grant or award [21].

Fulfillment in mathematics refers to the sense of personal satisfaction and purpose that mathematics teachers experience while pursuing professional goals and milestones in the field of mathematics. This can include a sense of intellectual fulfillment from solving challenging problems, a feeling of social or economic impact from applying mathematics to real-world problems, or a sense of accomplishment from mentoring others or contributing to the mathematical community [22].

*“Tertiary mathematics teachers should have strong academic, personal, and professional philosophy in mathematics and be inspired by their significant milestones and achievements to be fulfilled in doing the profession in the field of mathematics”.* [RP1; RP2; RP3; RP4; RP5]

**Emergent Model**



**Figure 1. Emergent Model of the Notable Accounts of the Professional Practice of Tertiary Mathematics Teachers in the Philippines**

The emergent model shows nine (9) predominant accounts of the professional practice of tertiary mathematics teachers in the Philippines. These include the interconnectedness of teachers' professional qualifications; professional qualities, curriculum and instruction, student diversity and learning development, mathematical research, innovation, sustainability, and

technology; educational policy and quality assurance, professional partnerships, linkages, and services, professional ethics, growth, development, and responsibility, and professional philosophy, milestones, and fulfillment. This is a proposed model describing what tertiary mathematics teachers undergo to professionally grow and thrive amidst the complex discipline-specific demands in Philippine Higher Education.

**IV. CONCLUSION & RECOMMENDATIONS**

The emergent notable accounts of the professional practice of tertiary mathematics teachers in the Philippines are essential principles to carry out their professional duties and responsibilities at the tertiary level.

It is very necessary for mathematics teachers to have relevant professional qualifications, including a strong academic background in mathematics and teaching experience. Moreover, it is also important for them to possess professional qualities such as expertise, flexibility, passion, dedication, and effective communication skills.

Second, the curriculum and instruction of mathematics should be designed to engage students and promote critical thinking skills. The teachers should also be trained to effectively handle student diversity and address the varying learning needs of their students.

Third, mathematical research, innovation, sustainability, and technology should be incorporated into teaching practices to promote an up-to-date and relevant curriculum.

Fourth, educational policies and quality assurance should ensure that mathematics education is of high quality and accessible to all students.

Fifth, professional partnerships, linkages, and services should be established to promote collaboration among teachers and institutions and enhance the professional development of teachers.

Sixth, professional ethics, growth, development, and responsibility should be instilled in teachers to promote their personal and professional growth and ensure ethical teaching practices.

Seventh, sound professional philosophy, milestones, and fulfillment should be fostered to promote the personal and professional well-being of teachers and to encourage deeper motivation and satisfaction in their chosen profession.

Finally, this study recommends a quantitative analysis to test the generalizability of the emergent themes leading to the development of professional standards for tertiary mathematics teachers in the Philippines.

Overall, it is important to continuously improve the professional practice of mathematics teachers in the Philippines to ensure quality mathematics education and student success.

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## V. REFERENCES

- [1] Alcantara, J. R. C., & De Leon, M. A. L. (2018). Innovative pedagogies of mathematics education in the Philippines: An exploratory study. *Journal of Science and Mathematics Education in Southeast Asia*, 41(2), 165-182.
- [2] Luzano, J. F. (2020). Development and Validation of Strategic Intervention Materials (SIMs) of the Selected Topics in Trigonometry of Precalculus Discipline in Senior High School. *Journal of Mathematics and Statistics Studies*, 1(2), 26–37.
- [3] Cadag, J. R., & Arceo, J. M. (2019). Professional development of mathematics teachers in the Philippines. *Journal of Mathematics Education*, 12(2), 69-85.
- [4] Quibuyen, T. D., & Varona, R. S. (2018). Integrating technology in mathematics education: A case study in the Philippines. *Journal of Educational Technology Development and Exchange*, 11(1), 1-16.
- [5] Creswell, J. W. (2003). *Research Design: Qualitative, Quantitative, and mixed methods*. <http://bit.ly/32SYiXi>
- [6] Gerring, J. (2006). *Case study research: Principles and practices*. Cambridge university press. <http://bit.ly/39qrR56>
- [7] Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4. <https://bit.ly/2pkWtTw>
- [8] Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., & Neville, A. J. (2014, September). The use of triangulation in qualitative research. *Oncology nursing forum*, 41 (5). <https://bit.ly/31QMKBM>
- [9] Ajjawi, R., & Higgs, J. (2007). Using Hermeneutic Phenomenology to Investigate How Experienced Practitioners Learn to Communicate Clinical Reasoning. *Qualitative Report*, 12(4), 612-638. <http://bit.ly/2PQCBSH>
- [10] Webb, D. C., & Dougherty, B. J. (2018). Professional Development for Mathematics Teachers: A Review of the Literature. *Proceedings of the 40th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 601-609). Greenville, SC: University of South Carolina.
- [11] Ball, D. L., & Bass, H. (2003). What Makes a Great Mathematics Teacher? *Phi Delta Kappan*, 84(9), 655-659. <https://doi.org/10.1177/003172170308400912>
- [12] National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: Author.
- [13] Aranzo, R., et al. (2023). A Case Analysis of the Strategies of Students in Learning Mathematics amidst Academic Disruption. *International Journal of Multidisciplinary Approach and Studies*, 10(2), 1-15.
- [14] Pang-an, A., et al. (2022). Learning Experiences of College Students in Mathematics in the Modern World during Synchronous Classes. *International Journal of Academic Multidisciplinary Research*, 6(10), 89-97.
- [15] Vandenbroucke, I., Verschaffel, L., & Greer, B. (2014). Teaching Mathematics to Low-Achieving Children: A Review of International and National Research. *Review of Educational Research*, 84(2), 162-203. <https://doi.org/10.3102/0034654313499610>
- [16] American Mathematical Society. (2018). *Mathematics and technology*. <https://www.ams.org/journals/notices/201810/rnoti-p1426.pdf>
- [17] Eisenhart, M. A., & Davis, R. B. (2011). Mathematics education and public policy: A framework for analysis. *Handbook of research on mathematics teaching and learning*, 4, 110-149.
- [18] Lotan, R. A., & Kelly, S. P. (2018). Building effective partnerships in mathematics education: Lessons from research. *Journal of Mathematics Education Leadership*, 16(1), 1-12.
- [19] Stylianou, D. A., Blanton, M. L., & Knuth, E. J. (2016). Professional responsibility in mathematics education. *Journal for Research in Mathematics Education*, 47(4), 376-382.
- [20] Lesh, R., & Doerr, H. M. (2003). Mathematics education as a design science. *Building a foundation for the 21st century*, 13-46.
- [21] Males, L., & Adler, J. (2014). Professional development milestones for mathematics teachers. *Journal of Mathematics Teacher Education*, 17(1), 1-17.
- [22] Li, Y., & Kitchen, R. S. (2018). Teacher motivation and professional development in mathematics education: A systematic literature review. *Review of Educational Research*, 88(5), 681-724.