

AN ANALYTICAL STUDY OF INSTRUCTIONAL LEADERSHIP ON PROFESSIONAL DEVELOPMENT FOR PROMOTING PRIMARY MATHEMATICS TEACHING

Pyae Phyo Khin¹, Cho Cho Sett²

Abstract

The objectives of this research are to investigate the levels of principals' instructional leadership knowledge and to analyze the principals' instructional leadership practices on professional development for promoting primary mathematics teaching, to study the relationship between principals' instructional leadership practices on professional development and teachers' primary mathematics teaching practices, and to identify the excellent predictors of instructional leadership practices on professional development for promoting primary mathematics teaching. Ninety two principals and five hundred teachers were selected in Yangon City Development Area (YCDA) by using the proportional stratified sampling. For quantitative study, questionnaire for principals and questionnaire for teachers were used to collect data. Interview, documentation, and observation checklists were used in qualitative study. Instrument was reviewed by a panel of expert. Descriptive statistics, independent samples *t* test, one-way ANOVA, Item Percent Correct (IPC), Pearson product moment correlation, and multiple regression analysis were employed to analyze the data in quantitative study. Cyclical process was used for qualitative study. The principals' instructional leadership practices on professional development were satisfactory. There were significant differences in principals' instructional leadership practices on professional development grouped by qualification, professional qualification, positions, level of knowledge. There was an association between principals' instructional practices on professional development and teachers' primary mathematics teaching practices. According to the result of multiple regression analysis, providing incentives, organizing learning opportunities, leading learning, and establishing a vision were the excellent predictors for promoting primary mathematics teaching practices. Based on the qualitative data, it appears that principals' instructional leadership practices on professional development had an influence on teachers' primary mathematics teaching practices.

Keywords: Instructional Leadership, Professional Development

- ¹ Dr, Assistance Lecturer, Department of Educational Theory, Yangon University of Education
- ² Dr, Lecturer, Department of Educational Theory, Yangon University of Education

Introduction

Findley and Findley (1992: 102, cited in Chell, 2002) state that "if a school is to be an effective one, it will be because of the instructional leadership of the principal". Moreover, Teacher quality and their effective pedagogy are defined as essential elements that maximize student participation and learning (Colbert et al., 2008; Mills et al., 2009; Dixon & Senior, 2011; cited in Jun*, 2014). This allows principals to rethink how they can better equip teachers with capacity to foster student knowledge acquisition in the classroom (Jun, 2014). Furthermore, mathematics is a core skill for all adult in life and makes an essential contribution to a good rounded education (ACME, 2011a; Vorderman et al., 2011, cited in Joubert, 2013). Mathematics is an excellent vehicle for the development and improvement of a person's intellectual competence in logical reasoning, spatial visualisation, analysis and abstract thought. Students develop numeracy, reasoning, thinking skills, and problem solving skills through the learning and application of mathematics (Singapore Ministry of Education, 2006). Therefore, mathematics teaching is vital role in education. So, it is urgently important to become effective mathematics teaching practices of teachers. The researcher believes that this study will be helpful to the development of a better understanding and appreciation of the importance of the instructional leadership of principals to improve the quality of teacher in primary mathematics teaching of our country

Objectives of the Research

The objectives of this study are as follows:

1. To investigate the levels of principals' instructional leadership knowledge on professional development for promoting primary mathematics teaching
2. To analyze the principals' instructional leadership practices on professional development for promoting primary mathematics teaching
3. To study the differences in principals' instructional leadership practices on professional development for promoting primary mathematics teaching in terms of personal factors and their knowledge level

4. To investigate the levels of teachers' knowledge on primary mathematics teaching
5. To study the relationship between principals' instructional leadership practices on professional development and teachers' primary mathematics teaching practices perceived by teachers
6. To identify the excellent predictors of instructional leadership practices on professional development for promoting the primary mathematics teaching

Research Questions

1. What are the levels of principals' instructional leadership knowledge on professional development for promoting primary mathematics teaching?
2. To what extent do teachers perceive the principals' instructional leadership practices on professional development for promoting primary mathematics teaching?
3. Are there any significant differences in principals' instructional leadership practices on professional development for promoting primary mathematics teaching in terms of personal factors and their knowledge level?
4. What are the levels of teachers' knowledge on primary mathematics teaching?
5. Is there any relationship between principals' instructional leadership practices on professional development for promoting primary mathematics teaching and teachers' mathematics teaching practices perceived by teachers?
6. What are the excellent predictors of instructional leadership practices on professional development for promoting the primary mathematics teaching?

Theoretical Framework

The following five dimensions of instructional leadership will be used in this research.

- Establishing a vision
- Organizing learning opportunities
- Leading learning
- Developing leadership
- Providing incentives

Establishing a Vision

The principal must be involved in the developing of a realistic vision_ based on alternative possibilities_ of better student outcomes, more meaningful curriculum content, or different pedagogical approaches to promote problem solving skill, reasoning skill, connection skill, communication skill, and representation skill. Therefore, there are four goals for professional development: goals for student learning, goals for teacher learning, goals for teaching practices and goals for the organization. In establishing a vision, the best professional development experience for mathematics teachers are needed to be considered. They include the followings:

- They are driven by a clear, well defined image of effective teaching and learning.
- They provide teachers with opportunities to develop knowledge and skills, and broaden their teaching approaches for strengthening the learning opportunities of mathematics teaching in promoting student outcomes.
- They use instructional methods to promote adult learning.
- They build or strengthen the learning community of mathematics teachers.
- They prepare and support teachers to serve in leadership roles.
- They provide links to other schools.
- They include continuous assessment.

This vision is a powerful catalyst for teachers to engage in professional development and the basic of teachers' goals for student outcomes. Teachers' ideas are solicited to establish this vision. And then, the principal finds ways to make teachers' diverse practices and voices to be valuable to the vision and mission.

Organizing Learning Opportunities

A principal should be ready to plan for, understand and support ongoing needs as the learning community grapples with new learning and change, and that careful planning and sustainability are two features of effective professional learning activities, features which permit teachers to obtain follow-up and support. To be effective in mathematics professional development, teachers need to ample time for in-depth investigation, reflection, continuous learning, professional materials, teaching materials, computers and advanced technology for themselves and their students. The best professional development experiences for mathematics teachers provide them with opportunities to develop knowledge and skills and broaden their teaching approaches to create better learning opportunities for students. Moreover, principals allow teachers to construct their own knowledge through immersion in the mathematical processes. Effective principals reorganize collaborative networks among educators were essential for successful teaching and learning.

Leading Learning

Leading learning is that instructional leaders become to involve in the learning itself and promote learning cultures within their schools. Firstly, the principal leads the structures and conditions within the learning community and provides the support through continuing the dialogue, being involved in the process, coaching and problem solving within the environment of collegiality. The second is about knowing what content and learning activities are likely to be of benefit. The third challenge is for leaders to understand what is required if improvements in student outcomes are to be sustained once major external support is withdrawn and the drive and initiative must come from the teachers themselves (Timperley *et al.*, 2007).

Developing Leadership

Teachers are leaders lead within and beyond the classroom, identify with and contribute to a community of teacher learners and leaders, and influence others towards improved educational practice'. Teacher leadership has three main facets:

- Leadership of students or other teachers
- Leadership of operational tasks
- Leadership through decision making or partnership

To become teachers master the skills of their profession, they need to be encouraged to step beyond their classrooms and play roles in the development of the whole school and beyond. Instructional leaders support the followings:

- Planning and implementing professional development opportunities for themselves and others,
- Acting as agents of change,
- Promoting a shared vision of mathematics education, and
- Supporting other teachers.

Providing Incentives

To become instructionally effective schools, principals develop incentives for learning that are school-wide in orientation. Principals have an important role in encouraging teachers to be involved in professional learning programs. Besides, principals recognize and celebrate people success and achievements, and their contributions to the professional/ learning community. Effective principals invite teachers to be part of the change process and encourage them to participate in different professional learning programs such as workshop, seminars, conferences and team learning. And then, they find ways to reward or recognize teachers for their efforts. Some of these are informal such as private words of praise; others are more formal such as recognition before peers, nomination for rewards or letters to the personnel files of teachers. Moreover, successful leaders have high expectations for themselves and their teachers.

According to Loucks-Horsely et al. (2010), instructional leadership knowledge are nature of mathematics, learners and learning, teachers and teaching, adult learning and professional development, and change process.

As an instructional leader, school principals are also responsible to improve mathematical process skills on the followings.

Problem Solving: Problem solving is the process of applying previous acquired knowledge in new and unfamiliar situations (Scusa, 2008).

Reasoning: Mathematical reasoning refers to the ability to analyse mathematical situations and construct logical arguments (Singapore Ministry of Education, 2006).

Communication: Communication is the process of expressing mathematical ideas and understanding orally, visually, and in writing, using numbers, symbols, pictures, graphs, diagrams, and words (Wichelt, 2009).

Connection: Connection refers to the ability to see and make linkages among mathematical ideas, between mathematics and other subjects, and between mathematics and everyday life (Singapore Ministry of Education, 2006).

Representation: Representation refers both to process and to product _ in other words, to the act of capturing a mathematical concept or relationship in some form and to the form itself (NCTM, 2000).

Definitions of Key Terms

Instructional Leadership

Instructional leadership refers to actions undertaken to develop a productive and satisfying work environment for teachers and desirable learning conditions and outcomes for children (Greenfield, 1987).

Professional Development

Professional development is defined as process and activities designed to enhance the professional knowledge, skills, and attitudes of educators so that they might, in turn, improve the learning of students (Guskey, 2000, cited in Steiner, 2004).

Operational Definition

Instructional leadership refers to actions undertaken to promote teachers' professional development for improving students learning outcomes. These actions include establishing a vision, providing learning opportunities, leading learning, developing leadership, and providing incentives.

Research Method

Both quantitative and qualitative methodologies were used in this study.

(i) Sample

The sample was consisted of 92 schools from YCDA. In addition, 92 principals and 500 teachers from selected schools in YCDA were chosen by using proportional stratified sampling method. So, teacher sample included 82 (16.3%) teachers from high school level, 100 (20%) teachers from middle school level, and 318 (63.7%) teachers from primary school level. Purposive sampling method is used in qualitative study. Among selected schools, 4 schools were purposefully chosen from the primary schools, and each 2 schools was chosen from middle schools and high schools group based on the highest and the lowest mean scores in each level.

(ii) Instruments

In the principals' instructional leadership knowledge questionnaire, demographic data, items for nature of mathematics, learners and learning, teachers and teaching, change process, and adult learning and professional development were included. There are 30 true/false items, and 10 multiple choice items in this questionnaire. There were 41 items in instructional leadership practices questionnaire and each item was rated on a five-point Likert scale ranging from 1 to 5 (1=never, 2=seldom, 3=sometimes, 4=often and 5=always). Among them, 8 items were related to the area of "Establishing a Vision", 10 items were related to "Providing Learning Opportunities", 9 items were related to "Leading Learning", 8 items were also related to "Developing Leadership" and 6 items were related to "Providing Incentives". Moreover, the set of questionnaire for teachers was developed by dividing two portions. One portion was to examine the knowledge of teachers based on

how children learn and mathematical process skills. This knowledge questionnaire included 10 true / false items relating to knowledge on how children learn, 15 multiple choice items, and 9 matching items related to mathematical process skills. The other is mathematics teaching practices of teachers. There are 20 items (five point Likert-type) relating to teaching practices on mathematical process skills: 1=never, 2=seldom, 3=sometimes, 4=often and 5=always. The internal consistency (Cronbach's alpha) were 0.87 for the questionnaire to investigate principals' instructional leadership practices, 0.69 for principals' instructional leadership knowledge questionnaire, 0.85 for the questionnaire to explore teachers' knowledge on primary mathematics teaching and 0.72 for the questionnaire of teachers' teaching practices. In qualitative study, interview, documentations, and observation checklist were used.

(iii) Procedures

In order to construct appropriate questionnaires concerning this study, the related literature was reviewed and analyzed. In addition, the researcher got some advice and guidance from 17 expert teachers who were experienced and well versed in this field. And then, the wording and content of items were modified to clarify for participants in according with the advice of experts. After receiving permission from the Director General of Education in Yangon Region, pilot study was conducted on 12th July 2016 in 11 Basic Education Schools. After reviewing and modifying the items of questionnaires based on the responses of pilot test, questionnaires were distributed to the selected Basic Education Schools on 1st September, 2016. All questionnaires were collected after two weeks. Interviews were conducted with selected principals and teachers to obtain more information about instructional leadership practices from December, 2016 to February, 2017.

(iv) Data Analysis

Descriptive, Item Percent Correct (IPC), Pearson correlation, Independent sample *t* test, One way ANOVA followed by Tuskey post hoc analyses, and Multiple Regression were used for quantitative data analysis. To analyze the qualitative data, the cyclical process was used.

Findings

Table 1: Knowledge Level of Principals about Nature of Mathematics (N=92)

Scoring Range	No. of Principals	Percentage (%)	Remark
<50%	2	2.2	Below satisfactory level
50%-74%	15	16.3	Satisfactory level
≥75%	75	81.5	Above satisfactory level

Scoring range: <50%= below satisfactory 50%-74%= satisfactory ≥75%=above satisfactory

Table 2: Knowledge Level of Principals about Learners and Learning (N=92)

Scoring Range	No. of Principals	Percentage (%)	Remark
<50%	8	8.7	Below satisfactory level
50%-74%	46	50	Satisfactory level
≥75%	38	41.3	Above satisfactory level

Scoring range: <50%= below satisfactory 50%-74%= satisfactory ≥75%=above satisfactory

Table 3: Knowledge Level of Principals about Teachers and Teaching (N=92)

Scoring Range	No. of Principals	Percentage (%)	Remark
<50%	2	2.2	Below satisfactory level
50%-74%	28	30.4	Satisfactory level
≥75%	62	67.4	Above satisfactory level

Scoring range: <50%=below satisfactory 50%-74%= satisfactory ≥75%=above satisfactory

Table 4: Knowledge Level of Principals about Change Process (N=92)

Scoring Range	No. of Principals	Percentage (%)	Remark
<50%	3	3.3	Below satisfactory level
50%-74%	22	23.9	Satisfactory level
≥75%	67	72.8	Above satisfactory level

Scoring range: <50%= below satisfactory 50%-74%=satisfactory ≥75%=above satisfactory

Table 5: Knowledge Level of Principals about Adult Learning and Professional Development (N=92)

Scoring Range	No. of Principals	Percentage (%)	Remark
<50%	7	7.6	Below satisfactory level
50%-74%	51	55.4	Satisfactory level
≥75%	34	37.0	Above satisfactory level

Scoring range: <50%= below satisfactory 50%-74%= satisfactory ≥75%= above satisfactory

Table 6: Mean Values and Standard Deviations for Principals’ Instructional Leadership Practices on Professional Development for Promoting Primary Mathematics Teaching Perceived by Teachers (N=500)

No	Variables	Mean	SD	Remark
1.	Establishing a Vision	3.52	.81	Moderately high
2.	Organizing Learning Opportunities	3.23	.78	Satisfactory
3.	Leading Learning	3.42	.83	Satisfactory
4.	Developing Leadership	3.56	.86	Moderately high
5.	Providing Incentives	3.37	.98	Satisfactory
	Overall Instructional Leadership Practices	3.41	.74	Satisfactory

1.00-1.49=very low 1.50-2.49=moderately low 2.50-3.49=satisfactory .50-4.49= moderately high 4.50-5.00=very high

Table 7: Results of Independent Samples *t* Test for Instructional Leadership Practices of Principals Perceived by Teachers on Professional Development for Promoting Primary Mathematics Teaching

Dependent Variable-*Overall instructional leadership practices*

Independent Variables	Group	Mean	SD	<i>t</i>	<i>df</i>	<i>P</i>
Gender	Male	3.44	.88	.306	115.510	ns
	Female	3.41	.71			
Qualification	BEd; Mphil; MEd	3.52	.71	3.273	498	.001***
	BA; BSc	3.30	.76			
Administrative Service	≤10years	3.46	.73	1.49	498	ns
	>10years	3.37	.75			

p*<.05, *p*<.01, ****p*<.001, ns= no significance

According to Table 7, it was found that there was significant difference in overall instructional leadership practices depending to their qualification ($t(498) = 3.273, p < .001$). There were no significant differences in overall instructional leadership practices on professional development according to gender, and administrative service.

Table 8: ANOVA Results of Principals' Instructional Leadership Practices Perceived by Teachers on Professional Development for Promoting Primary Mathematics Teaching

Dependent Variable-*Overall instructional leadership practices*

Independent Variables	Group	Mean	SD	F	P
Professional Qualification	JTTC	3.30	.71	5.520	.004***
	DTEC	3.43	.57		
	BEd;MPhil;M.Ed	3.52	.76		
Service	≤20	3.31	.71	.534	ns
	20-30	3.42	.67		
	>30	3.43	.80		
Position	Group 1	3.35	.80	3.257	.039*
	Group 2	3.48	.61		
	Group 3	3.56	.86		
Knowledge level of nature of mathematics	Group A	2.63	.21	2.237	ns
	Group B	3.41	.80		
	Group C	3.42	.73		
Knowledge level of learners and learning	Group A	3.38	.90	.089	ns
	Group B	3.41	.72		
	Group C	3.43	.73		
Knowledge level of teachers and teaching	Group A	3.09	.81	1.358	ns
	Group B	3.34	.78		
	Group C	3.44	.73		
Knowledge level of change process	Group A	2.41	.49	17.093	.000***
	Group B	3.36	.75		
	Group C	3.47	.72		

Independent Variables	Group	Mean	SD	F	P
Knowledge level of adult learning and professional development	Group A	3.15	.76	4.668	.010***
	Group B	3.42	.78		
	Group C	3.49	.67		

Group 1= primary school principals, Group 2 = middle school principals, Group 3 = high school principals Group A=below satisfactory level, Group B=satisfactory level, Group C= above satisfactory level * $p < .05$, ** $p < .01$, *** $p < .001$, ns= no significance

According to Table 8, there were significance differences in overall instructional leadership practices on professional development among three groups of teachers organized by their professional qualification, position, their level of knowledge about change process, and adult learning and professional development. There were no significant differences in overall instructional leadership practices on professional development with respect to their service, and their levels of knowledge about nature of mathematics, learners and learning, and teachers and teaching.

Table 9: Knowledge Level of Teachers about How Children Learn (N=500)

Scoring Range	Frequency	Percentage	Remark
<50%	4	.8	Below Satisfactory Level
50%-74%	237	47.4	Satisfactory Level
≥75%	259	51.8	Above Satisfactory Level

Scoring range: <50%= below satisfactory 50%-74%=satisfactory ≥75%= above satisfactory

Table 10: Knowledge Level of Teachers about Mathematical Process Skills (N=500)

Scoring Range	Frequency	Percent	Remark
<50%	184	36.8	Below Satisfactory Level
50%-74%	285	57.0	Satisfactory Level
≥75%	31	6.2	Above Satisfactory Level

Scoring range: <50%= below satisfactory 50%-74%=satisfactory ≥75%= above satisfactory

Table 11: Mean Values and Standard Deviations of Primary Mathematics Teaching Practices of Teachers (N=500)

Variable	Mean	SD	Remark
Primary Mathematics Teaching Practices	3.72	0.61	often

1.00-1.49=never 1.50-2.49= seldom 2.50-3.49=sometime 3.50-4.49= often 4.50-5.00=always

Table 12: Correlation between Principals' Instructional Leadership Practices on Professional Development and Teachers' Primary Mathematics Teaching Practices

	ILP	MTP
Instructional Leadership Practices	1	.523**
Teaching Practices	.523**	1

** . Correlation is significant at the 0.01 level (2-tailed).

ILP= Principals' Instructional Leadership Practices on Professional Development

MTP=Teachers' Primary Mathematics Teaching Practices

According Table 12, there is an association between principals' instructional leadership practices on professional development and primary teachers' mathematics teaching practices ($r=.523$, $p<0.01$).

The Potential Factors Affecting Primary Mathematics Teaching Practices

To investigate the excellent predictors of instructional leadership practices on professional development for promoting mathematics teaching practices, simultaneous multiple regressions was conducted by identifying predictors such as establishing a vision (EV), organizing learning opportunities (OLO), leading learning (LL), developing leadership (DL), and providing incentives (PI). The means, standard deviations, and inter correlations were shown in Table 5.

Table 13: Means, Standard Deviations, and Inter-correlations for Teaching Practices and Predictors Variables

Variables	Mean	SD	EV	OLO	LL	DL	PI
Mathematics Teaching Practices	3.72	.61	.450***	.475***	.475***	.438***	.458***
Predictors Variables							
Establishing a Vision	3.52	.81		.737***	.721***	.631***	.618***
Organizing Learning Opportunities	3.23	.78			.791***	.728***	.683***
Leading Learning	3.41	.83				.752***	.695***
Developing Leadership	3.56	.86					.785***
Providing Incentives	3.37	.98					-----

When the combination of variables to predict primary mathematics teaching included establishing a vision (EV), organizing learning opportunities (OLO), leading learning (LL), developing leadership (DL), providing incentives (PI), $F(5,494) = 37.88, p < .001$.

The beta coefficients were presented in Table 13. Providing incentives (PI), organizing learning opportunities (OLO), leading learning (LL), and establishing a vision (EV) significantly predict primary mathematics teaching practices when all five variables are included. The adjusted R squared value was .27. This indicates that 27% of the variance in mathematics teaching practices was explained.

Table 14: Simultaneous Multiple Regression Analysis for Factors Predicting Primary Mathematics Teaching Practices

Variables	B	Std. Error	Beta
Establishing a Vision	.097	.046	.129*
Organizing Learning Opportunities	.110	.055	.142*
Leading Learning	.102	.053	.140*
Developing Leadership	.006	.050	.009
Providing Incentives	.109	.040	.177**
Constant	2.279	.113	
$R^2 = .27; F(5,494) = 37.88, *p < .05, **p < .01, ***p < .001$			

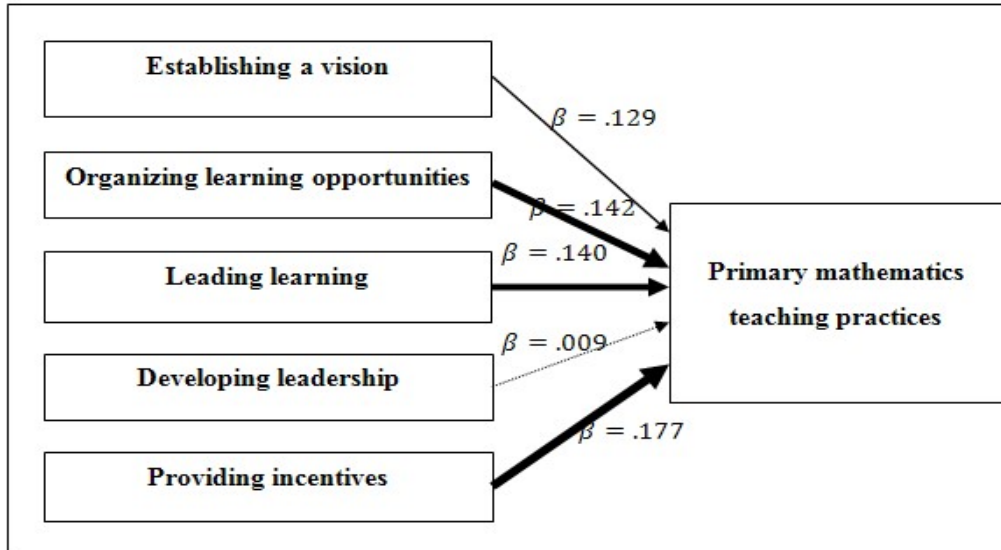


Figure 1: Potential Factors Affecting Primary Mathematics Teaching Practices
Predicting on Primary Mathematics Teaching Practices (Statistically significant)

Predicting on Primary Mathematics Teaching Practices (Not significant)

With regard to the difficulties in implementing the teachers' professional development activities in their schools, principals gave the following some responses.

1. Teachers have many responsibilities for all subjects. (N=5, 62.5%)
2. Principals are busy with clerical work. (N=1, 12.5%)
3. Teachers have too much workload of teachers (marking, remedial teaching, full time of teaching). (N=8, 100%)
4. Their schools are double shift schools. (N=2, 25%)
5. Their schools are necessary to be provided financial support for professional development. (N=3, 37.5%)
6. They can not sufficiently support mathematical books. (N=5, 62.5%)
7. Teachers have little time to read and study books at the school. (N=8, 100%)
8. Their schools do not have enough teachers. (N=2, 25%)

9. It is necessary to supply of more teachers in order to focus on professional development. (N=6, 75%)
10. Principal is more emphasis on taking the responsibilities for keeping problem children in the school. (N=1, 12.5%)

Moreover, some suggestions for promoting mathematics teaching recommended by the teachers were as follows:

The principal should

1. Provide teachers with necessary mathematical reference books. (N=10, 62.5%)
2. Provide teaching aids necessary for teaching. (N= 12, 75%)
3. Make Pre-planning and discussing the lessons with teachers before teaching. (N=2, 12.5%)
4. Motivate teachers to carry out their professional development. (N=2, 12.5%)
5. Make careful classroom observations to improve teachers' teaching practices. (N=2, 12.5%)
6. Help teachers gain satisfaction from their teaching. (N=2, 12.5%)
7. Award outstanding teachers "the best teaching prize" for the whole academic year based on their teaching performance. (N=4, 25%)
8. Arrange a separate room and setting time for teachers' professional development. (N=12, 75%)
9. Create and plan opportunities for teachers to attend workshop, refresher courses, and educational talks. (N=4, 25%)
10. Keep and recruit the outstanding mathematics teachers as much as possible (N=1, 6.25%)

According to the qualitative findings, Group A principals observed and gave feedback about their teaching and established goals concerning mathematics teaching. Group B principals had no special vision or goal about mathematics teaching. Group A principals supported mathematical books and teaching aids and arrange time and place to discuss the mathematics teaching and learning while Group B principals supported only Pyinnya Tazaung and teaching aids provided by Ministry of Education and have no definite time and

place to discuss mathematics teaching and learning. Group A principals often involved in leading learning although Group B principals sometimes involved in leading learning. Almost all principals gave teachers opportunities concerning developing leadership. Group A principals recognized formally and informally for teachers' good teaching practices.

According to qualitative findings, teachers from Group A principals' schools gave opportunities to students to think the ways to solve the problems and to discuss in group, used teaching aids for improving representation, explained the problem by connecting everyday life, and sometimes asked questions such why and how. Teachers from Group B principals' schools normally led to solve the problems, were weak in using teaching aids, were less emphasis on connecting everyday life, did not asked questions such as how and why.

Conclusion

Conclusion and Discussion

It can be concluded that most of the principals in this study had above satisfactory level of knowledge about nature of mathematics, learners and learning, teachers and teaching, and change process. Most of the principals are satisfactory level about adult learning and professional development.

The quantitative findings of this study revealed that the practices on establishing a vision were moderately high and it appears to be the fourth excellent predictor of teachers' primary mathematics teaching practices. According to the result of interview indicated that most of the principals from Group A had goals regarding student learning, methods of teaching and collaborative learning. Group A principals also facilitate to establish the goals for mathematics teaching and learning process together with their teachers. Therefore, as a principal should establish a vision or goals of teacher professional development on student learning.

According to quantitative findings, organizing learning opportunities was the best second predictors for teachers' primary mathematics teaching practices. Moreover, principals seldom practice in allocating appropriate funds for professional development. In qualitative findings, it was weak in supporting appropriate funds for professional development. Group A

principals supported needed materials for creating teaching aids and some mathematical books. It can be said that the more principals support funds, time, and mathematical books, the more teachers' profession improve.

According to the questionnaire survey, the practice of principals on leading learning was moderately high and it was the third excellent predictor for teachers' primary mathematics teaching practices. Based on the interview results, it is assumed that only two principals were keen to support teachers as facilitators for their professional development. Documentation highlighted that middle school level and high school level principals always involved in board of study meeting. Interview indicated that they sometimes involved in board of study meeting if they had time. Group B principals were weak in leading board of study meetings because they put an emphasis on administrative tasks. Thus, the findings highlighted that leading learning is also important for promoting teacher professional development.

The principals' instructional leadership practices on developing leadership were moderately high. Interview indicated that their teachers were allowed by principals to participate in school decision making process, shared ideas with colleagues, work with parents in order to promote their children's mathematics learning and lead mathematics teaching in some ways. Thus, it is necessary to delegate authority about instructional resources and activities to improve their teaching and professional development. So, principals are highly suggested to focus more on this area of developing leadership as much as possible.

Principals moderately practised providing incentives and it appeared to be the first excellent predictor of teachers' primary mathematics teaching practices. Interview pointed out that Group A principals publicly recognized teachers individually or in group for their good teaching practices and trying to sit for the selecting examination of outstanding teacher especially at meetings and annual prize giving ceremony held by parent teacher association. Moreover they gave rewards to the teachers who can create good teaching aids. Therefore, it has been recognized as a vital part of enhancing teacher professional development to promote primary mathematics teachings. It is clear that principals need to be trained to know the importance of providing incentives and the ways concerning providing incentives.

It was found that the practices of principals who had BEd degree were more than those of principals who had BA or BSc degree. There were significant differences in instructional leadership practices on professional development in accordance with their professional qualification. It appeared that the practices principals who attended BEd were more than those of principals who attended DTEC or JTTC. Moreover, a similar result was found in qualitative study according to these demographic characteristics. These differences apparently influence on instructional leadership practices on professional development and it is necessary to encourage primary level school principals to attend BEd degree courses.

There were significant differences in the instructional leadership practices on professional development according to their administrative service. It was concluded that the principals who had 10 years and less than 10 years of administrative service performed all areas of instructional leadership practices more than the principals who had more than 10 years of administrative service did. Based on the qualitative findings, it was found that the principals who had less administrative service possessed much professional qualification. Therefore, it would be suggested that the principals should have opportunities to attend professional training.

According to position, it was found that the practice of Group A (Primary level school principals) was significantly different from that of Group B (Middle level school principals) and Group C (High school level school principals) in the area of establishing a vision. Group C practised instructional leadership on professional development more than Group B and Group A.

There were significant differences in instructional leadership practices on professional development among principals relating to their knowledge level of change process, and adult learning and professional development. It is likely concluded that among the three groups, high satisfactory level group (Group C) mostly practised the instructional leadership on professional development. The instructional leadership practices of principals who had above satisfactory level for promoting professional development were more than other groups. It is also urgently needed to update principals' knowledge of professional development and instructional leadership.

According to the investigation into the knowledge of teachers on how children learn, most of the teachers were above satisfactory level. It can be concluded that they have sufficient knowledge about how children learn. Moreover, this study also investigated knowledge level of teachers on mathematical process skills. Only 31 teachers had above satisfactory level and 184 out of 500 teachers had below satisfactory level. Interview and documentation revealed that board of study meeting was found of discussing exam result of students and official instructions by Township Education Office, and putting less emphasis on professional development activities. Therefore, creating opportunities for participating in workshops, seminars, lesson study, mentoring and coaching programs, and providing the requirements such as financial support and books and teaching learning materials concerning mathematics should be implemented so that teachers can improve pedagogical content knowledge for mathematical process skills. It would be better when these opportunities are arranged in school setting in order that teachers can grasp these chances without giving much time. Findings from the questionnaire survey indicated that they often provided learning opportunities to promote mathematical process skills.

There is a relationship between instructional leadership practices of principals on professional development and primary mathematics teaching practices of teachers ($r=.523$, $p<.0.01$). These results are similar to those of Mwangi (2009) who attributed principals' leadership and engagement strongly impacts mathematics teaching performance.

Suggestions

- Since the principals' instructional leadership practice on professional development is crucial for promoting primary mathematics teaching, it is necessarily important to promote the role of principals concerning instructional leadership on professional development.
- Principals should encourage teachers to engage in the professional development activities for promoting primary mathematics teaching by establishing goals and directions based on students learning and their teaching practices.

- Principals should enhance teachers' engagement in professional development for promoting primary mathematics teaching by organizing learning opportunities such as time, place, books, and human resources.
- Principals should actively lead teachers' professional development by creating collaborative learning culture.
- Principals should create opportunities for teachers to participate in implementing professional development activities such as planning for themselves and others.
- Principals should recognize and praise teachers to their eagerness of participating in the professional development activities.
- Principals should be encouraged to draw individual development plan for teachers.
- Extra work loads which can be waste of energy and time for principals and teachers should be reduced.
- It is necessarily important to organize professional development activities such as lesson study, workshops, seminars, institutes, demonstration lesson, action research, coaching, mentoring, online professional development, and professional network that are supportive to improve primary mathematics teaching.
- It is certainly needed to support and give opportunities to principals for promoting their instructional leadership practices concerning professional development.
- It is highly required to appoint the sufficient number of well trained teachers to be able to implement professional development activities in the school setting.
- It is greatly necessary that school funds should be allocated and well spent on professional development activities.
- It is truly needed professional development programs for principals as instructional leaders in mathematics.

- School inspectors should emphasize not only teaching learning activities but also teachers' professional development activities when they visited the schools.

Need for Further Research

Further research could also find out the factors affecting principals' instructional leadership on professional development. It is necessarily demanded to reveal the barriers in instructional leadership practices on professional development for promoting primary mathematics teaching. Further study could compare the instructional leadership practices on professional development for promoting primary mathematics teaching between principals and subject deans. Moreover, it is necessary to investigate principals' instructional leadership practices on professional development for promoting primary mathematics teaching in other townships, states and divisions to represent the whole country. Furthermore, the similar study like "An analytical study of instructional leadership on professional development for promoting primary mathematics teaching" should be conducted for other subjects in order to promote teaching learning process of the respective subjects.

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