Professional Development, Instructional Practices and Academic Performance of Mathematics Students, Muang District Elementary Schools, Suratthani, Thailand

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Abstract
This study aimed to assess the professional development (PD), instructional practices (IP) of the teachers and their relationships to the academic performance of grades five and six students in mathematics of Muang District Elementary Schools, Suratthani, Thailand. The descriptive statistical analysis such as mean, standard deviation and inferential statistics such as correlation, t-test and ANOVA were used to answer the research questions. The respondents of the study were the thirty-six mathematics teachers and the fourteen administrators of the different public and private schools. The variables were measured through the two sets of questionnaires being adapted/modified. The areas of PD included induction/mentoring participation, PD type participation, impact/extent of PD, participation costs, teachers' needs, and participation barriers. The areas of IP included homework, maths instructional activities, assessments, instructional influences, classroom preparations, and teachers' opinions. The results showed that there was significant difference between the degree of professional development of administrators, teachers and different areas and respondents. Likewise, there was significant difference between the extent of instructional practices of teachers, different areas, and respondents. It was also found that there was significant difference between the level of academic performance of students in mathematics, grade levels, and schools. However, it showed that there was no significant relationship between the professional development and the academic performance of students in mathematics. Similarly, there was no significant relationship between the instructional practices and the academic performance of students in mathematics. Finally, this study revealed that there was significant relationship between the professional development and the instructional practices.

Keywords: Academic performance, Instructional practice, Mathematics students, Professional development, Southern Thailand elementary schools

Introduction

Education has always been a significant part of everyone's life. Time and again, it's been awash with new ideas about teaching and learning. According to United Nations Educational, Scientific and Cultural Organization or UNESCO (2017), "education" transforms lives and is at the heart of UNESCO's mission to build peace, eradicate poverty and drive sustainable development.

Thailand, like some other members of the ASEAN (Association of Southeast Asian Nation), is also struggling in terms of quality education among its students. The government is now doubling its efforts towards a globalized competitive education. The Thailand Ministry of Education has enacted major educational reforms and invested a significant proportion of its national wealth into educating its younger citizens, however, not all sections of society have benefitted equally from this expansion (OECD/ UNESCO, 2016).

Professional Development was explained broadly by the Organization for Economic Co-operation and Development (OECD) as "activities that develop an individual skills, knowledge, expertise and other characteristics as a teacher" (OECD 2009, p49).

The review of nine studies by Yoon, et. al (2007) found that sustained and intensive professional development was related to student achievement. Tantranont (2009) also concluded that most teacher-respondents were appreciative of the opportunities for continuing professional development (CPD) and valued its benefits to teachers, students, and schools – and that CPD must be of the highest quality to be effective in order to enhance the teaching practice and student achievement.

Instructional Practices was defined by Saskatchewan Ministry of Education, Canada (2011) as "the general descriptors for a range of instructional approaches that support thinking in each of the four domains of cognition: Knowledge Acquisition, Cognitive Processes, Metacognitive Processes, The Self-System (Dispositions)".

Klassen and Chiu (2010) also found that teachers experience an ongoing commitment towards the profession when they have high self-efficacy, believing in their capabilities to apply appropriate learning strategies, and that the relationship between teaching practices and associated factors are not linear, that is, successful teaching practices may lead to changes in beliefs, and the beliefs that teachers hold can in turn drive teaching practices.

Students' performance or commonly called the "academic performance" or "students' achievement" may refer to how the students deal with their studies and how they cope with or accomplish different tasks given to them by their teachers. Schools are established with the aim of imparting knowledge and skills to those who go through them and behind all these is the idea of enhancing good academic performance (Patena, A.D. & Dinglasan, B.L.H., 2013).

Khun-Inkeeree, H., et al., (2017) investigated the relationship between self-confidence and mathematics achievement among students on Grade 6 in Southern Thailand. They found that cooperative learning by student teams-achievement divisions technique

improves students' self-confidence in mathematics class. Another study of Khun-onkeeree, H. et. al. (2016) found that there is positive relationship between students' attitude towards learning mathematics and their achievement. On the same year, Khun-Inkeeree, H. et al. (2016) conducted another study and found that private schools perform better than public schools.

It has been said that Mathematics has always been considered by many students as one of the difficult subjects. Nowadays, there are various researches and international tests regarding these subject to measure the learning proficiency of students worldwide. The latest scores and rankings in the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) were once again disappointing for Thailand.

Thai students' scores remained below average in both international academic surveys and came as a disappointment for the government education system. According to the latest PISA result for 2015, Thailand scored 421 in science, 415 in mathematics and 409 in reading with the average ASEAN PISA scores of 493, 490 and 493 respectively. Thailand's overall education result was lower than the previous test in 2012 and was below the average of OECD countries ("Thailand's Students' Scores", 2017).

With regards to the TIMSS result, the mean score in mathematics and science education had improved though the scores in both subjects were still below average. The Asian TIMSS 2015 score for Thailand in mathematics was 431 compared to 427 in 2011, ranking 26 out of 39 countries. The score in science was 456, compared to 451 in the last assessment, which also ranked 26. The mean score of both subjects was 500 ("Thailand's Students' Scores", 2017).

Theoretical / Conceptual Framework

Actions, Processes, Objects, Schemas Theory or simply APOS Theory is a theory of mathematical understanding, its nature, and its development; the basic tenet of this theory, a constructivist theory, is that an individual's understanding of a mathematical topic develops through reflecting on problems and their solutions in a social context and constructing or reconstructing certain mental structures and organizing these in schemas to use in dealing with problem situations (Dubinsky, 2014).

The study of Firmender, J., et al. (2014) examined the relationship between teachers' instructional practices and students' mathematics achievement. Results indicated that significant, positive relationships existed; the teachers' implementation scores for verbal communication and encouraging mathematical language instructional practices were predictors of student mathematics achievement.

In Thailand, the gap between the rich and the poor is rising, and the average income of the rich is about 27 times higher than the average income of the poor (Prasertkul, 2008). As in other countries, the students with low-socioeconomic status in Thailand unavoidably encounter difficulties in earning high quality of living and academic performance (Katwibun, 2013). Recognizing the importance of mathematics learning,

the Minister of Thai Education (2008) stated that students in Thailand were expected to learn to associate knowledge of mathematics with other sciences.

The next figure showed schematic diagram of how the variables of the study are interconnected to each other. The independent variables are the Professional Development (PD) of teachers/administrators and the Instructional Practices (IP) of teachers. These variables were gathered through questionnaire. The PD has six areas, namely; participation in induction and mentoring activities, participation by type of PD, Impact and extent of PD activities participated in, participation rates and financial costs, teachers' need for PD, and the barriers to participation in PD. The instructional practices (IP) has also six areas, viz; homework, instructional activities in mathematics, assessments, instructional influences, classroom instructional preparations, and teachers' opinions. These variables are put in separate rectangular boxes to show their independence with each other. However, the double-headed arrow in between them represents the logical interrelatedness of these variables. The two arrows pointing directly to the right box also indicate their relatedness to the third variable. The improved academic performance of students in mathematics was the main concept in the right box as the output of the study. In this particular case, the output of the study also served as the dependent variable where the significant correlations were tested.

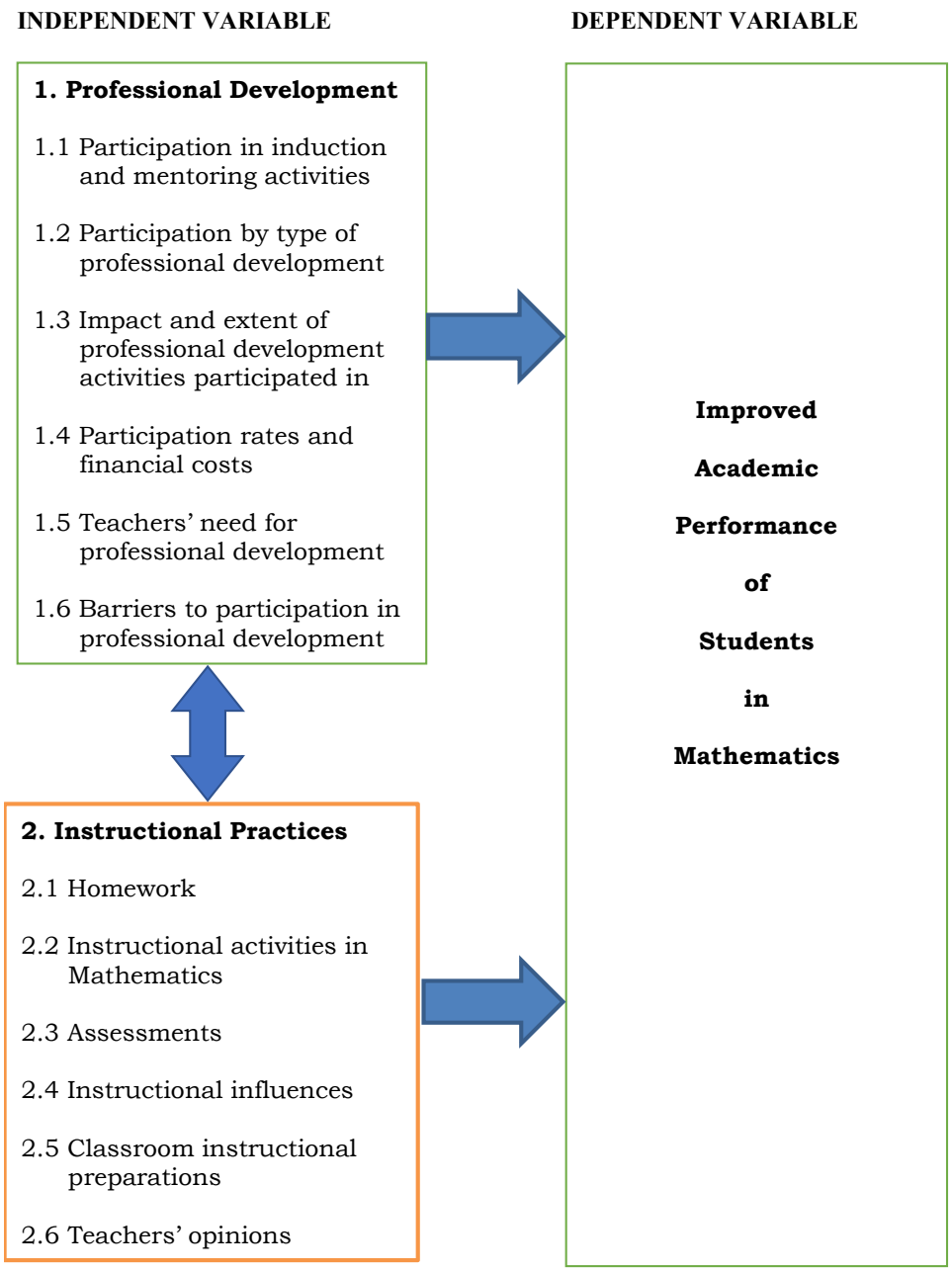

Figure 1. Paradigm of the study

Statement of the Problem

This study attempted to assess the professional development, instructional practices of the teacher and their relationships to the academic performance of grade 5 and 6 mathematics students of Muang District Elementary Schools, Suratthani, Thailand. Specifically, it sought to answer the following questions:

1. What is the degree of professional development of administrator and teachers by schools in terms of the different areas:

1.1 Participation in induction and mentoring activities

1.2 Participation by type of professional development

1.3 Impact and extent of professional development activities participated in

1.4 Participation rates and financial costs

1.5 Teachers' need for professional development, and
1.6 Barriers to participation in professional development?
2. Is there a significant difference between the degree of professional development of administrators and teachers by:
2.1 areas,
2.2 respondents, and
2.3 schools?
3. What is the extent of instructional practices of teachers by schools in terms of the different areas:
3.1 Homework
3.2 Instructional activities in mathematics
3.3 Assessments
3.4 Instructional influences
3.5 Classroom instructional preparations, and
3.6 Teacher opinions?
4. Is there a significant difference between the extent of instructional practices of teachers and
4.1 the areas
4.2 the respondents, and
4.3 the schools?
5. What is the level of academic performance of students in mathematics according to grade levels?
6. Is there a significant difference between the level of academic performance of students in mathematics by Grade levels and by schools?
7. Is there a significant relationship between:
7.1 professional development and instructional practices
7.2 professional development and academic performance of students in mathematics,
7.3 instructional practice and academic performance of students in mathematics?
8. What recommendations is deduced to improve the academic performance of students in mathematics?

Hypotheses

1.There is no significant difference between the degree of professional development of administrators and teachers by:
1.1 areas
1.2 respondents, and
1.3 schools.
2. There is no significant difference between the extent of instructional practices of teachers and the:
2.1 areas
2.2 respondents, and
2.3 schools.
3. There is no significant difference between the level of academic performance of students in mathematics by Grade levels and by schools.
4. There is no significant relationship between:
4.1 professional development and instructional practice
4.2 professional development and academic performance of students in mathematics,
4.3 instructional practice and academic performance of students in mathematics.

Research Method

The descriptive-correlational method was used because it is a fact-finding study with adequate and accurate interpretations of the findings. It describes with emphasis on what actually exists such as current conditions, problems, situations or any phenomena. It will test the three variables to find out their correlation or relationship.

Research Environment

This study was conducted in Muang District Elementary Schools, Suratthani, Thailand. The Muang District is located at the center of Suratthani City which is 651 km south of Bangkok. It consists of 14 major elementary schools; 4 of which are EP (English Program) schools and 10 are Non-EP schools. Suratthani is the largest of the southern provinces of Thailand.

Respondents

Data and information needed to answer the problems in the study were taken from Grades 5 and 6 Mathematics teachers and administrators of Muang District Elementary Schools, Suratthani City, Thailand. All Grades 5 and 6 students who were enrolled during the 1st semester for the school year 2017-2018 which the respondents are teaching, were also taken as secondary data. 14 schools are identified as school respondents, that is, 7 public schools and 7 private schools. 15 out of 36 or 41.67% are public school teachers while 21 out of 36 or 58.33% are private school teachers. For the school administrator respondents, 7 out of 14 or 50% are from public schools and the other half are from private schools. 72% of the respondents were teachers while 28% of the total respondents were school administrators.

Data Gathering Tools

This study used the questionnaire for the teacher professional development which was adapted and modified from the Organization for Economic Co-operation and Development (OECD) – Teaching and Learning International Survey (TALIS) of 2013 while the questionnaire for the instructional practice was adapted and modified from the Survey of Instructional Practices Teacher Survey Grades K-8 Mathematics, Council of Chief State School Officers Wisconsin Center for Educational Research, U.S.A.

Data Gathering Procedures

Before doing the actual data collection, the researcher sought the approval and secured a written permission from the Ministry of Education Area Office in Suratthani, Thailand. When the researcher was given the permit, the same request was presented to the different directors of the different elementary schools in Muang District, Suratthani, Thailand. The researcher personally administered the questionnaire on teacher professional development and instructional practices.

Statistical Treatment

The responses of the respondents were analyzed and interpreted using the following statistical tools: the frequency count and percentage were used to determine the proportion of respondents in each category against the total number of respondents. In testing the correlation between the dependent and independent variables and in testing their significant relationship, the paired t-test, ANOVA and the Pearson Product Moment of Correlation were used. The t-test for correlation was utilized in testing the significant difference. Results were tested at 0.05 level of significance.

Results and Discussions

Table 1 below identifies the degree of professional development (PD) of administrators and teachers by schools in terms of participation in induction and mentoring activities. For *public schools*, it had a *weighted mean* of *2.79* which denotes a *high degree* of PD while *private schools* had a *weighted mean* of 3.05 which also denotes a *high degree* of PD in terms of the participation in induction and mentoring activities.

Schools	Public		Private	
	Mean	*Description*	*Mean*	*Description*
Administrators	2.89	High Degree	3.11	High Degree
Teachers	2.69	High Degree	2.98	High Degree
Weighted Mean	*2.79*	*High Degree*	*3.05*	*High Degree*

Table 1. The degree of professional development of administrators and teachers by schools in terms of participation in induction and mentoring activities

The succeeding Table 2 reflects the degree of PD of administrators and teachers by schools in terms of participation by type of PD. For *public schools*, it had a *weighted mean* of *2.53* which denotes a *high degree* of PD while the *private schools* had a *weighted mean* of 2.57 which denotes a *high degree* of PD in terms of the participation type of PD.

Schools	Public		Private	
	Mean	*Description*	*Mean*	*Description*
Administrators	2.44	High Degree	2.51	High Degree
Teachers	2.61	High Degree	2.62	High Degree
Weighted Mean	*2.53*	*High Degree*	*2.57*	*High Degree*

Table 2. The degree of professional development of administrators and teachers by schools in terms of participation by type of professional development

Table 3 below describes the degree of PD of administrators and teachers by schools in terms of the impact and extent of PD activities they participated in during the last 12 months. For *public schools*, it had a *weighted mean* of *2.70* which denotes a *moderate positive impact* or *high degree* of PD while the *private schools* had a *weighted mean* of *2.71* which denotes a *moderate positive impact* or *high degree* of PD in the activities they participated in.

Schools	Public		Private	
	Mean	*Description*	*Mean*	*Description*
Administrators	2.62	Moderate positive impact or High Degree	2.88	Moderate positive impact or High Degree
Teachers	2.77	Moderate positive impact or High Degree	2.53	Moderate positive impact or High Degree
Weighted Mean	*2.70*	*Moderate positive impact or High Degree*	*2.71*	*Moderate positive impact or High Degree*

Table 3. The degree of professional development of administrators and teachers by schools in terms of the impact and extent of professional development activities they participated in

The next Table 4 reveals the degree of PD of administrators and teachers by schools in terms of the participation rates and financial costs. *Public schools* had a *weighted mean* of *2.09* which denotes *low degree* or *sometimes* they have to pay while *private schools* had a weighted mean of *2.02* which denotes *low degree* or *sometimes* they also have to pay for their PD.

Schools	Public		Private	
	Mean	*Description*	*Mean*	*Description*
Administrators	2.24	Sometimes or Low Degree	2.17	Sometimes or Low Degree
Teachers	1.94	Sometimes or Low Degree	1.86	Sometimes or Low Degree
Weighted Mean	*2.09*	*Sometimes or Low Degree*	*2.02*	*Sometimes or Low Degree*

Table 4. The degree of professional development of administrators and teachers by schools in terms of the participation rates and financial costs

Table 5 shows the degree of PD of administrators and teachers by schools in terms of the teachers' need for PD. *Public schools* had a *weighted mean* of *3.19* which denotes *high* degree or *moderate level of need* while the *private schools* had a *weighted mean* of 3.32 which also denotes *high* degree or *moderate level of need* for a PD in terms of the teacher's need for PD.

Schools	Public		Private	
	Mean	*Description*	*Mean*	*Description*
Administrators	3.28	High Degree or Moderate level of need	3.40	High Degree or Moderate level of need
Teachers	3.10	High Degree or Moderate level of need	3.24	High Degree or Moderate level of need
Weighted Mean	*3.19*	*High Degree or Moderate level of need*	*3.32*	*High Degree or Moderate level of need*

Table 5. The degree of professional development of administrators and teachers by schools in terms of the teachers' need for professional development

Table 6 describes the degree of PD of administrators and teachers by schools in terms of the barriers to participation in PD. *Public Schools* had a *weighted mean* of *2.70* which denotes *high* degree or *agree* while the *private schools* had a *weighted mean* of 2.35 which denotes *low* degree or *disagree*ment to the barriers to participation in PD.

Schools	Public		Private	
	Mean	*Description*	*Mean*	*Description*
Administrators	2.86	Agree or High Degree	2.25	Disagree or Low Degree
Teachers	2.53	Agree or High Degree	2.44	Disagree or Low Degree
Weighted Mean	*2.70*	*Agree or High Degree*	*2.35*	*Disagree or Low Degree*

Table 6. The degree of professional development of administrators and teachers by schools in terms of the barriers to participation in professional development

Table 7 reveals the significant difference between the degree of PD of administrators and teachers by areas. Using *t-test* to identify the significant difference, it had the overall t-value of *0.80* and a p-value of *0.37* which means *insignificant* and implies the acceptance of the null hypothesis. As hypothesized, there was no significant difference between the degree of PD of administrators and teachers by areas. The result of this study proved the truthness of this hypothesis. This finding is supported by Kessels, C. (2010) who found that most induction programs were of a moderate to high intensity, consisting of more than 50 hours of support for beginning teachers. however, most teachers were very positive when asked whether an induction program in general was of value to beginning teachers' PD.

Different Areas of Professional Development	Mean	t-value	p-value	Interpretation/ Decision
1. Participation in induction and mentoring activities	2.72	0.88	0.40	Insignificant / Accept H_0
2. Participation by type of professional development	2.66	-0.79	0.45	Insignificant / Accept H_0
3. Impact and extent of professional development activities participated in	2.81	1.30	0.22	Insignificant / Accept H_0
4. Participation rates and financial costs	1.98	2.08	0.06	Insignificant / Accept H_0
5.Teachers' need for professional development	3.20	0.99	0.38	Insignificant / Accept H_0
6. Barriers to participation in professional development	2.40	0.41	0.69	Insignificant / Accept H_0
Overall	*2.63*	*0.80*	*0.37*	*Insignificant / Accept H_0*

Table 7. The significant difference between the degree of professional development of administrators and teachers by areas.

Table 8 shows the significant difference between the degree of PD of administrators and teachers by respondents. Using *t-test* to identify the significant difference, the following are the results: *Administrators and teachers had* 2.68 as weighted mean. It had a *t-value* of 1.86 and a *p-value* of 0.07 which is *insignificant*. It implies the *acceptance* of the *null hypothesis*. This finding is in contrast with the findings of Hilton, A., et. al. (2015), Luke & McArdle (2009) and Southworth (2010). Their findings showed that school leaders' participation in teacher PD programs has a positive influence on the capacity for teachers to enact and reflect on new knowledge and practices and that in order for a school and its staff to continuously improve and be effective, lifelong learning for its teachers and administrators is fundamental.

Respondents	Mean	t-value	p-value	Interpretation/ Decision
Administrators	2.75	*1.86*	*0.07*	*Insignificant/ Accept Ho*
Teachers	2.61			
Weighted Mean	*2.68*			

Table 8. The significant difference between the degree of professional development of administrators and teachers by respondents

Table 9 reveals the significant difference between the degree of PD of the administrators and teachers by schools. Using *t-test* to identify the significant difference, public and private schools had 2.68 as weighted mean. It had a *t-value* of *0.35* and a *p-value* of *0.73* which is *insignificant*. It implies the *acceptance* of the *null hypothesis*. This result disagrees with Badri, M., et. al. (2016) who claimed that with regard to the perceived need for PD activities, the most significant variation is observed with regard to public or private schools and with regard to the impact of those activities, public schools also assign higher perceived impact scores for all activities that they participated in. This result also negates Guskey (2009) who said that school contexts differ drastically, and what works well in one setting may not work equally well in another.

Schools	Mean	t-value	p-value	Interpretation/ Decision
Public	2.69	*0.35*	*0.73*	*Insignificant/ Accept Ho*
Private	2.67			
Weighted Mean	*2.68*			

Table 9. The significant difference between the degree of professional development of the administrators and teachers by schools

Table 10 reflects the extent of instructional practices (IP) of teachers by schools in terms of homework. *Public and private* schools had a *weighted mean* of *3.19* which means *to a moderate extent* or *some 26-49 % of homework time for the school year.*

Schools	Mean	Description
Public	3.17	Some 26-49 % of homework time for the school year or to a moderate extent
Private	3.22	Some 26-49 % of homework time for the school year or

		to a moderate extent
Weighted Mean	*3.19*	*Some 26-49 % of homework time for the school year or to a moderate extent*

Table 10. The extent of instructional practices of teachers by schools in terms of homework

Table 11 identifies the extent of IP of teachers by schools in terms of instructional activities in mathematics. *Public* and *private* schools had a *weighted mean* of *3.56* which means *to a great extent* or *considerable 50% or more of individual work time on mathematical exercises, problems or tasks*.

Schools	Mean	Description
Public	3.49	Considerable (50% or more of individual work time on mathematical exercises, problems or tasks) or to a great extent
Private	3.63	Considerable (50% or more of individual work time on mathematical exercises, problems or tasks) or to a great extent
Weighted Mean	*3.56*	*Considerable (50% or more of individual work time on mathematical exercises, problems or tasks) or to a great extent*

Table 11. The extent of instructional practices of teachers by schools in terms of instructional activities in mathematics

Table 12 shows the extent of IP of teachers by schools in terms of assessment. *Public and private* schools had a *weighted mean* of *3.34* which means *to a moderate extent* or *1 to 3 times per month* of assessing students learning in mathematics class.

Schools	Mean	Description
Public	3.30	1 to 3 times per month or to a moderate extent
Private	3.37	1 to 3 times per month or to a moderate extent
Weighted Mean	*3.34*	*1 – 3 times per month or to a moderate extent*

Table 12. The extent of instructional practices of teachers by schools in terms of assessment

Table 13 reveals the extent of IP of teachers by schools in terms of instructional influences. *Public and private* schools had a weighted mean of 3.77 which indicates *to a great extent* or *a positive influence* while teaching the target mathematics class.

Schools	Mean	Description
Public	3.75	Positive Influence or to a great extent
Private	3.79	Positive Influence or to a great extent
Weighted Mean	*3.77*	*Positive Influence or to a great extent*

Table 13. The extent of instructional practices of teachers by schools in terms of instructional influences

Table 14 reflects the extent of IP of teachers by schools in terms of classroom instructional preparations. *Public and private* schools had a *weighted mean* of *2.96* which means *to a moderate extent* or *well-prepared* in terms of classroom instructional preparations.

Schools	Mean	Description
Public	2.80	Well-prepared or to a moderate extent
Private	3.12	Well-prepared or to a moderate extent
Weighted Mean	*2.96*	*Well-prepared or to a moderate extent*

Table 14. The extent of instructional practices of teachers by schools in terms of classroom instructional preparations

Table 15 shows the extent of IP of teachers by schools in terms of teachers' opinions. *Public and private* schools had a *weighted mean* of *3.61* which means *to a great extent* or *strongly agree* in terms of teachers' opinions.

Schools	Mean	Description
Public	3.45	Agree or to a moderate extent
Private	3.76	Strongly Agree or to a great extent
Weighted Mean	*3.61*	*Strongly Agree or to a great extent*

Table 15. The extent of instructional practices of teachers by schools in terms of teachers' opinions

Table 16 reveals the significant difference between the extents of IP of teachers by areas. Using *t-test* to identify the significant difference, the results had an overall *t-value* of *47.479* and a *p-value* of *0.001* which is *significant.* It implies the *rejection* of *null hypothesis*. Though it was hypothesized that there was no significant difference between the extent of the IP of teachers and the areas, the result however, is the other way around. This result is supported by the study of Rosario, P., et. al. (2015) that showed that three types of homework follow-up practices (checking homework orally, checking homework on the board, collecting and grading homework) had a positive impact on students' performance.

Different Areas of Instructional Practices	Mean	t-value	p-value	Interpretation/ Decision
1. Homework	3.194	67.096	0.001	Significant/ Reject Ho
2. Instructional activities in Mathematics	3.560	65.308	0.001	Significant/ Reject Ho
3. Assessment	3.336	36.381	0.001	Significant/ Reject Ho
4. Instructional influences	3.767	62.610	0.001	Significant/ Reject Ho
5. Classroom instructional preparations	2.960	22.622	0.001	Significant/ Reject Ho
6. Teachers' opinions	3.607	32.477	0.001	Significant/ Reject Ho
Overall	*3.404*	*47.749*	*0.001*	*Significant/*

				Reject Ho

Table 16. The significant difference between the extents of instructional practices of teachers by areas

Table 17 indicates the significant difference between the extent of IP of teachers by respondents. Using *t-test* to identify the significant difference, the results showed a weighted mean of 3.52. It had a *t-value* of *4.520* and a *p-value* of *0.001* which is *significant*. It means the *null hypothesis is rejected*. As hypothesized, there was no significant difference between the extent of IP of teachers by respondents. However, the result showed the opposite – a significant difference. This finding relates with the analysis of Teaching and Learning International Survey (TALIS) 2008 data that demonstrated a relationship between a number of school leadership and teacher level factors with higher levels of teacher self-efficacy, including teachers' participation in collaborative forms of PD, teachers' appraisal and feedback of their work, and teachers' use of greater variety of teaching practices in the classroom (Vieluf, et.al., 2012).

Respondents	Mean	t-value	p-value	Interpretation/ Decision
Administrators	3.63	*4.520*	*0.001*	*Significant/ Reject Ho*
Teachers	3.40			
Weighted Mean	*3.52*			

Table 17. The significant difference between the extent of instructional practices of teachers by respondents

Table 18 below illustrates the significant difference between the extent of IP of teachers by schools. Using *t-test* to identify the significant difference, it showed that public and private schools had a weighted mean of 3.41. It had a *t-value* of *-2.055* and a *p-value* of *0.046* which is *significant.* It implies the *rejection* of the *null hypothesis*. This result harmonizes with the study of the University of Illinois at Urbana-Champaign (2009) which claimed that education professors have found that public-school students outperformed their private-school classmates on standardized math tests due to certified math teachers and a modern, reform-oriented math curriculum. This result also confirms Khun-Inkeeree, H., et. al. (2016) that claimed that Thailand's private schools show better performance as compared to public schools.

Schools	Mean	t-value	p-value	Interpretation/ Decision
Public	3.33	*-2.055*	*0.046*	*Significant/ Reject Ho*
Private	3.48			
Weighted Mean	*3.41*			

Table 18. The significant difference between the extent of instructional practices of teachers by schools

Table 19 shows the level of academic performance of students in mathematics according to grade levels. In Grade 5, the average academic performance is *3.31* which means *good* performance while in Grade 6, the average academic performance

is *3.11* which also means *good* performance. The *weighted mean* of the academic performance in the two levels is *3.21* which means *good* academic performance in mathematics.

Grade Level	Academic Performance	Description
Grade 5	3.31	Good
Grade 6	3.11	Good
Weighted Mean	*3.21*	*Good*

Table 19. The level of academic performance of students in mathematics according to grade levels

Table 20 describes the significant difference between the level of academic performance of students in Mathematics by grade levels and by schools. Using paired sample *t-test* to identify the significant difference, the results showed an overall mean value of 3.35 for grade 5 and grade 6 public and private schools. It had *t-value* of *1.915* and a *p-value* of *0.006* which is significant. Therefore, the *null hypothesis is rejected.* Thus, there was a significant difference between the level of academic performance in Mathematics by grade levels and by schools. This finding is consistent with the finding of Khun-Inkeeree, et. al (2016) who found that private schools perform better than public schools. Also, this finding agrees with the studies of Ameer, I.S. & Singh, P. (2012) who revealed that there was a significant difference in the numeracy performance between the grade levels.

Paired Sample Test	Mean	t-value	p-value	Interpretation/ Decision
Grade 5				
Public	3.83	-4.545	0.003	Significant/ Reject Ho
Private	2.87			
Grade 6				
Public	3.10	-4.578	0.003	Significant/ Reject Ho
Private	2.96			
Overall for Grade 5 and Grade 6				
Grade 5	*3.35*	*1.915*	*0.006*	*Significant/ Reject Ho*
Grade 6				

Table 20. The significant difference between the level of academic performance of students in Mathematics by grade levels and by schools

As can be seen in Table 21, there was ***significant relationship*** between the professional development (PD) and the instructional practices (IP). Using *Pearson correlation*, it has an *r-value* of *-0.341* and a *p-value* of *0.001*. This signifies the *rejection* of the *null hypothesis*. This means that there was a *significant relationship* between PD and IP. This result confirms the studies of Evers, et. al (2016) who said that "PD is necessary to fill in the gaps in the skill sets of new teachers, and to continue to develop the expertise of teachers". Also, Rauf, et.al. (2017) showed that there is a positive significant relationship between school-based PD models and teachers' IP. Lastly, YuSoe (2018) concluded that teachers who completed teacher PD

can implement more effectively than those who didn't complete the teacher PD such as teacher training, teacher induction program and mentoring program.

On the other hand, the relationship between the PD and the academic performance of students in mathematics was ***insignificant*** because it has an *r-value* of *-0.027* and a *p-value* of *0.806* which implies the *acceptance* of the *null hypothesis.* This result is quite surprising because most researchers claimed the other way around, namely; Hill, H.C., et. al. (2013) showed that PD is significantly linked to student achievement; Huffman, et.al (2010) regression analyses suggested that curriculum development for mathematics teachers was significantly related to student achievement; Parish (2013) indicated that 5th grade students whose teacher spent more hours in professional learning for continuous improvement had increased likelihood of scoring above the district median on curriculum-based assessments; and Carillo, C., et. al. (2016) showed that PD interventions are more likely to lead to positive (and significant) effects when math rather than reading comprehension is used as the outcome measure.

Finally, there was ***no significant relationship*** between the teachers' IP and the academic performance of students in Mathematics. Using *correlation*, it has an *r-value* of *-0.052* and a *p-value* of *0.639* which is *insignificant*. This denotes the *acceptance* of the *null hypothesis*. Again, this is another remarkable unexpected result as most studies showed the opposite of this result. To mention a few, here are some of the researches: Johnson, A. (2017) found that the data indicated a significant correlation between teacher practice and student growth; Kiptum (2018) concluded that there was a positive and significant relationship between teachers' instructional leadership and students' academic achievement; and Blazar (2016) found that student outcomes are predicted by teaching practices between teachers' classroom organization and students' behavior in class; and between teachers' math errors and students' math achievement.

With these findings, it is but proper to mention that perhaps additional evidence on these relationships can suggest specific hypotheses for the future study such as IP which in turn, will provide research evidence that could strengthen PD of teachers and the improvement of students' academic performance. Adding more respondents from all grade levels and extending the research environment to more districts can perhaps lead important empirical evidence to support a well-established theory on the multidimensional nature of teachers' IP and students' academic performance, and thus the need for teachers' PD policies that account for this complexity.

Variables		t-value	p-value	Interpretation/ Decision
Professional Development	Instructional Practices	-0.341	0.001	*Significant/ Reject Ho*
Professional Development	Academic performance of Students in Mathematics	-0.027	0.806	*Insignificant/ Accept Ho*
Instructional Practices	Academic performance of Students in	-0.052	0.639	*Insignificant/ Accept Ho*

	Mathematics			

Table 21. The significant relationship between the professional development, instructional practices and the academic performance of students in Mathematics

Conclusions

1. The degree of professional development (PD) of administrators and teachers by schools was *high* in terms of the following areas: participation in induction and mentoring activities, participation type of PD, the impact and extent of PD activities participated in, and the teachers' need for PD. However, it had a *low* degree in terms of the areas in participation rates/ financial costs and the barriers to participation in PD.

2. There was *significant difference* between the degree of PD of administrators and teachers and the different areas of PD; there was *significant difference* between the degree of PD of administrators and teachers and the different respondents; and there was *significant difference* between the degree of PD of administrators and teachers and the different schools.

3. The extent of instructional practices (IP) of teachers by schools in terms of the areas such as the instructional activities in mathematics, instructional influences, and teachers' opinions were of *great extent*. However, there were *moderate extent* in terms of the areas in homeworks, assessments, and classroom instructional preparations.

4. There was a *significant difference* between the extent of IP of teachers and the different areas of the IP. There was also a *significant difference* between the extent of IP of teachers and the different respondents. And there was a *significant difference* between the extent of IP of teachers and the different schools.

5. The levels of academic performance among Grade 5 and 6 students in mathematics were both *Good.*

6. There was a *significant difference* between the level of academic performance of students in mathematics and the Grade levels and the schools.
7. There was a *significant relationship* between the professional development (PD) and the instructional practices (IP). However, there was *no significant relationship* between the PD and the academic performance of students in mathematics. Finally, there was *no significant relationship* between the IP and the academic performance of students in mathematics.

Recommendations

1. The teachers/administrators' professional development (PD) activities must be enhanced especially in the following areas: induction and mentoring activities; participation in the different type of PD such as courses/workshops, education conferences/seminars, observation visits, in-service trainings, network of teachers, and individual/ collaborative research. Math teachers/administrators must be encouraged to update their knowledge by attending in any PD programs in their field of specializations.

2. Surveys on PD Needs of mathematics teachers as well as administrators must be conducted regularly to ensure that the designed seminars/trainings/workshops/conferences will be in parallel and relevant to their actual *needs*, various activities/programs must be available for the teachers/administrators for the regular updating of their profession.

3. It is also recommended that the *great* extent of instructional practices (IP) of teachers by schools in terms of the instructional activities in mathematics, instructional influences and teachers' opinions must be maintained. On the other hand, the IP of teachers in terms of homeworks, assessments, and classroom instructional preparations must be strengthened.

4. The School as well as the Ministry of Education Area Office must regularly monitor the performance of mathematics teachers in terms of the different areas of IP such as homework, instructional activities in mathematics, assessment, instructional influences, classroom instructional preparations, and teachers' opinions. There must be regular in-service trainings for mathematics teachers.

5. The *Good* level of academic performance in mathematics among Grade 5 and 6 students must be improved. This must be reinforced in line with their actual needs and to jive with the emerging needs of the mathematically-inclined global students. Thus, it is recommended that there must be regular school-wide and city-wide activities for the mathematics.

6. It is also recommended that the Education Area Office must create a pool of Test Constructors whose sole task is to make a mini standardized test in mathematics so that there will be Centralized Mathematics Achievement Tests for all the schools and in specific levels.

7. It is further recommended to reevaluate the PD activities being offered and participated by the mathematics teachers. Also, it is encouraged to revisit/ reassess the IP of mathematics teachers as to whether or not it constantly adheres to the required/expected learning competencies in mathematics based on the updated curriculum focused on the authentic needs of the mathematics students.

8. It is finally recommended that future related studies such as other variables and predictors affecting the academic performance of students in mathematics, an in-depth systematic review and analysis of pre-service and in-service PD activities among mathematics teachers, and how the mathematics teachers cope with the dynamic IP involving authentic assessment among mathematics learners, are recommended in order to further enrich and strengthen the findings of this study.

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