

Professional Development vis-a-vis Teaching Effectiveness of Public Secondary Mathematics Teachers

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Abstract: Professional Development vis-a-vis Teaching Effectiveness of Public Secondary Mathematics Teachers. Objectives: This study examined the relationship between professional development and students' perceptions of mathematics teachers' teaching effectiveness in one of the largest public high schools in Eastern Visayas, Philippines. **Methods:** Descriptive and correlational research designs were employed to address the study's objectives. The participants included 30 mathematics teachers and 314 randomly picked students from all the classes handled by the mathematics teachers. An adopted survey questionnaire collected the data on Teaching Effectiveness and Questionnaire Checklist. **Findings:** Results revealed a moderately significant positive relationship between teaching experience and participation in professional development activities, and mathematics teachers' commitment. The result suggests that commitment to the teaching profession necessitates teaching experience. The study likewise indicated a significant positive relationship between mathematics teachers' professional development activities and teaching for independent learning. **Conclusion:** Exposure to such professional activities is an essential factor that influences teachers' development, sense of responsibility to their profession, and ability to assist their students in becoming independent learners.

Keywords: mathematics teachers, perceptions, professional development, teaching effectiveness.

Abstrak: Pengembangan Profesional versus Efektivitas Mengajar Guru Matematika SMA Negeri.

Tujuan: Studi ini mempelajari hubungan antara pengembangan profesional dan persepsi siswa terhadap efektivitas pengajaran guru matematika di salah satu SMA Negeri terbesar di Visayas Timur, Filipina. **Metode:** Desain penelitian deskriptif dan korelasional digunakan pada penelitian ini. Peserta terdiri dari 30 guru matematika dan 314 siswa yang dipilih secara acak dari semua kelas yang diajar oleh guru matematika. Kuesioner survei yang diadopsi mengumpulkan data tentang Efektivitas Pengajaran dan Checklist Kuesioner. **Temuan:** Hasil mengungkapkan hubungan positif yang cukup signifikan antara pengalaman mengajar dan partisipasi dalam kegiatan pengembangan profesional, dan komitmen guru matematika. Hasilnya menunjukkan bahwa komitmen terhadap profesi guru membutuhkan pengalaman mengajar. Studi ini juga menunjukkan hubungan positif yang signifikan antara kegiatan pengembangan profesional guru matematika dan pengajaran untuk pembelajaran mandiri. **Kesimpulan:** Paparan terhadap beberapa kegiatan profesional merupakan faktor penting yang mempengaruhi perkembangan guru, rasa tanggung jawab terhadap profesi mereka, dan kemampuan untuk membantu siswa menjadi pembelajar mandiri.

Kata kunci: guru matematika, persepsi, pengembangan profesi, efektivitas mengajar.

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■ INTRODUCTION

Classroom Teaching Effectiveness is one of the critical internal-school factors affecting student progress (Chetty et al., 2014; Suryanti & Arifani, 2021; Tokarieva et al., 2019; Baliyan & Moorad, 2018). Consequently, educational sectors worldwide initiated programs and interventions to improve the quality of classroom instruction through teachers receiving professional development. It is argued to be the key to learning state-of-the-art teaching strategies and practices that can help enhance teachers' performance related to their expertise and impact student learning (Hammond et al., 2017).

Padillo et al. (2021) stated that the caliber of teachers determines the quality of instruction. The opportunity to improve classroom instruction and meet students' and parents' learning expectations in school may be contingent on whether professional development initiatives and programs are structured to address current needs. In developing nations like the Philippines, teachers play a critical role in ensuring that their students are equipped with the necessary mathematical skills to remain competitive and relevant in a rapidly changing global environment (Cabuquin, 2022). Therefore, mathematics teachers should value the chance to engage in professional development activities (Alzahrani & Nor, 2022) and be well-equipped with content and pedagogical knowledge to assist students in their learning endeavors.

Professional development is becoming more widely recognized as an essential instrument (Caena & Redecker, 2019; Kelentriæ et al., 2017) for providing teachers with the knowledge and expertise they need to help students acquire 21st-century skills. It is said to equip teachers with innovative methods of instruction (Kalyani & Rajasekaran, 2018) that will help students develop relevant skills like critical thinking, communication, and problem-solving (Hammond et al., 2017). Korthagen (2017) also accentuated

that professional development could influence teachers' content and pedagogical knowledge, classroom management techniques, and commitment to teaching. Similarly, through lifelong learning, Gess-Newsome et al. (2019) emphasized that teachers could demonstrate improved pedagogical content knowledge and skill in developing and delivering lessons (Dong et al., 2020; Vaughn et al., 2017).

Furthermore, Magulod et al. (2020) indicated that teachers who pursue lifelong learning become learning catalysts in the classroom since they can advance professionally and realize their full potential. Surjanti and Soejoto (2018) also pointed out that effective classroom instruction serves as a means of increasing students' knowledge. In mathematics teaching, the development of students' problem-solving abilities and their interaction with their constantly evolving educational needs, such as those related to critical thinking, collaboration, communication, and creativity, are indications that could urge mathematics teachers to develop professionally. Kelentriæ et al. (2017) further stressed the relevance of professional development for mathematics teachers' ability to deliver engaging lessons to their students and assist them in developing their skills in their areas of expertise.

However, the many functions that schools expect teachers to perform have made it difficult for them to find time for professional development as school-related task replaces homework. It can also be observed that most teachers, particularly those who teach in public schools, have expressed dissatisfaction with the educational system's lack of support for professional advancement. As a result, teachers conveyed that they are no longer motivated to advance their careers and instead spend time teaching in the classroom. As they had to use their limited resources for professional development, they also expressed that sometimes enrolling in graduate degree programs or attending conferences to advance their learning

was no longer a priority but an additional expense for them.

McMillan et al. (2016) reported that teachers' participation in professional development or learning activities that support professional growth could be driven by personal and school-related factors. In addition, Jamil et al. (2018) mentioned that whatever the motivation, professional development should go beyond teachers attending seminars and other training sessions, especially during teachers' increased responsibilities (Van der Klink et al., 2017; Keiler, 2018). The study of Kim and Lee (2020) recognizes that the activities teachers should engage in can be formal or informal and take various forms, such as courses and workshops, conferences, and seminars (Nasreen & Odhiambo, 2018), degree courses, school observation, research, and mentoring and coaching. Akram (2019) likewise specified that professional development must be efficient and enhance instructional strategies and student performance.

Meanwhile, Tokarieva et al. (2019) stated that effective teaching has structural and core characteristics that include the kinds of activities used, how long they last, and how much emphasis is placed on group participation (Desimone & Pak, 2017). Conversely, Boylan et al. (2018) mentioned that the core features of teaching effectiveness consist of the content, active learning, and coherence of the professional learning activities with broader educational agenda. The assertion of Amadi and Paul (2017) likewise corroborates with that of Yurtseven Avci (2020), who stated that the associated teaching strategies promote active or hands-on learning, create an opportunity for sharing ideas and collaboration (Bates & Morgan, 2018), and allow the modeling of the best teaching practices and instruction. Additionally, it encourages mentoring and support, as well as the sharing of

pedagogical knowledge (Al-Husseini & Elbeltagi, 2018), creates opportunities for giving and soliciting feedback and for reflecting on one's teaching practice (Rustandi, 2017), and provides teachers with sufficient time to learn and put into action what they learned (Jenset et al., 2018).

Previous studies have claimed that professional development is crucial in boosting teachers' creativity (Arifani et al., 2019; Suryanti & Arifani, 2021; Kennedy, 2016). However, studies focusing on the professional development profile of teachers related to educational attainment, teaching experience, and professional development activities and how it interacts with teaching effectiveness are minimal, particularly regarding mathematics teachers. There is also a need for more research in the Philippine context investigating how professional development affects the quality of classroom instruction of public secondary mathematics teachers in terms of some of the dimensions measured in this study. Moreover, what contributes to teaching effectiveness and how it can be measured have yet to be explored. It is therefore appealing to delve deeper into this matter and investigate whether mathematics teachers' professional development profiles are related to the students' perceptions of teaching effectiveness. The results of the present study could contribute to the body of knowledge about the value of professional development activities for boosting mathematics instruction. This study further anticipates helping mathematics teachers improve their abilities in their area of specialization and uncover the importance of professional development to the teacher's teaching effectiveness.

This study explored the relationship between mathematics teachers' professional development profiles and students' perceptions of teaching effectiveness. Specifically, this study determined the (1) teachers' profile in terms of (a) educational attainment, (b) teaching

experience, and (c) professional development activities; (2) levels of students' perceived teaching effectiveness in terms of (a) commitment, (b) knowledge of the subject matter, (c) teaching for independent learning, and (d) management of learning; and examined the (3) relationship between professional development and students' perceptions of teaching effectiveness.

■ METHODS

Participants

The participants included 30 Mathematics teachers from one of the largest public high schools in Eastern Visayas, Philippines, who were chosen using complete enumeration. More than three-fifths were female (63.33%), whereas 36.67% were male. In addition, from the population of 1,686 junior high school students and using a sample size calculator by Raosoft Inc., 314 student participants from all the classes handled by the mathematics teachers were determined by simple random sampling. Most of the student participants were female (52.87%), whereas 47.13% were male; the participants' age range was from 12-18 years old, with a mean age of 14.37. The students came from different municipal governments in the provinces of Eastern Visayas, such as Biliran, Samar, and Leyte.

Research Design and Procedures

This study employed descriptive and correlational research designs. The descriptive aspect involved determining the mathematics teachers' profile regarding educational attainment, teaching experience, and professional development activities. It also involved determining the levels of students' perceived teaching effectiveness considering several facets such as commitment, knowledge of subjects, teaching for independent learning, and management of learning. Meanwhile, the correlational aspect of the study focused on

determining whether professional development profiles are related to mathematics teachers' teaching effectiveness. The permission to conduct the research was requested in writing from the head of the concerned school before beginning. Likewise, the full consent of the participants was sought to ensure their voluntary participation. Protection for privacy and the confidentiality of the research data was guaranteed. It was likewise ensured that the participants were neither harmed nor coerced, and the data gathered were used only to address the study's objectives. The survey was administered in the second quarter of the academic year 2019-2020.

Instrument

The study utilized a survey questionnaire on Teaching Effectiveness adopted from the existing Faculty Evaluation Instrument (QCE of the NBC 461), which was also used in the work of Aagsalud (2016). The questionnaire was further subjected to expert validation, particularly by school heads and experts in mathematics education, to determine its suitability. It comprised 20 items that measure the students' perceptions of the teaching effectiveness of mathematics teachers viewed in terms of the following dimensions: commitment with five indicators, knowledge of the subject (5), teaching for independent learning (5), and management of learning (5). The survey questionnaire used a 5-point Likert scale (5- Outstanding, 4- Very Satisfactory, 3- Satisfactory, 2- Fair, and 1- Poor) based on the identified dimensions of teaching effectiveness. In addition, the student participants were allowed to express their perceptions of the teaching effectiveness of mathematics teachers with a specific statement using Likert-type scales. Meanwhile, the researchers' Questionnaire Checklist was used to collect data on the professional development profiles of the mathematics teachers viewed in terms of

educational attainment, teaching experience, and professional development activities.

Data Analysis

Tabular presentations of the data gathered complemented with textual descriptions were utilized. Descriptive statistical tools such as percentages, frequency distribution, and means were applied in presenting, analyzing, and interpreting the data. Pearson Product Moment of Correlation (Pearson r) was used to measure the strength of the relationship between teaching experience and professional development activities to the identified dimensions of teaching effectiveness. On the other hand, the eta (ζ) correlation coefficient was employed to measure

the strength of the relationship between educational attainment and teaching effectiveness. The data were processed using the Statistical Package for the Social Sciences and Microsoft Excel.

RESULTS AND DISCUSSION

The results of this study are presented in three parts to address its objectives. Subsequent discussions include the professional development profiles of the mathematics teachers, their levels of teaching effectiveness in terms of the identified dimensions, and the relationship between professional development profile variables and students' perceptions of teaching effectiveness.

Table 1. Frequency distribution of mathematics teachers' professional development profiles

Variable	Frequency	Percent
Educational Attainment		
Bachelor's Degree Holder	2	6.67
With Master's Units	15	50.00
Master's Degree Holder	10	33.33
With Doctorate Units	3	10.00
Teaching Experience		
> 20 years	8	26.67
16 – 20 years	5	16.67
11 – 15 years	6	20.00
6 – 10 years	5	16.67
1 – 5 years	6	20.00
Professional Development Activities		
Seminars	115	47.33
Training	101	41.56
Workshops	27	11.11
<i>N=30 (EA); N=30 (TE); N=243 (PSTW)</i>		
<i>Range</i>	<i>Description</i>	
<i>> 20 years</i>	<i>Highly experienced</i>	
<i>16 – 20 years</i>	<i>Experienced</i>	
<i>11 – 15 years</i>	<i>Moderately experienced</i>	
<i>6 – 10 years</i>	<i>Slightly experienced</i>	
<i>0 – 5 years</i>	<i>Neophyte</i>	

Table 1 displays the profiles of mathematics teachers in terms of educational attainment, length of teaching experience, and the seminars, training,

and workshops that mathematics teachers had completed, measured per day of participation. As reflected in the table, one-half (50%) of the total

mathematics teachers were still getting their master's degree, whereas one-third (33.33%) of them were already master's degree holders. It can also be noted that none of the mathematics teachers were doctorate holders. It could indicate that most teachers stop pursuing higher education upon receiving their master's degrees. It may also be ascribed to the fact that teachers were too busy at work; they ceased pursuing further education as they could no longer find the time, opting for a master's degree or at least a few units to get them promoted.

In terms of teaching experience, slightly more than one-fourth (26.67%) of mathematics teachers were highly experienced. These teachers had at least 20 years of teaching experience in the classroom. Meanwhile, about 20% of the teachers were described as neophytes or those with five or fewer years of classroom experience. Further, it was clear that most mathematics teachers were seasoned professionals with a

significant amount of prior classroom experience, yet most chose to avoid undertaking higher education. Additionally, teachers may be overloaded not only with their academic classes but also with ancillary tasks. Horn and Jang (2017) mentioned that teachers should further pursue and complete their graduate studies to improve the quality of classroom teaching.

Furthermore, mathematics teachers participated in relevant seminars, training, and workshops to expand their knowledge and be informed of the most up-to-date teaching strategies for teaching 21st-century learners. Garcia (2021) suggested that to maximize the activation of 21st-century skills, teachers should modify their instruction to follow 21st-century approaches. Similarly, Padillo (2021) underlined that participation in diverse professional development activities facilitates the transmission of best practices among teachers from other institutions.

Table 2. Levels of students' perceptions of the mathematics teachers' teaching effectiveness

Dimension	WM	Std. Dev.	Description
Commitment	3.603	0.418	Very Satisfactory
Knowledge of Subject	3.403	0.294	Satisfactory
Teaching for Independent Learning	3.825	0.401	Very Satisfactory
Management of Learning	3.719	0.382	Very Satisfactory
<i>N= 30; Grand Mean = 3.638 (Very Satisfactory); Std. Dev. = 0.246</i>			
<i>Score Range</i>	<i>Description</i>		
<i>4.21 - 5.00</i>	<i>Outstanding</i>		
<i>3.41 - 4.20</i>	<i>Very Satisfactory</i>		
<i>2.61 - 3.40</i>	<i>Satisfactory</i>		
<i>1.81 - 2.60</i>	<i>Fair</i>		
<i>1.00 - 1.80</i>	<i>Poor</i>		

Table 2 displays the teaching effectiveness of mathematics teachers as perceived by the students. As the table shows, mathematics teachers have demonstrated a very satisfactory commitment to their teaching job. The dedication of teachers is an essential instrument for effectively improving classroom instruction

execution. Toropova et al. (2021) indicated that teachers who are committed to their profession are more likely to keep their jobs than those who are not. Kiral (2020) added that intensifying teachers' performance by empowering them and assisting them should be at the top of the educational administration's priority.

Respectively, mathematics teachers' teaching for independent learning and management of learning were also perceived as very satisfactory by the students. It could indicate that mathematics teachers' teaching strategies are effective in helping students learn the subject. Teaching methods and strategies that consider the interaction between students and their teachers improve students' knowledge acquisition (Abulhul, 2021). Further, Cardino and Cruz (2020) asserted that learning mathematics helps students think analytically and have better reasoning abilities. It is then essential to develop students' lifelong learning skills to solve problems in life and become independent learners.

Moreover, teachers' teaching effectiveness is performed in collaboration with other crucial

factors, including student achievement, career progression, and classroom management. Amadi and Paul (2017) indicated that effective classroom instruction places a premium on teachers' subject-matter expertise. Meanwhile, Kenny et al. (2019) added that continuous learning favors teachers' teaching effectiveness and ability to connect various subject areas to benefit students' learning. This signifies that teachers may be able to demonstrate enhanced pedagogical subject knowledge and expertise in creating and delivering instruction through lifelong learning. The study of Simonsen et al. (2020) and Hepburn et al. (2021) also observed that teachers who engaged in professional development activities applied classroom management strategies that work well in getting students' attention.

Table 3. Relationship between professional development profiles and students' perceptions of teaching effectiveness

Dimension	Profile					
	Educational Attainment		Teaching Experience		Professional Development Activities	
	η -value	p-value	r-value	p-value	r-value	p-value
Commitment	0.396 ^{ns}	0.211	0.603 ^{**}	0.000	0.519 ^{**}	0.003
Knowledge of the Subject matter	0.106 ^{ns}	0.960	0.21 ^{ns}	0.264	0.128 ^{ns}	0.501
Teaching for Independent Learning	0.306 ^{ns}	0.458	0.325 ^{ns}	0.080	0.390 [*]	0.033
Management of Learning	0.131 ^{ns}	0.927	0.226 ^{ns}	0.231	0.296 ^{ns}	0.112

ns – not significant; ^{*} significant at $\alpha < 0.05$; ^{**} moderately significant at $\alpha < 0.01$

Table 3 presents the relationship between Professional Development and the Teaching Effectiveness of mathematics teachers. The findings revealed a moderately significant positive relationship between mathematics teachers' commitment and teaching experience (r-value = 0.603 and p-value = 0.000). According to Irvine (2019), teachers who have been in the service for several years are most likely to improve

students' achievement as their experience enhances their instructional and pedagogical knowledge. Kini and Podolsky (2016) also reported that experienced teachers are more effective than novice teachers at raising students' achievement. This study likewise found that participation in professional development activities has a bearing on the commitment of mathematics teachers (r-value = 0.519 and p-value = 0.003).

The result implies that participation in seminars, training, and workshops, as well as pursuing graduate and postgraduate studies, can help mathematics teachers improve their teaching abilities and their understanding of 21st-century learners.

As further outlined in Table 3, the r -value is equal to 0.390, and the p -value is 0.033, indicating a statistically significant relationship between the teaching for independent learning and professional development activities of mathematics teachers. Professional development activities are also viable avenues for communicating new trends in teaching and learning as they can affect teachers' commitment and teaching for independent learning. However, the study's results differ from that of Du Plessis and Mestry (2019) who stated that professional development could have a negative impact because teachers may not receive high-quality continuing education. Magulod et al. (2020), on the other hand, stated that participation in professional development activities such as seminars, training, and workshops helps teachers acquire knowledge and skills that they can use in improving classroom teaching.

Further, other studies revealed that teachers' dedication to their job grows as their years of experience or length of service increases (Gray et al., 2017; Al Salami et al., 2017; Michaeli et al., 2020; Gist et al., 2019). This pattern was observed in different commitment dimensions, such as commitment to the teaching profession (Räsänen et al., 2020), affective, normative, continuous, and workgroup commitment (Chanana, 2021). Park and Johnson (2019) also showed that work engagement was not a moderator in the link between job satisfaction and intention to leave. Given the positive benefits these work attitudes have on performance, it is crucial to ensure that teachers are engaged and satisfied with their work.

■ CONCLUSIONS

The study examined the relationship between professional development and students' perceptions of teaching effectiveness. Given the results, activities for professional development can increase mathematics teachers' commitment and promote teaching for independent learning. Meanwhile, being committed to their teaching profession necessitates teaching experience. The teaching for independent learning and teachers' commitment rests on their involvement in seminars, training, and workshops. Likewise, mathematics teachers can devise instructional strategies that facilitate students to grasp the fundamental concept they need to learn. Exposure to such professional activities is an essential aspect that affects the development of teachers, their sense of responsibility to their profession, and their abilities to assist their students in becoming independent learners.

Moreover, mathematics teachers should pursue graduate studies and continue to increase their engagement in seminars, training, and workshops to become more knowledgeable in catering to the needs of the students. School leaders should also support teachers' professional development to broaden their understanding of the state-of-the-art teaching methods and practices suitable for 21st-century education. Kini and Podolsky (2016) likewise noted that better effectiveness is observed from experienced teachers than novice teachers regarding enhancing students' achievement.

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