

Teaching Professional Training to Work Transitions of Mathematics Teacher Pedagogical Content Knowledge in Malaysian Chinese Private High Schools

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Abstract: *The research aimed to examine the effects of teaching professional training in Malaysian Chinese Private High Schools (CPHSs) on mathematics teachers' pedagogical content knowledge (PCK). A total of 28 respondents were involved in interviews using a multi-stage sampling technique. The respondents were comprised of four groups, namely five principals, five deputy principals, five mathematics division leaders, and 13 mathematics teachers of the five CPHSs. Principals, deputy principals, and mathematics division leaders participated in in-depth interviews while mathematics teachers involved in focus group interviews. Results revealed that most of the mathematics teachers are possessing PCK excellently except the new teachers. The entire respondents came to an agreement that the teaching professional training is eligible to improve mathematics teachers' PCK abilities to deal with the varying requests to keep well-informed of the current eras.*

Keywords: *Chinese Private High Schools, pedagogical content knowledge, teaching professional training*

INTRODUCTION

In recent decades, according to the past educational researchers such as [1, 2, 3, 4, 5, 6] have provided an undeniable confirmation that mathematics teacher ability particularly PCK is acknowledged as a vital mandatory to advance students' mathematics learning process and their achievements. This statement was supported by [7] who highlighted that mathematics teachers have to gain sufficient knowledge and be able to utilize the gained knowledge to various learning environments within their teaching contexts. According to [8], PCK is defined as the knowledge required making the content of the subject reachable to learners. This is further concluded as the knowledge of learners' conceptions and misconceptions on the specific subject and teaching methods as well as representations, by some past researchers [9, 10, 11]. In addition, [4] indicated that the mathematics teachers' specialization is sophisticated in nature, causing the complexity is occurred not only between the different mathematics subject knowledge-based and learning situated competence aspects, but also the quality of teaching practice which needs a substantial teaching professional training for mathematics teachers' development.

CPHS is a kind of independent high school providing secondary education in the Chinese language using Mandarin as the medium of instruction. Currently, there are 62 CPHSs scattered in most of the bigger municipalities in Malaysia operate as „independent“ entities. Dong Zong so called as a nationwide United Chinese School Committees' Association of Malaysia administers a uniform examination that is the United Examination Certificate (UEC) as a qualification for direct admission to universities [12]. According to [13], the quality of education requires scientific management with high-quality teachers who are able to transform education. Hence, [12] emphasized that teaching professional training is a vital service to convey the up-to-date pedagogical principles and concepts to teachers who are going to teach the entire group of learners and should be a fundamental fragment of Chinese private education in particular. Teaching professional training for in-service teachers in CPHSs is currently managed by New Era College.

On this line of reasoning, [12] further stressed the recent concern about the educational quality in CPHS to embark the school principals to appraise and enhance mathematics teachers' PCK. This statement is compliant with the suggestions made by experts including [14] and also [15]. Those experts affirmed that educational leadership and management is affecting greatly on mathematics teachers' PCK and appeared as a rising indicator as well as the main success factor to reach CPHS's visions. Currently, there are more than 3,900 teachers consisting of 87.9 percent of Chinese, 5.1 percent of Malay, and 5.9 percent of Indian ethnic groups of the total respectively in accordance with the record of [16]. The Education Affairs and Teaching Personnel divisions of Dong Zong are responsible to plan and conduct teaching professional training in order to enhance teachers' PCK abilities.

Furthermore, [3] highlighted that an effective power to transform a school is promising if the teacher turns out to be the crucial motivating force. [17] stated that the foundation of the mathematics teacher's PCK that containing pedagogical ability, mathematics subject instructive ability, pedagogical-structural ability, and ability in a trained pedagogical (self-) thinking are the weights to mathematics teachers to direct a transformation in CPHS. This matches to researcher's conception about the multifarious environment of mathematics teacher's occupation and the researcher wants to consider it as a source of her thoughts regarding mathematics teachers' PCK in CPHSs.

Recently, Dong Zong has developed new curriculum programs to support the visions of the CPHS's mathematics reformation. Since the United Examination Certificate–Senior Middle Level (UEC-SML) has been accepted as the admission criterion in numerous international universities, namely Singapore, Australia, Taiwan, China, and some European countries as well as majority of the Malaysian private colleges, a very high international standards-based curriculum has to be designed [18]. As a result, mathematics teachers in CPHSs are compulsory to retain the capability to appreciate, judge, organize and practice mathematics in various intra- and extra-mathematical settings and conditions in their instructions in order to prepare their learners to cope with the high standard of UEC-SML. However, the national result of UEC-SML examination report indicated that mathematics subject was the only subject had the highest failure from 2012 to 2015 with the percentage ranged from 19.15 to 24.96 percent of failure from the academic year 2012 to 2015 [16]. As a result, the mathematics subject was the poorest academic achievement if comparing with the rest of the 20 subjects in UEC-SML examination. A factual problem challenging CPHSs is the scarcity of competent mathematics teachers because CPHSs are in the deficiency of admittance to formal teaching professional training. On this line of reasoning, mathematics teachers' abilities are critically needed to improve and the demand for a continuous source of competent mathematics teachers is accelerating in CPHSs.

THE AIM OF THE STUDY

The research aimed to explore mathematics teachers' PCK abilities from the perspectives of principals, deputy principals, mathematics division leader, and mathematics teachers concentrating in the condition of the case study of CPHSs in the Penang state of Malaysia.

LITERATURE REVIEWS

Those learners who want to follow Chinese education in Malaysia can have choices to choose to study in a CPHS or national-type Chinese secondary school after completing their elementary education in national-type Chinese elementary schools. Learners usually spend six years to complete their high school education if they choose to study in CPHS. The duration of six years is distributed into two phases, namely three years in junior middle and three years in the senior middle. This is similar to the high school system either in mainland China or Taiwan. Learners are streamed into two trajectories, namely Art/Commerce or Science during their senior middle phase. In addition, some CPHSs offer another year in the senior middle phase, providing learners to take the government's public examinations such as the Malaysian Higher School Certificate which is equivalent to A-level. Owing to the Malaysian government does not recognize the UEC examination, some CPHSs offer teachings in the public high school syllabus on top of the private school syllabus, hence allowing the learners to sit for Form 3 Assessment (PT3), the Malaysian Certificate of Education, and Malaysian Higher School Certificate [19]. At the same time, CPHS learners must take their standardized tests known as the UEC at the end of Junior Middle 3 and Senior Middle 3. The UEC-SML covers subjects such as mathematics, sciences (biology, chemistry, and physics), bookkeeping, accounting and commerce in both Chinese and English.

In the CPHS educational system, learners' overall academic performance of an academic year will determine his promotion to the following year in the next academic year. If they fail to do so, then they are required to repeat the particular study year. In general, if they fail to be promoted for two consecutive years in a poor result will cause a dismissal. However, public school learners in Malaysia are automatically promoted regardless of academic performance [19]. The curriculum used in CPHSs is established and organized by the Curriculum Department of United Chinese School Committees Association of Malaysia (UCSCAM) with the orientation to high school education curriculum around the world, particularly Malaysia's national high school education curriculum and those of either mainland China or Taiwan. All the textbooks used in CPHS are published by UCSCAM.

Those teachers in CPHSs who are not attending any teaching professional training before employment, they have to participate in various internal staff professional development programs to develop their PCK abilities. In other words, CPHS teachers have to exclusively rely on the non-governmental organization to provide relevant teaching professional training and further improve their teaching professional development. The teaching professional training is assumed to enliven the quality of teaching because it can improve their instructional competence and pedagogical skills.

Generally, the board of director in CPHSs would employ the mathematics teachers who have the qualification at least Diploma, Bachelor Degree, and Master Degree. However, those mathematics teachers who have just graduated from high school would have to attend some external short courses provided by New Era College. This was primarily carried out in the preliminary phases as to yield as many teachers in an expressway so as to tailor for the requests of teachers in CPHS. This is mainly caused by CPHSs are the private educational organizations whereby they have to train and sourced out their mathematics teachers by themselves without the help of the Ministry of Education, Malaysia.

New Era College is a community-funded tertiary institution in Malaysia to provide teaching professional training programs to CPHS teachers. New Era College has worked together with some selected foreign universities to offer training programs in Mandarin so that it can adapt to the needs of CPHS teachers. The Department of Education of New Era College has managed under- and post-graduate teaching professional training to enhance CPHS teachers' PCK abilities.

PCK in this study refers to the definition given by [20]. PCK is operationalized as detailed knowledge of how greatest to form the teaching and learning processes. In specific, knowledge of the basics of education can be predictable to have subsidiary effects on teaching practice [20]. It is defined as the knowledge of (i) explanation and demonstrating mathematical contents; (ii) mathematics-associated learner cognitions (distinctive mistakes and problems), and (iii) the possibility of mathematical tasks (for numerous solution trails). PCK is concluded as general pedagogical knowledge of instructional planning which comprising meta-theoretical models of lesson planning, domain-general ideologies of lesson planning, and instructional approaches in the extensive wisdom. Mathematics teacher PCK ability was recognized as the preliminary fact of the research outline which defined the central task of mathematics teachers and accordingly the progress of their teaching abilities or, in wider wisdom, of professional abilities. Two dimensions of PCK are conceptualized, with a discrepancy being pinched between teaching-related aspects (e.g., those relating to the curriculum and lesson planning), and learning process-related aspects (e.g., those related to teachers' actual instructional practice), on the other.

In addition to the domain-specific knowledge, teachers also need domain-general knowledge of how best to form the teaching and learning processes, that is, of aspects enclosed mainly by the common pedagogical knowledge element (but also knowledge of learners component) of [8]'s taxonomy. Specific stress was assumed to the succeeding general pedagogical abilities namely classroom management and arrangement of the learning process, general knowledge of learner development and learning, analytical skills and evaluation of learner performance, and professional manners in the CPHS content.

According to [21, 22, 23] conducted studies on Teacher Education and Development Study: Learning to Teach Mathematics (TEDS-M) under the support of the International Association for the Evaluation of Educational Achievement (IEA), aimed at assessing the effectiveness of teacher education in terms of teacher knowledge and teacher beliefs both across countries and specifically on mathematics subject. TEDS-M was a large-scale assessment of tertiary education that combined direct testing using symbolic respondents including university graduates from 17 countries from both east and western countries. It is a huge study covered both primary and lower secondary mathematics teachers. The emphasis of TEDS-M was final year pre-service teachers who would obtain a license to teach mathematics in one of the grades 1 to 4 from primary schools or in Grade 8 of lower secondary school. Both studies followed the demanding IEA quality control devices of sampling nationally demonstrative respondents, data collection,

coding, and data analysis. About 23,000 pre-service teachers participated in both studies in 2008. In Germany, a total of 771 pre-service teachers participated in high schools while 1032 in primary schools. The main concerns of the TEDS-M studies were multi-layered, encompassing the assessment of pre-service mathematics teachers' teaching professional abilities and also the impacts of institutional and national situations of mathematics teacher education on these abilities.

[4] investigated mathematics teachers' teaching professional abilities which are categorized by diverse theoretical tactics to conceptualization and evaluation of teachers' teaching professional abilities, namely cognitive versus situated approaches. They built on the international IEA Teacher Education and Development Study in Mathematics (TEDS-M) and its follow-up study, TEDS-FU, they compared the cognitive and situated approaches on mathematics teachers' teaching professional abilities. [4] debated on the diverse types of theoretical frameworks and the consequences for the evaluation methods, the strengths, and weaknesses of both tactics. [4]'s findings allowed an inclusive understanding of the structure and development of the teaching professional abilities of mathematics teachers. Their results indicated on the one hand that both tactics namely cognitive and situated are needed for an inclusive explanation of teachers' teaching professional abilities. On the other hand, it is shown that both tactics can be combined in a dynamic way.

[24] created tests to directly evaluate mathematics teachers' content knowledge and PCK which are the key components of teacher abilities that affecting learner progress. They compared the PCK and content knowledge of four groups of mathematics teachers at different points in their teaching professions in Germany based on the created tests. Confirmatory factor analysis exhibited that PCK and content knowledge measurement was fitting invariant across the teacher populations considered. As anticipated of them, the biggest differences in content knowledge and PCK were found between the beginning and the end of initial teacher education. Differences in the structure of teacher education were convincingly well simulated in mathematics teachers' content knowledge and PCK.

[25] examined the validity of the Cognitive Activation in the Mathematics Classroom and Professional Competence (COACTIV) concepts of PCK and content knowledge. The COACTIV tests of PCK and content knowledge had been administered to various „contrast populations“, namely, candidate mathematics teachers, mathematics students, teachers of biology, and chemistry, and innovative learners. The hypotheses for each population's performance in the PCK and content knowledge tests were conveyed and empirically tested. [25] had equated the COACTIV approach with associated conceptualizations and results of two other research groups. [25] found that there is a significant difference between mathematics teachers' content knowledge across the different types of school. In addition, their findings also showed that there is a significant relationship between the university training that the mathematics teachers gained and their teaching at the academic track. On top of that, [25]'s findings also revealed that mathematics teachers' subjective belief in mathematics has external correlations with their learning of mathematics. This implies that knowledgeable mathematics teacher tends to consider mathematics can be learned effectively through listening carefully and reject the points that mathematics is just a toolbox. Finally, their structural equation modeling results indicated that PCK abilities were mediated by the lessons that supporting student learning. A concrete foundation of content knowledge, sequentially, seemed to ease the creation of PCK. [25]'s findings are flawlessly corresponding to the theoretical characters that usually accredited to content knowledge and PCK.

METHODOLOGY

Exploratory case study research design was employed because it was planned to pronounce the actions of the mathematics teachers as a total, not the actions of each teacher in the interview group. In addition, it not only permits the researcher to discover mathematics teachers or CPHSs through intricate involvements, relationship, groups, or occurrence in which it happened [26] but also provides a better understanding of a situation. The method, based on the social phenomenology paradigm, used interviews to seize the elucidation of the principals, deputy principals, mathematics division leaders, and mathematics teachers about mathematics teachers' PCK abilities.

Qualitative data was collected through a few rounds of in-depth interviews with principals, deputy principals, mathematics division leaders and also the focus group interviews with mathematics teachers. This research is demonstrating a wide-ranging of ideas toward mathematics teachers' PCK abilities. The multiple case study design was used for identical resolutions of seizing rich expressive contexts of the mathematics teachers' PCK abilities [27] and supporting the designs of results using [28]'s duplication reasoning. In order to enhance the validity of qualitative findings, researcher practiced triangulation [29]. [29] further emphasized that the strong point of qualitative research which lies in the triangulation of

numerous methods, data collection strategies and data sources to obtain a more thorough illustration of the theme under research and also to cross-check information.

The researcher employed a multi-stage sampling technique consuming geographical cluster sampling followed by purposive sampling technique to identify all the five CPHSs in Penang, Malaysia. Firstly, the researcher compiled the CPHSs into four clusters namely north, central and south of Peninsular Malaysia, and east Malaysia along with their location. In geographical cluster sampling, the entire population was distributed into four comparatively small sub-divisions which were clusters and then some of these clusters were randomly selected for enclosure in the sample. Under this sampling design, every cluster of the whole population had an equivalent chance of inclusion in the sample. In order to avoid biasedness, a lottery method was employed whereby the researcher selected a cluster from the four clusters with folded eyes from a box. This is the greatest selecting the representative sample process. The researcher randomly selected the north cluster using the lottery method. Subsequently, the researcher applied a purposive sampling method to deliberately selecting the state with the highest number of CPHSs. The priority consideration was taken because the researcher believes that it would be the typical and representative of the north cluster. With this purpose, Penang state with a total of five CPHSs would be the best representative of the north cluster.

Firstly, researchers decided the suitable respondents be selected because they are the mathematics teachers' direct leaders. A total of 15 respondents comprised of principals, deputy principals, and mathematics division leaders involved in in-depth interviews. This is an essential step to collect relevant data because this perspective qualitative method would deliver researcher a method to acquire an exhaustive understanding of the original rationales, mind-sets, and performances behind countless actions to show the PCK abilities. Secondly, researcher selected a sample size of mathematics teachers depending on the school size consuming snowball sampling. School A, B, and C are considered as big size CPHSs with a total number of learners more than 1,500 meanwhile school D and E are small sizes CPHSs with a total number of students less than 1,000. The mathematics teachers were nominated in keeping with the references made by their deputy principals or mathematics division leaders until the comfortable interactions congregate into some kind of a certainly shared arrangement. The criteria were to select a group of representative mathematics teachers who are experienced and directly dealt with the learners so that they are able to provide necessary and detail information, more elaborative and appropriately. They have been in the CPHS for a number of years and are very much familiar with the setting and environment.

There were two instruments utilized in this study: (i) structured interview protocol for principals, deputy principals, and mathematics division leaders and (ii) structured interview protocol for mathematics teachers. The two instruments consisted of six kinds of open-ended interview questions of mathematics teachers' PCK abilities: (i) experience or behavior; (ii) sensory; (iii) opinion or value; (iv) knowledge; (v) feeling, and (vi) background or demographic. PCK abilities including how mathematics teachers outline their teaching, their classroom management skills, their learning process planning, their knowledge of student development, their diagnostic skills or abilities on weak learners, and their abilities to assess learners' performance.

A pilot study is usually utilized to evaluate the design of the actual study which can then be adjusted [30]. This is to check the validity and reliability of the research instruments. A try-out of the developed interview protocols to three experts consisting of two language teachers and an assistant professor. The expert board assessed whether each interview question gives an adequate range of responses, checked that all the interview questions are relevant, and re-word the interview questions to validate contents for both instruments. Besides, the researcher managed the interviews with the pilot subjects in exactly the same way as it will be conducted in the actual study in order to endorse the reliability of the research instruments.

The selected direct leaders including a principal, a deputy principal, and a mathematics division leader of each CPHS were invited for about an hour's in-depth interview sessions with the researcher for a collection of qualitative data as from leaders' perspectives. Likewise, two to three selected mathematics teachers, based on their experience and involvement in Senior Middle-level Mathematics Education were invited for about an hour's focus group conversation with the researcher for collection mathematics teachers own opinions regarding their PCK abilities. Thematic analysis was used utilized to analyze all the collected interview data. Thematic analysis is a method of identifying, analyzing, and reporting patterns (themes) within data [31].

RESULTS

The researcher conducted 15 rounds of in-depth interviews with five principals (P1 to P5), five deputy principals (DP1 to DP5), and five mathematics division leaders (DL1 to DL5) to obtain their opinions that associated to mathematics teachers' PCK abilities and also the relevance of the teaching professional training. Besides, the researcher also conducted five rounds of focus group interviews with the 13 mathematics teachers (T1 to T13) to triangulate obtained data. The researcher blended the opinions specified by the direct leaders in accordance with the succeeding themes in concerning mathematics teachers' PCK caused by teaching professional training.

Principal' Perspective

Principals satisfied with the teaching professional training offered by New Era College in terms of promoting their mathematics teachers' PCK abilities. On top of that, they also would like their mathematics teachers to attend external training. They also admitted that it is their responsibility to offer internal staff development training to develop their mathematics teachers' PCK abilities. Specifically, P1 hoped that Dong Zong can offer direct training to all the mathematics teachers in CPHSs so that they will be polished up their PCK abilities. However, P3 felt that training itself is not sufficient to develop mathematics teachers' PCK abilities but practicing after training will be more reliable.

"We also ask our new mathematics teachers to go for training in New Era College. The training is about two and a half years. It hinges on when the mathematics teachers join us, sometimes when they join that time, New Era College does not start a new training program yet, then have to wait until they start a new training program. There is a drastic increase of the learner in this school. Therefore, I have to send my teachers for training almost every year." (P3)

"My mathematics division leader is very good to train our mathematics teachers through internal training. Most of our new mathematics teachers are trained by their direct leaders like division leaders or deputy principal. I think it is more focus and better. On top of that, the division also has met every Friday to discuss the problems and solving method related to teaching and learning together. The meetings normally start from 2.30 to 3.30 p.m. for about one hour. Major concerns during the meeting are related to teaching, examination, and designing questions for certain examination." (P1)

"I allowed my mathematics teachers to go for teaching professional training once Dong Zong provided any new course. After those mathematics teachers completed the training, I asked them to have in-house training to their colleagues so that all the mathematics teachers in my school will get the benefits." (P2)

"I gave numerous support systems such as reflection group, external course training during school holiday, and also mentor mentees system. Every month we have several sharing sessions to discuss new teaching methods." (P4)

"Whether the teaching professional training is effective or not, is depending on individual mathematics teacher's intention. Of course, somehow or rather, I would say the teaching professional training will help them. For example, I found that some mathematics teachers did not go for any teaching professional training but they have their intention to grape and learn the effective strategies to teach. I found that they are very confident. While those who go for teaching professional training but did not practice at all, then turn up as meaningless. Because teaching profession is a professional job, all the mathematics teachers have to obtain a professional certificate for assurance." (P3)

"My school provides online training despite teaching professional training provided by Dong Zong or other internal training. Actually what we need is direct training related to teaching method for mathematics teachers particularly to help them on teaching applied mathematics which is a very difficult subject. I hope very much that Dong Zong can provide direct training to my mathematics teachers because the change of examination format made our mathematics teachers very confused on how to teach. I would be very happy those experts who are working with Dong Zong can provide direct training to our mathematics teachers." (P1)

"Senior teachers who are good have no time to train our new teachers because they also have to teach. Ministry of Education in Malaysia is not making teaching professional training as compulsory to our teachers in CPHSs. Therefore, sometimes I found external training from overseas can provide better training. For example, one of our sister schools in China, their trainees are able to give better training partly because of their mathematics level of difficulty is almost the same as our UEC. Sometimes, I have no choice, I sent our mathematics teachers to learn from our outstanding CPHS in Johor because it is the biggest CIHS in Malaysia. They have many mathematics teachers who are very experienced and senior can share their experiences thus promote my mathematics teachers' PCK." (P1)

"According to my mathematics teachers, they said that the training is very useful to them. Most of the training is very much related to examination, and teaching." (P2)

Deputy Principals' Perspective

In general, all the five deputy principals highlighted that the teaching professional training should be designed in a more practical method rather than just a kind of knowledge transfer. Current advanced technology should be taken into account by New Era College to modify their training program accordingly.

"The New Era College is providing us the relevant teaching professional trainings but somehow they are not practical. This is because our teaching profession has to keep up with the changing in information technology progress. Therefore, I would say that some content of training may not utilize in the real situation. For example, nowadays if teachers cannot utilize Whatsapp to communicate with their learners, they cannot get to their learners' world hence cannot understand their learners' mathematical problems. So, in my opinion, mathematics teachers have to keep on improving themselves to suit our learners who are right up on the top of the high technology world." (DP1)

"I cannot very precisely state that my mathematics teacher PCK abilities were caused by the New Era College teaching professional training or our internal daily teaching experiences, or any other factors. I cannot answer definitely because there is no research result to prove the relationship of this teaching professional training with mathematics teachers' PCK abilities. Of course, this kind of training is very directly related to the classroom practice but from my experience, those mathematics teachers whom we employed either from education background or not, did not reflect the PCK abilities differently. University graduates, I would say that they are equipped with sufficient PCK abilities to teach in CPHS. This is because current education, teacher's PCK abilities are more on applying the skills in career and daily life rather than just providing knowledge." (DP5)

Mathematics Division Leaders' Perspective

According to the mathematics division leaders' observations, can be concluded that the teaching professional training provided by New Era College were found to be relevant in terms of improving their mathematics teachers' PCK abilities.

"Those mathematics teachers who have been confirmed as permanent teaching staff, I will plan for them to attend the teaching professional training offered by the New Era College for three years. Previously, I would say that the New Era College had provided us the convenience in the school administration. For example, they choose one of the CPHSs in the north region and all the new teachers from the five CPHSs in Penang state, who haven't yet had sufficient PCK abilities could apply and attend the training without affecting their daily teaching. This is really helping us in the administrative matters. Mathematics teachers were able to go for training without neglecting their teaching duties in CPHS because they do not need to take leave to travel to the main campus which is located in Kajang, Selangor to attend the training. In recent years, those teachers who need to attend the training, they have to go to New Era College every week for the period of three years. Although I myself never attend this kind of training before, I found that those mathematics teachers who returned from the training, I could see that there is a drastic change in their PCK abilities. However, some of the theories that they learned may not necessary they can use or practice in the classroom." (DL1)

"Of course, we cannot deny that the New Era College really have offered us substantial teaching professional training, and found all the training programs are really helpful to our mathematics teachers' PCK abilities. Sometimes I myself also utilized the knowledge and skills from the teaching professional training indirectly without noticing it." (DL2)

Mathematics Teachers' Own Views

The 13 mathematics teachers who participated in the focus group interviews came to the consensus that the teaching professional training offered by Dong Zong or New Era College are really meaningful and assisting them in conducting their teaching process in the classroom. They found themselves improved significantly after attending the teaching professional training.

"I would say that the teaching professional training really help me particularly in teaching my learners on how to tackle the UEC examination questions. Last year, there was some changing of UEC examination format, the change of format makes us confusing on what and how to teach. Before that, we separate out

the questions into two separate parts but the new examination format needs our learners to do the two separate parts and combine the two parts later. After I have attended the teaching professional training, I have learned the methods to resolve the problems appropriately and found learners learned effectively from my new teaching strategies which I possessed through the teaching professional training." (T4)

"To my opinion, I found that Dong Zong actually has done a good job so far. Generally, Dong Zong would send the modified textbooks to all the CPHSs before they made any changing in the UEC examination format. In fact, Dong Zong also provides training to mathematics teachers on how to use the textbooks from time to time. Dong Zong also provides those mathematics teachers who go for training to bring back some important teaching materials to their own CPHSs to share with their colleagues." (T2)

"It is a compulsory matter for us to attend the teaching profession training offered by New Era College. Anyway, we found that the teaching professional training is really very useful to us. We had attended most of the related training program courses for two consecutive years." (T4, T5, and T6)

"I found that the teaching professional training covers a lot of aspects not only all the content knowledge and PCK of mathematics subject. The training also is included counseling, Malaysian educational history and so on. I found the training is very fruitful and we were having a lot of assignments during the trainings." (T6)

"I found that the coverage of the New Era College's teaching professional training is considered as quite comprehensive and including so much knowledge other than mathematics such as educational psychology, educational assessment and evaluation, Malaysian education philosophy and so on." (T13)

DISCUSSION

Results of the research can be concluded that most mathematics teachers in CPHS are possessing sufficient PCK abilities including they have utilized several teaching strategies and methods to make sure that their learners understand well about the content knowledge. Besides, the majority of the mathematics teachers are experienced and they have the excellent abilities to manage the class, plan the learning process, understand well about their learners' development, and also possess diagnosis skills and abilities toward weak learners. Finally, mathematics teachers in CPHSs are found to have PCK ability in term of assessing their learners' academic performance. All the mentioned skills above are associated with their PCK abilities, as indicated by their direct leaders, namely their principals, deputy principals, and mathematics division leaders. In addition, the teaching professional training offered by New Era College is found to be significantly aided those mathematics teachers to raise their PCK abilities in particular and also their abilities to cope with the changing demands to keep abreast of the times. Other than the teaching professional training which is compulsory to all the new teachers in CPHSs, the in-service training or some in-house training which provided internally are found to use in providing useful reference and guidance on the practical aspects of the implementation of mathematics teachers according to their division leaders.

Furthermore, most of the principals are having higher expectation on their mathematics teachers' PCK abilities compared to their content knowledge. This implies that PCK abilities which include the teaching strategies and assessing learners' academic performance are the major concerns of their principals because applied mathematics subject is the most difficult subject in UEC examination. Therefore, all the principals would like to give their full supports as much as they can, for example teaching aids, teaching professional training, giving the advice to help their mathematics teachers to deal with weak students, and also classroom management skills. On top of that, some principals emphasized that PCK is the most essential ability that mathematics teachers must possess. On the other hand, most of the deputy principals expected different components of PCK abilities particularly on teachers' diagnostic skills and classroom management abilities to other components. It can be concluded that all the research CPHSs are quite an examination oriented except School E. School E is a religious-based CPHS and focusing more on soft skills development rather than academic achievement. On this line of reasoning, the components of PCK are found to be able to improve the academic achievements in UEC has been given priority by mathematics teachers' direct leaders.

In addition, all the five mathematics division leaders are found to respond for promoting their mathematics teachers' PCK as reflected from the results. Ultimately, they granted that mathematics teachers should have classroom management skill, for example, utilizing „small teacher approach“, providing systematic exercise and undertaking additional past year examination questions. These PCK abilities are deliberated as crucial components to mathematics teachers. Besides, mathematics teachers have the same views with their division leaders as they are engaging and possessing a high quality of PCK.

Mathematics teachers also give emphasis to the significance of systematic exercises and must complete all the past year UEC examination questions in order to improve learners' arithmetic abilities to handle their UEC examination. Basically, all the mathematics teachers in CPHSs are found to be moderately competent in nearly all the components of PCK including classroom management skill, diagnostic skill, assessing abilities, and teaching skills.

On top of that, results also designated that teaching professional training especially on the job is found to be extremely significant to enhance mathematics teachers' PCK abilities particularly to the new mathematics teachers. However, in-service teaching professional training which is conducted internally by the CPHSs is still in their infancy [12]. Additional development is obligatory to progress a teaching professional training program that is more substantial compared to existing teaching professional training offered by New Era College to satisfy the long-term needs. Added experiences and understandings would allow fine-tuning and upgrade so that the system turns into more operative in assisting mathematics teachers to deal with the ever-changing consequence of Chinese education as well as accomplishing the high standards and quality of UEC examination. This is because the foremost norm of Dong Zong to keep on the high standards and quality of the UEC examination so that it is to be accepted as a qualification for direct admission to a growing number of foreign universities in countries such as Australia, Britain, Canada, China/Hong Kong/Taiwan, New Zealand, Singapore, and the United States of America [12]. Moreover, CPHS graduates have been well-intentioned of their qualifications and have accomplished well in most of the foreign universities [32].

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