ISSN 2732-3781 DOI: 10.52398/gjsd.2021.v1.i2.pp29-43

GiLE Journal of Skills Development

Curriculum development as a tool for professional development: Teacher learning through collaboration and communication

Khin Khin Thant Sin
Eötvös Loránd University, Doctoral School of Education, Faculty of Education and Psychology

Abstract

This study investigates teacher participation in national curriculum development in Myanmar. The purpose of this study is to explore teacher learning and reflection during the process of curriculum development through collaboration and communication. A qualitative research method has been applied in this study. Six participants participated in the study through individual interviews. The participants include six school teachers from Basic Education High Schools, specifically, two curriculum developers, two teachers who delivered the subject content of the new curriculum to their colleagues and two school teachers who were trainees for the content. The results showed that teachers experienced significant development in their professional knowledge, especially in their understanding and connection to the subject matter content across different grades and pedagogical content knowledge when they learnt from their colleagues. Moreover, the results also highlighted improvement in their reflective thinking and analytical skills. Because of the challenging tasks during the curriculum development process, teachers became more motivated in their teaching and learning which led to enhance their work performance.

***Keywords*:** teacher learning, curriculum development, professional development, collaboration and communication, reflection

1. Introduction

Learning is not only about transferring ideas from a knowledgeable person to one who is not (Sandholtz, 2002). According to Sandholtz (2002), learning is perceived as a personal, reflective, and transformative process with integration of ideas and experiences and the creation of knowledge. Traditionally, teacher professional development is assumed as teachers listening to lecturers and attending trainings provided by academics. Furthermore, it had been recognized as an activity separated from teachers' daily work (Fullan, 1995).

As time has changed and the demands of society on schools has increased, teachers as passive receivers of knowledge are not enough for the challenges of society. As many scholars have claimed, teachers should be active participants in their own professional growth since they also have rich experiences and knowledge which can be shared by collaborating and communicating with their colleagues and even with other professions (Hargreaves, 1999; Sandholtz, 2002; Shulman, 1986).

2. Theoretical Background

In this section, literature on teacher learning, teacher collaboration and communication for professional development will be discussed. Furthermore, curriculum development as a tool for teachers' professional development will be outlined.

2.1 Curriculum development as an impetus for professional development

Many scholars have pointed out curriculum development as an impetus for improving the professional development of teachers (Fullan & Pomfret, 1977; Keiny, 1993). Some authors have noted that school curriculum is a framework for collective action and individual growth while the school can be considered as an entity or a social organism (Skilbeck, 1998).

According to Keiny (1993), school-based curriculum development (SBCD) can be seen as an endeavor aimed at improving and changing the education system in three areas. First of all, curriculum development at schools can support the school to get more autonomy by reducing dependency on central or national curricula. Secondly, teachers can reflect on their students' needs and then adapt their behaviors to the capacities and abilities of their students through SBCD. The last factor which curriculum development can foster is the professional development of teachers who actively participate in curriculum development by collaborating with colleagues, university professors and different professionals (Keiny, 1993). This article will highlight the growth of the professional knowledge of teachers during the process of new curriculum development in Myanmar.

Teachers' professional development and curriculum development are two couple processes (Keiny, 1993). According to Keiny, teachers gather together in a group to discuss, reflect and learn from each other in the curriculum development process. When they are working in a group, their opinions, experiences, and their knowledge are shared, and they reflect on their own practices while learning from others. Through group working in the curriculum development process, teachers learn from each other and undergo a process of professional growth (Keiny, 1993).

According to Fullan (1991), there are three approaches to curriculum implementation. The first one is "fidelity or programmed approach" where the expectation is that there is consistency between curriculum designers' proposals and what happens as outcomes. The second approach is called "mutual adaptation" where school teachers and principals become decision makers of what is most useful for their schools and students. The third is "evolutionary change" where the practitioners get autonomy to change their practice in order to achieve the desired results (Fullan & Pomfret, 1977). Each approach offers learning opportunities for teachers. As they participate in developing curriculum or delivering curriculum, they reflect on their practices and improve their understanding and knowledge about the subject matter and pedagogical knowledge.

2.2 Collaboration and communication between teachers towards professional knowledge development

In parallel with the need for improving teacher quality, upgrading teachers' professional knowledge has been recognized and favored in education. Since Vygotsky's theory of zones of proximal development and Piaget's theory of cognitive development, our understanding of the nature of teachers' professional knowledge has developed rather slowly (Revai & Guerriero, 2017). Since there was a lack in emphasizing collaboration in teacher education, this led to the slow development in our understanding of teachers' professional knowledge compared to other professions where research and practices are strongly connected during application.

According to Shulman (1987), teacher knowledge can be organized into seven categories. These include:

a) content knowledge,
b) general pedagogical knowledge (broad principles and strategies of classroom management, etc.),
c) curriculum knowledge,
d) pedagogical content knowledge,
e) knowledge of learners and characteristics,
f) knowledge of educational contexts (governance and financing of school districts, etc.),
g) knowledge of educational goals, purposes, values and philosophical and historical grounds (Shulman, 1987).

Among the conceptualizations of knowledge from different disciplines, the distinction between "tacit and explicit knowledge" and "declarative and procedure knowledge" are among the most frequently mentioned ones (Nonaka, 1994). Explicit knowledge is knowledge that teachers can express in words or other symbolic representations to another person while tacit knowledge is what teachers cannot articulate or articulate only with some difficulty. Sometimes, this tacit knowledge is thought of as a personal one which can only be transferred through direct contact with the owner. There is an assumption that the knowledge of teachers is largely tacit, that is, "they know more than what they can tell" (Polányi, 1967). Declarative and procedural knowledge represents "knowing that" and "knowledge how" where declarative is often referred to as "explicit memory" and procedural knowledge as "implicit memory" (Revai & Guerriero, 2017). At this point, to deliver tacit knowledge, collaboration and communication among teachers is extremely important. Many scholars have stressed that since teachers possess knowledge that they cannot articulate, collaboration and communication is the optimal way to disseminate this knowledge within the teacher community.

Besides focusing on teachers' professional knowledge itself, some scholars have highlighted the importance of teachers' professional knowledge in establishing "knowledge-creating schools" (Hargreaves, 1999). According to Hargreaves (1999), teacher professional knowledge is very important in creating such kind of schools and this kind of schools have specific characteristics related with developing teachers' professional development. The features of knowledge creating schools include:

a) auditing the professional working knowledge of teachers,

b) managing the process of creating new professional knowledge,

c) validating the created professional knowledge, and finally,

d) disseminating the created professional knowledge.

This implies that teachers' professional knowledge should be audited, created, validated and disseminated in knowledge-creating schools. Shulman (1987) suggested that the research community collaborate with teachers in order to have access to the practical pedagogical wisdom of teachers. Hargreaves (1999) and Shulman (1987) highlighted that the collaboration among teachers and other professionals assure the knowledge creation and dissemination within teacher communities.

2.3 The specific context: Myanmar

Myanmar, located in Southeast Asia, is the largest country in this region and has a population about 54 million based on the 2014 Census. The education system of the country experienced decline for many decades and it has been at the bottom of the league table of ASEAN since 1962 (Borg et al., 2018). In 2015, the country reemerged from decades of international isolation and started to create reform in every sector of the country. This study investigated one of the reform areas of the country's education system.

With the rapid changes in every sector to achieve sustainable economic development, the country is also focusing on education reform. One of the reforms in education is basic education reforms for the 21st century which include four reform areas:

a) Access, quality, and inclusion

b) Curriculum

c) Student assessment and examinations

d) Teacher education and management

It is assumed that basic education curriculum is an essential building block for the country's socio-economic development and quality education (Ministry of Education, 2015). The Ministry of Education (MOE) focuses on improving the basic education curriculum in order to prepare students for 21st century skills, soft skills (including personal development and employability skills) and higher-order thinking skills. The aims of the basic education curriculum include a number of new items. According to official documents (Ministry of Education, 2015): after the completion of basic education, students will be able to:

1. attend the school until the completion of basic education,
2. develop "union spirit" and appreciate, maintain, and disseminate languages and literatures, cultures, arts and traditional customs of all national groups,
3. become good citizens with well-developed five strengths including critical thinking skills, communication skills and social skills,
4. apply their civic and democratic potentials in daily lives and abide by laws,
5. be competent for Myanmar language which is the official language of the Republic of the Union of Myanmar and develop their skills in their respective ethnic language and English,

6. develop foundational knowledge and skills for higher learning and technical and vocational education,
7. develop sound body and sportsmanship through participation in physical education activities and school health activities, and apply health knowledge in their daily lives,
8. appreciate and maintain natural environment and materialize its sustainability,
9. become global citizens with awareness and appreciation of human diversity and abilities to practice basic knowledge of peace in their daily lives,
10. take pride in being a citizen of the Union of Myanmar.

In parallel to curriculum reforms, MOE tried to strengthen the professional capacity of curriculum development teams. The intention of MOE was to strengthen the professional skills of these teams in order to make them capable to lead the development of the new basic education curriculum and undertaking regular monitoring and reviews. Therefore, MOE implemented the Curriculum Capacity Development Program. Its main components include teacher training on the new basic education curriculum, capacity development of curriculum development teams and capacity development for curriculum development teams of nationalities' languages (Ministry of Education, 2015).

In this research, three groups of high school teachers who participated in curriculum development process at national level and school level were interviewed. The first group includes the teachers who participated in the curriculum development process at the national level. At the national level, teachers collaborated with university professors and academic specialists as members of the curriculum development team. The teachers have the main responsibilities to develop the new curriculum of the specific subject areas. They have worked together with colleagues and professors in adjusting the scope of content to the context and in negotiating new curriculum content according to their specific subjects. The second group includes teachers who were trained by curriculum developer teachers and then were assigned as trainers to share and teach the new curriculum content with colleagues. Teachers were trained by university professors and academic specialists for two days. After two days of training, they have been appointed as trainers to deliver the new curriculum related knowledge to their colleagues in the township where their schools are located. The third group are teachers who attended those trainings (delivered by trainer teachers for seven days) in the process of curriculum development.

3. Methodology

In order to comprehensively understand the teachers' learning and collaboration during the process of curriculum development and implementation, this research applied a qualitative study through individual interviews with participants. The main method of data collection was semi-structured interviews with six school teachers.

3.1 Participants

The selection of interviewees followed two main rules: firstly, selected interviewees had to be representative of basic education teachers in the curriculum processes within the country. Secondly, it is a random selection from three categories of curriculum processes:

1. teachers who participated in developing curriculum at national level (curriculum developer teacher),

2. teachers who were trained by curriculum developers and were appointed as trainers to deliver the new curriculum to their colleagues at school level (trainer teacher), and
3. teachers who received trainings from curriculum delivery teachers (trainee teacher).

The six interviewees include two high school teachers who participated as curriculum developers collaborating with university scholars and curriculum specialists, two high school teachers who delivered the new curriculum to their colleague teachers and two high school teachers who received trainings from trainer teachers (see TABLE 1).

TABLE 1. INTERVIEWEES BY CATEGORIES

Interviewee	Role in curriculum development process	Number
High school teacher	Curriculum developer teacher	2
High school teacher	Trainer teacher	2
High school teacher	Trainee teacher	2

Source: own editing

3.2 Procedures and Data analysis

An interview guide and protocol were developed based on the literature review on teacher professional growth in the curriculum development process through collaboration (Johnson, 2000; Goodnough, 2004; Gu & Wang, 2006; Shawer, 2017; Lwin, 2019). Interview questions were also structured based on careful reading and analysis of literature on curriculum development and teachers' professional growth (Johnson, 2000; Goodnough, 2004; Gu & Wang, 2006; Shawer, 2017; Lwin, 2019). All the interviews were recorded and transcribed. All the recordings had been deleted after the transcription was done. Interview data were analyzed through coding.

The codebook was created by the researcher before starting the coding process based on the thorough analysis and coding of one document. The codebook was added and left open for further coding process. In order to increase trustworthiness in data analysis, documents were coded at least two times by the researcher at different times.

4. Findings

The findings can be presented in three parts. These three parts are presented as areas of teachers' professional development in teaching and learning. According to interview results, skill development and knowledge development are the main domains where teachers significantly improved in their practices. The third area includes the motivation and work performance of teachers.

4.1 The skills domain

4.1.1 Reflective thinking and practice

According to the interview results, high school teachers who participated in curriculum development, improved their reflective thinking skills. Teachers reflected on their own practices to develop the content of the specific subject matter. They felt that they had improved

in their knowledge and in their pedagogical understanding of the content compared to their prior knowledge before they participated in the curriculum process. The teacher who was responsible for Grade 7 and Grade 8 mathematics curriculum development claimed that she was scared at the beginning of the process and only focused on "work done". As she had no experiences with developing curriculum, she could not focus on connections between concepts and content of mathematics across the grades. She reflected on her previous understanding of the curriculum development and the present time, and she found that she missed some important points in developing curriculum. She reflected to her experiences on developing Grade 7 curriculum compared to her present experiences in developing Grade 8 curriculum. She realized that she learnt from her experiences and apply her new knowledge in new situation.

> *"First of all, I will say that I am satisfied what I have done. There was a great improvement in me. For example, there is a difference in me between Grade 7 curriculum development and Grade 8. I became to know a lot of things that I didn't know before. When I started Grade 7 curriculum development, I mainly focused on "work done"; work done of having a new curriculum. I was so scared. I felt like I was working on a project in my bachelor studies. I only concentrated to finish it and to work it quickly. I didn't really focus on mathematics concept and their connection and didn't realize how to connect them with the future content. For example, in Grade 7 curriculum, we have to include teaching about triangles. So, altitudes and medians; these concepts are important to learn "triangles". I never thought to check what was included in the previous grade (curriculum) concerning these concepts. I never asked my colleagues who were responsible for this chapter in the previous grade. But this ignorance of mine changed when I started developing Grade 8 curriculum. As I developed Grade 8 curriculum, I checked both the previous grade 7 content and upcoming grade 9 content. I analyzed what was the point of giving these concepts in Grade 7 and what was in Grade 8. I make the connection between these concepts across the grades to make the children to understand these concepts easily based on what they have learnt in the previous grade." (curriculum developer teacher 1)*

For the other teacher who was responsible for science curriculum development, he came to understand that he did not know a lot of subject matter information before he started participating as a curriculum developer.

> *"I thought that I knew quite a lot about my subject and all my understanding is correct. But if I compared myself to previous me, I realized that I knew very little and I learnt a lot more than before. I came to realize that some content or concepts I understood wasn't correct. I learnt them from professors and subject specialists." (curriculum developer teacher 2)*

In the case of teachers (trainer teachers) who delivered new curriculum content to colleagues, they reflected on their teaching methods and approaches according to the situations they encountered. At first, they tried to lecture about the new topics of the subject. Then they realized that the situation was out of control when they lectured to teachers and did not give a chance to discuss and participate. One of the reasons they changed the lecture to discussion form of training was based on their reflection of the situation and teachers' knowledge. They were aware of the knowledge they possessed and did not try to dominate the whole training.

"As we have been trained by university professors only 50 minutes for the new topics and content, we didn't have that strong academic knowledge. At first, we tried to do the lectures and trainings, but later, we realized that discussion and collaborative form of training was more effective that lectures and trainings. We discussed together with trainee teachers and then we learnt together." (Trainer teacher 1)

In case of trainee teachers, they realized that their prior knowledge was not enough to teach new curriculum content to students. Not only they realized that the future task would be very challenging for them but also they were aware of their existing knowledge and of polishing their skills and knowledge about the new curriculum content.

"The new curriculum content of my subject is so advance and difficult for me. It will be very challenging task to deliver it to students. I have to be rich in subject knowledge before I deliver it to my students. My usual teaching methods are not enough to teach the new content anymore. I need to invent and try new teaching approaches for it." (Trainee teacher 1)

4.1.2 Collaboration and communication

One of the factors that foster teacher learning for professional development is collaboration and communication. Teachers learn mostly when they cross their boundaries and try to communicate with colleagues and other professionals. Teachers know more than what they can tell (Revai & Guerriero, 2017). They have a lot of tacit knowledge and these elements of tacit knowledge can be drawn out and shared to others by collaboration and communication with their colleagues.

According to interview results, teachers got the chance of collaboration and communication with their colleagues by participating in the curriculum development process. One curriculum developer teacher mentioned that he got the chance to collaborate with others which he couldn't do intensively in his daily teacher's life.

"I made a lot of discussion with my colleagues who were developing curriculum on another chapter or topics. We discussed with each other when we had dilemmas and were not sure about the concepts and ideas. For example, we always compared and checked between the old curriculum and the scope of new curriculum. Old curriculum focus more on using logarithms and etc. But the new curriculum didn't focus on it. So we discussed about it to change learning objectives, teaching methods and important ideas. This kind of collaboration could not happen in a teacher's daily life. Now, we got a real intensive communication with each other." (curriculum developer teacher 2)

Another curriculum developer claimed that she learnt a lot from academic professors and specialists during the curriculum development process through collaboration. There occurred difficulties during the collaboration process, but she tried to cope with the situation and ultimately she learnt from it.

"In Grade 8, the professors wanted to give more concepts, more content and ideas to students. But for us, we wanted to do more activities. The reason behind is that they are mostly from academia, so they are experts in subject matter and wanted to focus more on ideas and content of the new curriculum. But for teachers, like us, we wanted to create learning environments as more joyful and exciting place. We had to adjust between us and professors. We included what we want, and not to exclude what they wanted. So, the negotiation was really working here. Sometimes, I felt like I am

defending my thesis with my supervisors. We argued and discussed a lot. But I like the experiences. We couldn't get this opportunity to discuss with professors without participating in this process." (curriculum developer teacher 1)

Collaboration and communication was also intensive when trainer teachers delivered knowledge about the new curriculum to their colleagues. During the training, they collaborated with their colleagues whom they never communicated with before. They found that all teachers have their unique abilities and teaching methods.

> *"All teachers are amazing. They know how to give the practical knowledge to students. How to connect the theory and practice of the subject knowledge? There are some topics in my subject that I don't understand really well. But when the teachers did micro teaching, I felt that I understood the concept completely." (Trainer teacher 1)*

> *"We called it as training, but it was more like discussion. There was very intensive collaboration between teachers. We prepared the lesson together and found solution if we all did not know the new topics and concepts. So all the teachers read a lot or asked their teachers (university professors). Some learnt from private tutoring books and in the next day, we discuss together about unsolved problem; In this way we got the solution." (Trainer teacher 2)*

One of the trainee teachers mentioned that she needed to guide her colleagues as she is a head of English subject department at her school. She searched teaching aids and approaches to motivate and help her colleague teachers who have difficulties in understanding some contents of the new curriculum.

> *"I searched songs, phonetic apps and videos to share for my teachers. Then I made a gathering before the teaching. We discussed and practiced before we teach." (Trainee teacher 2)*

For another teacher trainee, she had a chance to meet all the teachers in the township where their schools are located.

> *"I got a chance to meet all the teachers who are working in different schools of the same township. Some of them, I have met before. But through this curriculum training, I met all teachers in the same township including private teachers." (Trainee teacher 1)*

4.2 The knowledge domain

Another factor that the findings highlight was the professional development of teachers in subject matter knowledge. Through collaboration with university professors and academic specialists, teachers gained ideas and knowledge about the specific subject they teach at schools. One curriculum developer teacher mentioned that she learnt a lot from professors as they gave explanations and corrected the teachers when they misunderstood some concepts in the subject matter.

> *"Another thing is that the knowledge what I learnt from university subject specialists and retired professors. As a high school teacher, we are not so much strong enough in subject matter knowledge. Some concepts we understand are not true or valid. At that time, we got the new knowledge from professors and specialists. Whatever we proposed are revised and corrected by professors and specialists. For example, there are some*

mathematics terms like "quartile" and we don't know how to translate it into Myanmar language. Then, the professors and specialists discussed with each other and with us, then we made the translation and definition. Sometimes, we misunderstand the concept, then they explained and corrected. Some of my friends had to re-develop/write the whole curriculum content because the professors pointed and explained that her work was not valid or needed to be improved. We learned a lot from them." (Curriculum developer teacher 1)

For teacher trainers, they were trained two days by university professors. One trainer teacher stressed how much she learnt about the specific subject knowledge when she collaborated with her colleagues. When she was trained by university professors, it was only two days and the lecture for specific subject content was only 50 minutes. Related to subject matter knowledge, she learnt a lot from her colleagues whom she gave training to for seven days.

"Compared to the training I got and training that I gave, I got academic knowledge more from the training I gave when I was a trainer. The reason is that we got only 50 minutes training about new subject matter from academic professors. The training was two days in total, yes, but only 50 minutes was related to new content. When I gave training to school teachers, it was seven days. But we discussed and worked a lot and did micro teaching together with colleagues. Then it was very rich experiences as we discussed together, so we learn a lot." (Trainer teacher 1)

"There was one trainer teacher who has been teaching this subject for more than 25 years. She got her master degree in the subject. So, she is an expert in the subject. I was so scared to give training to colleagues. We have new concepts and two new chapters in this new curriculum. I was so stressed and afraid to give lectures because I didn't have enough knowledge in this new subject area. Fortunately, the experienced teacher said that she will take responsibility for these new chapters. And she did it. When I was listening to her lectures, I felt like I understood these concepts completely and became confident. I gained a lot of subject content knowledge from her." (Trainer teacher 2)

This also happened with trainer teacher 1. The trainer teachers got only two days training and they felt that they were not qualified enough to give lecturers to their colleague teachers. However, with the help of experienced teachers, they did the trainings successfully and effectively.

"And there was one teacher who is very experienced in the subject. She has been teaching this subject for 20 years or more. She is an expert in the subject matter. And she did micro teaching, and she explained very well and I can feel that the pupil will like her so much. She is an expert teacher and can explain very well what she understands, and she knows. I am a trainer, but I learnt a lot from her. She can connect the lesson and how to teach it according to ITPR. This ITPR is what we got from training; which means that you have to teach lessons through the following "ITPR"; introduction first, then teaching, and then practice and review. She taught lesson perfectly according to that procedures and it was amazing. She can connect the lesson with the practical things very well." (Trainer teacher 1)

Besides the subject matter knowledge, the interview results showed that teachers learnt pedagogical content knowledge through the trainings they got and the trainings they gave to

their colleague teachers. For the curriculum developer teachers, they have participated in several trainings by consultants. They worked together with international consultants and academic professors. In the trainings given by consultants, they learnt how to approach a lesson to achieve the objectives and educational theories related to teaching and learning.

> *"In the training, they gave the lecturers on Bloom's Taxonomy. I have already learned in my bachelor of education. But when I learnt this again together with my colleagues and other professors in the curriculum development process, I understand more about it." (curriculum developer teacher 1)*

For the trainer teachers, they learnt new teaching approaches and educational standard from the training.

> *"Total training days by professors is two days. Academic professors and methodology professors gave lectures to us. First day of training is for all subject teachers in general, introducing "ITPR" and 5 C. "ITPR" is how to approach a lesson according to introduction (I), teaching (T), practice (P), review (R) and 21st century skills. I didn't know about ITPR before that. We just know it now. So, the main concept of training is to use ITPR in every lesson. Usually we listen to the training, after the training, we had questions and answers section." (Trainer teacher 1)*

> *"There was two parts in the training. First one is the general lectures about how to approach a lesson and how to teach. The second part is lectures about specific subject content." (Trainer teacher 2)*

For the trainee teachers, they also learnt pedagogical content knowledge from their colleagues. One of them learnt several different ways to solve one problem in her specific subject.

> *"During training, we did in a collaborative way. For example, we were divided into the groups. There were private teachers group, government teachers group, novice teachers group, etc. In mathematics, there are several ways to solve a problem. When private teachers group proposed one method to solve a problem, government teachers discussed it in alternative way. And so on, we discussed a lot. It was a group discussion. Through those group discussion, we leant several different ways to solve a problem which we didn't know before." (Trainee teacher 2)*

4.3 Motivation and work performance

The interview findings showed that the teachers improved their motivation and work performance during developing and implementing curriculum. One curriculum developer teacher noted that she became a more responsible and reliable person. She can manage the time and workload better than prior to her participation in the curriculum development process.

> *"Another thing is that I learned responsibility and accountability. And how to manage workload and how to do work precisely and systematically. I have full responsibility for what I am doing in this curriculum process and I became more responsible person than before." (Curriculum developer teacher 1)*

For school teachers who gave trainings to their colleagues, they became more motivated in their teaching and learning. The task was challenging and this led them to read more, and do some research on the subject matter before they taught it.

"It is a mixture of public and private school teachers when we gave training. I saw that there was always competing situation between two groups. And it was very challenging for me. For example, there was one teacher who asked a lot of questions about the content and ideas. So, to answer their questions and to lead discussion, I need to read a lot and prepare a lot before giving training to them. This was not an easy job but I am satisfied that I tried hard and learnt a lot from it." (Trainer teacher 2)

According to trainer teacher 2, the active participants and challenging situations forced them to read and study a lot in order to give the training and face the difficulties. Not only were they motivated by the participants' discussions, but also their work performance improved as they tried hard to handle the various situations.

5. Discussion

Keiny (1993) mentioned that teachers' professional development and curriculum development are two couple processes. This study proved that teachers developed their professional knowledge by participating in curriculum processes. The teachers' knowledge improvement in this study can be presented according to Cochran-Smith's three conceptions of teacher knowledge.

Cochran-Smith (1999) distinguished three conceptions of teacher knowledge to understand the relationship between knowledge and practice:

1. knowledge for practice,
2. knowledge in practice, and
3. knowledge of practice.

In this study, teachers experienced all this knowledge through participating in the curriculum development process. Knowledge-for-practice is referred to formal knowledge and theory that teachers can use in order to improve their practice (Cochran-Smith & Lytle, 1999). In the curriculum development process, curriculum developer teachers discussed with academics for the subject matter content, and this led to improve in their knowledge-for-practice. In the case of trainer teachers and trainee teachers, learning and teaching new curriculum content led them to improve the specific subject content and how-to-teach their subject. All three groups of teachers gained "knowledge-for-practice" through trainings and discussion during curriculum development.

Regarding knowledge-in-practice, which is practical knowledge, teachers learnt and observed this knowledge from their experienced teachers who are expert in the subject matter (Cochran-Smith & Lytle, 1999). For knowledge-of-practice component, teachers need to investigate their own classrooms and school sites as well as from their colleagues' teaching practices. Then, they need to construct and connect these observations and learning to their practices (Cochran-Smith & Lytle, 1999). In the curriculum development processes, teachers did investigation on their own practices and observed their colleagues' teaching. From this, they built their own knowledge-of-practice to apply in their situation.

One of the important elements that can foster the optimal professional development of teachers is "reflection". This study explored teachers' professional development through curriculum development processes. It is obvious that teachers showed significant improvement in their professional development in their subject matter knowledge, pedagogical content knowledge

and pedagogical knowledge. All of these improvements were resulted from teachers' reflection on their practices and also reflection on their colleagues' practices. They learnt from reflection through collaboration and communication.

5.1 Beyond professional development: knowledge creation

According to Hargreaves (1999), teachers' professional knowledge should be audited, created, validated and disseminated in knowledge-creating schools. This research did not focus on school-based curriculum development, but on teachers' collaboration in the curriculum development processes. However, this research context can be discussed and reflected on the basis of Hargreaves' characteristics of knowledge creation in school. All groups of teachers participated in knowledge validation, creation and dissemination stages during the curriculum development processes.

During the curriculum development process, teachers collaborated and communicated with their colleagues, university professors and academic specialists. Throughout the process, they constructed new knowledge by rebuilding their concepts which they might have misunderstood and conducted reflections on their practices. As one of the curriculum developer teachers mentioned, the prior knowledge he had proved to be not valid and with the help of specialists and professors, he has built new understanding of the concept and validated his knowledge.

> *"Some concepts we understand are not true or valid. At that time, we get the new knowledge from professors and specialists."*

This showed that the collaboration with colleague teachers and professors changed the existing invalid knowledge of teachers to validated knowledge. Through these processes of discussion and collaboration, teachers have created their new knowledge and understanding on specific subject matters.

According to Gu and Wang (2006), professional learning and development of teachers can be obtained through enhancing their collaborative learning and giving opportunities to utilize their analytical skills on their practices. This study showed that the participating in curriculum development process is the key to teachers' professional learning and development as it fosters teachers' collaborative learning and utilize their analytical skills on practices.

Professional development is obvious in teachers' reflective thinking and practice skills as well as in subject matter knowledge and pedagogical content knowledge. Curriculum developers reflected more on the connection among the subject content. They tried to reflect on their previous work done and learnt from it. They realized that they had weaknesses during the first experiences of developing curriculum. Curriculum developer teacher 1 said that:

> *"first time, I only concentrated to finish it. I didn't really focus on mathematics concept and didn't realize how to connect them with the future content."*

They only concentrated on work to be done but not on the connection among the concepts and ideas in mathematics curriculum. They were worried and anxious of work not being done. Nevertheless, they reflected on their past experiences and analyzed the situation. Finally, they learnt from past experiences and produced better work in the next procedures.

All teachers showed "professional development" in subject matter knowledge. Curriculum developers learnt subject matter knowledge in collaboration with university professors and

academic specialists. In the case of school teachers, they learnt subject matter knowledge as well as pedagogical content knowledge through discussion, group work, micro teaching, and collaboration with their colleagues.

During the curriculum development processes, there is no doubt that creation and dissemination of knowledge occurs constantly. Teachers collaborated together in order to learn new curriculum content in their specific subject matter. This creates the opportunity for teachers share their tacit experiences and knowledge through group discussion and communication. Furthermore, teachers also practiced micro teaching. Tacit knowledge of teachers was transmitted through micro teaching and group discussion. One school teacher stated that she was amazed by the way her colleague teacher was doing micro teaching. And she learnt a lot from the teacher. This proved that they disseminated their tacit knowledge which they couldn't articulate with the help of micro practice teaching.

6. Conclusion

Teacher participation in curriculum development has been recognized as an opportunity for teachers' professional development and knowledge creation (Keiny, 1993). Participation in curriculum development makes teachers reflect on their practices, analyze experiences, and create new knowledge. Collaboration and communication are essential for sharing practices and creating new knowledge in developing curriculum content. It is obvious that teachers become active participants in developing professional knowledge through participating in curriculum development.

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