

The Role of the Teacher Mentor in the Development of Pedagogical Content Knowledge (PCK) of the Information and Communication Technology (ICT) Trainee Teachers

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Abstract - This research aims to study the role of the teacher mentor in the development of Pedagogical Content Knowledge (PCK) of the Information and Communication Technology (ICT) trainee teachers. A total of 109 trainee teachers from the Degree in Information Technology Education (AT20) Sultan Idris Education University (UPSI) who have completed their 14 weeks teaching practice program were the respondents. This quantitative research used the questionnaire with a validity value of Alpha Cronbach 0.966. The research focussed on four PCK elements: i) communication; ii) knowledge about students and learning; iii) curriculum knowledge; and iv) knowledge on teaching strategy. The research found that all four elements are good. The mean of PCK communication element is 3.05, knowledge about student and learning is 3.25, curriculum knowledge is 2.94, and teaching strategy knowledge is 3.21. The percentage of mentoring proses rated by the trainee teacher is low (44%). A total of 56% of trainee teachers are not satisfied with the mentoring received which is within the range of 20% to 50% only. Further detailed research is needed to measure the role of teacher mentor in developing the PCK of the ICT trainee teachers.

Index Terms: Mentoring and Supervision, Teaching Practice Program, Pedagogical Content Knowledge

I. INTRODUCTION

ICT is one of the subjects offered to secondary school students for form four and five in Malaysia as a preliminary disclosure in knowing and moving towards higher-level computer science (Sulaiman, 2012). While in higher education, ICT is a program offered by public and private institutions of higher learning to students interested in learning and learning about the subject.

Quality of teaching is influenced by education and training followed by teacher education program (Rice, 2003), to distinguish between trained and untrained teachers. Therefore, in college training, PCK needs to be mastered in order for the college profession to be guaranteed (Norasliza&Zaleha, 2008). Therefore, teacher education institutions have introduced teaching training programs as one of the key elements in teaching practice programs.

Teaching exercises are one of the fundamental components to be trained by each trainee's teacher including trainees who attend the education program at Sultan Idris Education University (UPSI). According to MegatAman (2010), such programs are practical exercises for trainee teachers practicing all the theories and methods that have been learned and applied knowledge, methods and teaching skills in real situations that are in the classroom and school.

Pedagogical Content Knowledge

The Pedagogical Content Knowledge (PCK) was introduced by Lee Shulman (1986) focusing on teacher education research to expand and enhance new knowledge that teachers need to master the combined pedagogical knowledge with content knowledge. This knowledge is what distinguishes the quality of teaching each teacher. Shulman (1987) also pointed out that PCK is an important knowledge and as a basic knowledge of teaching:

"The key to distinguishing the knowledge base of teaching lies at the intersection of content and pedagogy, in the capacity of a teacher to transform the content knowledge he or she possesses into forms that are pedagogically powerful and yet adaptive to the variations in ability and background presented by the students" (pg. 15)"

Scheffler (1973) emphasized that institutions that handle teacher education should be aware that the provision of teachers not only has the skills in implementing procedures such as educational management skills but should take seriously the knowledge of what they are teaching or known as content knowledge.

According to Shulman (1987), the basics of PCK construction are the blend of content knowledge and pedagogical knowledge as shown in Figure 1.

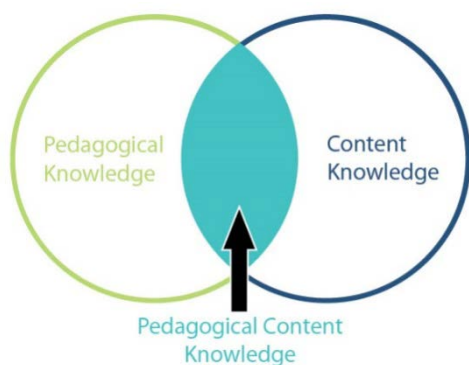


Figure 1: Pedagogical Content Knowledge Framework (Shulman, 1986)

The PCK contains some of the core knowledge that teachers need to have; (i) knowledge of content, (ii) general pedagogical knowledge, (iii) curriculum knowledge, (iv) pedagogical content knowledge, (v) knowledge of students and characteristics of students, (vi) knowledge about the context of education and (vii) knowledge of educational goals.

According to Roehrig (2004), PCK is divided into four knowledge, namely (i) teacher knowledge about concept understanding by students, (ii) curriculum knowledge, (iii) knowledge of teaching strategy and (iv) knowledge of needs and teaching use.

Grossman (1990) intends to introduce PCK to (i) knowledge about pupils and learning, (ii) curriculum knowledge and (iii) knowledge of teaching strategies. Shulman (1986) and Grossman (1990) also point out that the new teachers' PCK has not yet been built until they are blending the content knowledge and pedagogical knowledge into new knowledge namely Pedagogical Content Knowledge.

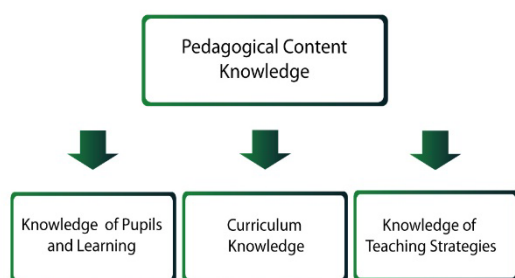


Figure 2: Formulation of Pedagogical Content Knowledge (Grossman, 1990)

Whether Shulman (1986, 1987), Grossman (1990) and Roehrig (2004) emphasize that all the knowledge that forms the PCK should be implemented simultaneously and used dynamically. Teachers should also be able to integrate knowledge vertically that have a deep understanding of the relationship between knowledge and knowledge related topics and broadly linking between pedagogical knowledge and content knowledge (Sulaiman, 2012).

Sulaman (2010) who studied PCK ICT trainee teachers found that ICT trainees teachers failed to integrate syntactic knowledge and substantive knowledge that shaped pedagogical knowledge because of isolated syntactical knowledge with substantive knowledge. This will cause the trainee teacher not to understand the development of PCK and fail to integrate separate knowledge and not unite the knowledge received during the course of study and will not be used simultaneously in teaching at school.

Substantive knowledge is the most important part of a discipline that covers the subject's facts and concepts. It also refers to the framework used to compile all the concepts and facts of the subject. While syntactic knowledge exists, methods involve the acceptance of new knowledge through several trial and endorsement procedures.

Teaching Practice Program

The teaching practice program is one of the fundamental components that every trainee teacher has to undergo an education program. This program depends largely on the mentoring and supervision of teaching. In the case of UPSI ICT trainee teachers, mentor is asked to perform at least four coaching sessions. Mentor is appointed from ICT and ICTL teacher in the school where the trainee teacher is placed. Teaching guides in the context of teaching practice need to be seen from a wider scope, not only as a field of trainees practicing all the theories but also the most useful medium for them to learn how to teach in real situations the school environment.

According to Rohaza (2010) teaching practice is one of the important components to equip the trainee teacher's knowledge before they are appointed teachers. This means that all the pedagogical knowledge and practices learned will be applied first within the prescribed period before they are absorbed as actual teachers. According to Abdul Malek (1999), his research on the relationships created by the mentor led to the development of professionalism and personal development, encouraging, building collaboration and inculcating the confidence of trainees' teachers to explore pedagogical knowledge and skills as well as teaching experience in more depth.

Ball and Feiman-Nemser (1988), Feiman-Nemser and Parker (1990) and Geddis (1993) are among researchers who found that among the problems of learning difficulty in learning from the teacher of the trainer is less ability to diagnose the difficulty of learning, pre-concept and conceptual misconception.

According to Frasson (2010) in his study, mentor as supervisors are required to play a role in supporting new teachers (mentee) included in the assessment as described in the consultative document in Sweden. The findings also found that mutual trust between mentor and new teachers was important as most new teachers objected to asking experienced partners to avoid losing their dignity or being uncompensated (Dinham 1992; Rust 1994).

Mentoring and Supervision

According to Al Ramaiah (1999) supervision is defined as an effort to encourage, coordinate, and guide the teacher in terms

of teaching so that teachers are more able to perform all the functions related to teaching. Jamaluddin et al., (2006) emphasize the role played by mentor in teaching practice program was huge and important because of their strong influence on trainee teachers. According to Jamaluddin, in the teaching practice session of the trainers, supervision will be made by the lecturers and teachers in the school. The supervision and mentoring provided will help trainee teachers prepare for the teacher's educational goals.

According to Hasnford et al., (2004), mentor play an important role in assisting trainee teachers in developing the practical skills, competencies and knowledge needed to be practiced in the classroom. At the same time, mentor plays a role in supervising trainee teachers in the classroom as well as forming the professionalism of teaching.

II. OBJECTIVE

This study attempts to study the role of mentor in assisting ICT trainee teachers to develop PCK. Two sub objectives have been outlined by researchers as a guide to achieving the main objectives are:

- i. Knowing the level of PCK of ICT trainee teachers
- ii. Knowing the level of mentoring and supervision from the perspective of ICT trainee during the Teaching Training program

III. RESEARCH QUESTIONS

Questions for this study are:

- i. What is the level of PCK of ICT trainee teachers for practice training programs?
- ii. What is the level of mentoring and supervision from the perspective of ICT trainee teachers during the Teaching Training program?

IV. PROBLEM STATEMENT

Recent studies have found that teachers who are less prepared to face problems in teaching often consider they inexperienced and do not have adequate training (Buell et al., 1999; Cains & Brown 1996; Martin et al. In the context of teaching profession, Experience and training of teachers are two different issues. Experience is empirical knowledge such as the experience of undergoing teaching training while the teacher training is more theoretical. They need each other to make a teacher reach the level of competency claimed. Therefore, Goodwin (1999) defining teacher training and teaching experience as one of the key basics of effective teaching.

Quality education comes from teaching and learning. Furthermore, the quality that is determined by the mastery of Pedagogical Content Knowledge (PCK) of a teacher and the level of knowledge and skills possessed at the entrance to the classroom of the results of the teacher education program that participates mainly involves the actual school environment (Shulman, 1986; Grossman, 1990; 1999, Darling-Hammond, 2000). In addition, according to Rice (2003), the success of this teacher's teaching was influenced by the education and training that followed during a teacher education program. In this context, the real environment is a teaching practice program

that becomes the mandatory course of every student who attends a teaching program.

Hence there must be a difference between trained and untrained teachers. The role of trained teachers should be far from being able to deliver information from books to students. Therefore, in the training of teachers, various knowledge and skills must be mastered by the trainee so that the profession of the college is guaranteed (Norasliza & Zaleha, 2008). The education system in Malaysia is based on the National Education Philosophy which emphasizes that capable human beings in all respects require mentoring and education from professionals. To look at the credibility and capabilities of trainee teachers in teaching, the teacher education institution has introduced teaching practice program as one of the key elements in teacher education program. Therefore, to produce quality instructors is very important in the study conducted to see how far the program teacher education is administered to develop the PCK of the trainee teachers.

V. ANALYSIS AND DISCUSSION

This study is a descriptive case study with quantitative methods. The respondents of this study were trainee teachers in the Bachelor of Information Technology (ISMP-AT20) who had participated in the teaching practice program. They consist of 109 people as respondents of the study using purposive sampling with the required characteristics are in the final year AT20 (ISMP-Information Technology) who have undergone teaching practice program including their readiness and consent to be involved in the study.

The research instrument is a set of questionnaires developed by researchers based on the construction of PCK prepared by Sulaiman (2010). The construction of PCK (Sulaiman, 2010) which has the Kappa Coefficient Value (Cohen Coefficient) is 0.92. Its construction is based on a questionnaire formulation in the form of a four-point scale likert. The questionnaire consists of five sections as in table 1.

Table 1: Item of questionnaire

Section	Item
A: Demographic	General Information
B: Communication	6
C: Knowledge about students and learning	9
D: Curriculum Knowledge	15
E: Knowledge on Teaching Strategies	32
Total	62

The data collected and analyzed using descriptive statistics by searching the mean using the Statistical Package for Social Science (SPSS) software version 20.0. The questionnaires used are four-point likert scale which means the following and the findings are described in form descriptive and table. Further explanation on four-point likert scale is shown in Table 2.

- 1 = Strongly disagree
- 2 = Do not agree
- 3 = Agree
- 4 = Strongly Agree

Table 2: Levels of Respondents Assessment Based on Mean

Assessment Level	Mean
Very contributing	3.6 – 4.0
Contributing	3.0 – 3.5
Not contributing	1.6 – 2.9
Very not contributing	1.0 – 1.5

The rating level of the respondents based on the mean of the four points of the likert scale score is "Very Contributing" = 3.6 - 4.0, "Contributing" = 3.0 - 3.5, "Not Contributing" = 1.6 - 2.9 and "Very Not Contributing" - 1.5.

Section A: Demographics

A total of 109 respondents, 103 (94.5%) get subject related to their study are an Information and Communication Technology (ICT) and Information and Communication Technology Literacy (ICTL). The rest are Trade (1), Visual Art Education (1), History (1), Civic (1) and Mathematics (1). If viewed from the point of view of the subject and the relevance to the formation of PCK, knowledge of students and learning also teaching strategies has no problem. However, it affects the formation of the curriculum's knowledge of the trainee teacher.

The frequency of mentoring and supervision by mentor is very satisfying. The lowest frequency is twice and the highest is eight times. Grade obtained is also very good that is 82.6% gets grade A (A +, A and A-) and 17.4% gets grade B (B + and B).

Section B: Communication

The study found that the respondents were comfortable with their mentor. Similarly, with the item '*They are uncomfortable if I ask too much for help*', mean is 1.53 which means that the mean is very not contributing and is not accepted by the respondent. Where the mentor is comfortable if the trainee teacher refers to it. On the other hand, the '*Good relationship with the mentor determines the actual grade of teaching practice (LM)*' that is 2.90 indicates that the respondents disagree with the good relationship with the mentor may affect the LM grade. If viewed at a mean assessment level, it is at a not contributing level. This means good relationship with the teacher does not affect the grade of teaching practice program.

Section C: Knowledge of Students and Learning

It is found that mean of knowledge students and learning is 3.25 and the standard deviation is 0.667. The level of knowledge students and learning is contributing to the development of PCK. Trainee teacher get good mentoring in aspects of knowledge about students especially their needs for ICT / ICTL learning with mean 3.39. Although understanding and conceptual misconceptions in ICT / ICTL are lowest 3.12, they are still in the evaluation stage that contributes to the PCK development of trainee teacher.

Section D: Curriculum Knowledge

The overall mean for curriculum knowledge section is 2.94 and the standard deviation is 0.553. Although 94.5% have received ICT subjects it does not show good construction.

They are still weak in mastering the syllabus description (HSP) of ICT. Assessment based on the mean of being not contributors which means the teaching practice program does not contribute to the curriculum knowledge development of ICT trainee teacher. Curriculum knowledge is very important to the development of PCK to trainee teacher. If viewed at the assessment level, the trainee teacher still needs mentoring and supervision to strengthen their curriculum knowledge.

Section E: Knowledge of Teaching Strategies

Knowledge of Teaching Strategies, the overall mean is 3.21 and the standard deviation of 0.693 is at the level of contributing to the construction of PCK. The 32 item indicates '*Method to implement school-based assessments (PBS)*' is still a problem with the lowest mean of the 32 items that is 2.74 which does not contribute to the development PCK of trainee teacher. Here, the trainee teachers are less likely to receive good exposure and mentoring from mentor teacher about the PBS. However, the trainee teachers are very satisfied with the mentoring of the diversity of teaching materials revealed to them with mean 3.44 which is at the level of contributing to the construction.

Teachers should play their part in ensuring that trainee teachers get trained training because teaching training program can shape their personality as teachers in a real environment.

Section F: Assessment Level of Mentoring

Assessment Level of mentoring, the researcher sees the percentage given by the trainee teacher for the mentoring and supervision they have received. Percentage range between 20% to 90%. 56% are 61 ICT trainee's teachers set a range of mentoring ranging from 20% to 50%. While, 44% that is 48 ICT trainee teacher set a range of mentoring and supervision ranges from 60% to 90%. It is at a low level of Mentoring and supervision assessment. Researchers see how frequent Mentoring and supervision do not contribute significantly to the percentage of evaluations for the formation of PCK of ICT trainers. The problem is what is being discussed during the mentoring and supervision session. And if we look at the PCK assessment level of the ICT trainee teacher, it is still at a positive level.

VI. RESULTS

Section A: Demographics

Table 3 shows the number and percentage of respondents involved in the study.

Table 3: Gender

Gender	Number	Percent (%)
Man	33	30.3
Woman	76	69.7
Total	109	100

The subjects taught during the teacher practice program can be seen in Table 4. This subject is determined by the school administration.

Table 4: Subjects

Subjects	Number	Percent (%)
ICT	51	46.8
ICTL	52	47.7
Trade	1	.9
Networking	1	.9
Visual Art Educatio	1	.9
History	1	.9
Civic	1	.9
Mathematics	1	.9
Total	109	100

Table 5 shows the frequency of mentoring and supervision by mentor recorded by researchers.

Table 5: Frequency of Mentoring and Supervision

Supervision Frequency	Number	Percent (%)
2	4	3.7
3	27	24.8
4	51	46.8
5	15	13.8
6	7	6.4
8	4	3.7
Missing	1	.9
Total	109	100

Table 6 shows the grade obtained for the teaching practice program.

Table 6: Teacher Practice Grade

Grade	Number	Percent (%)
A+	3	2.8
A	51	46.8
A-	36	33.0
B+	17	15.6
B	1	.9
Missing	1	.9
Total	109	100

Section B: Communication

A total of six items were submitted to the respondent. Mean for part B is Communication between trainee teacher and mentor within three. The lowest is 1.53 which is 'They are uncomfortable if I ask too much for help' while the highest is 3.57 is 'Comfortably communicate with them'. See Table 7.

Table 7: Communication

Communication Item	Mean	Standard Deviation
1. Comfortably communicate with them	3.57	.629
2. Very often discuss to them	3.39	.651
3. My mentor was very friendly	3.56	.617

4. They are uncomfortable if I ask too much for help	1.53	.729
5. Good relationship with the mentor determines the actual grade of teaching practice (LM)	2.90	.971
6. They believe in my ability to teach ICT	3.32	.622
N = 109		

Section C: Knowledge of Students and Learning

Table 8 shows nine items in Knowledge of Students and Learning. Mean within three. The lowest mean is related to the 'Misconceptions of ICT concept by students' were 3.12 and highest 3.39 'Students' needs to learn ICT / ICTL'.

Table 8: Knowledge of Students and Learning

Knowledge of Students and Learning Item	Mean	Standard Deviation
1. Student learning style	3.32	.665
2. Ability communicate students	3.34	.658
3. Existing knowledge of student	3.31	.676
4. Students' ability to learn	3.24	.668
5. Difficult topics to be taught	3.15	.743
6. The causes of the difficulties of learning ICT / ICTL students	3.19	.631
7. The concepts of ICT are always misunderstood	3.15	.705
8. Misconceptions of ICT concept by students	3.12	.663
9. Students' needs to learn ICT / ICTL	3.39	.592
N = 109		

Section D: Curriculum Knowledge

Table 9 shows 15 items of Curriculum Knowledge. Overall mean is 2.94. The lowest are related to the 'Differences in the nature of ICT/ICTL subjects with other subjects' is 2.27 and the highest 3.33 'Good object writing' and 'Moral values in ICT/ICTL teaching'.

Table 9: Curriculum Knowledge

Curriculum Knowledge Item	Mean	Standard Deviation
1. The goal of teaching ICT	3.12	.593
2. The relationship between National Education Philosophy (FPK) with ICT teaching	3.13	.595
3. The contents of the lesson contained in the syllabus (HSP)	2.77	.527

4. Information contained in syllabus (HSP)	2.44	.464	9. The use of skill-based teaching approaches	3.32	.651
5. The suitability of the contents of the lesson in the ICT curriculum	3.25	.566	10. Use of task-based teaching approaches	3.28	.610
6. Change the subject title sequence which is suitable for my students	3.31	.556	11. Use of self-directed learning approaches	3.09	.660
7. Area of ICT/ICTL lesson content	3.29	.598	12. Use of self-accessed learning approach	3.01	.619
8. Depth of contents of ICT/ICTL lessons	2.28	.433	13. Use of self-assessed learning strategies	3.04	.652
9. The teaching methods proposed in syllabus (HSP)	3.17	.621	14. Use of teaching strategies is in line with the level of difficulty in the subject matter	3.08	.598
10. The contents of each lesson are taught	2.45	.466	15. Teaching strategy selection is based on the level of difficulty in the content of the lesson	3.28	.668
11. Differences in the nature of ICT/ICTL subjects with other subjects	2.27	.432	16. Method to overcome the difficulty of learning a student	3.27	.718
12. Knowledge dominated by students	3.18	.611	17. Method to modify teaching strategies when teaching if necessary	3.32	.679
13. Good object writing	3.33	.639	18. Use of group learning methods based on lesson content needs	3.39	.693
14. The depth and breadth of learning outcomes that need to be assessed	2.79	.530	19. Method to keep students focused on teaching and learning	3.26	.738
15. Moral values in ICT/ICTL teaching	3.33	.667	20. Method to evaluate the learning progress of each student	3.31	.604
N = 109					

Section E: Knowledge of Teaching Strategies

A total of 32 items were submitted to respondents related to the Knowledge of Teaching Strategy. Mean for this part in the range of three. The lowest mean is 2.74 which are 'Method to implement school-based assessments (PBS)' while the highest is 3.44 which is 'Use of various materials that fit the lesson'. See Table 10.

Table 10: Knowledge of Teaching Strategies

Knowledge of Teaching Strategies Item	Mean	Standard Deviation			
1. Time distribution is appropriate for teaching	3.39	.593	21. Method to implement school-based assessments (PBS)	2.74	.966
2. Length of teaching time to achieve an objective	3.12	.720	22. Method to overcome teaching problems stems from desktops in laboratories	2.96	.838
3. The choice of teaching materials that facilitates the learning process	3.36	.674	23. Method to overcome the problem of teaching comes from computer software	3.17	.756
4. Use of various materials that fit the lesson	3.44	.686	24. Method to overcome teaching problems is caused by computer hardware	3.23	.753
5. Planning of teaching activities corresponds to the contents of the lesson	3.39	.667	25. Method to maximize the use of teaching time	3.25	.709
6. Misconceptions of ICT concepts of students before learning	3.11	.674	26. Use of e-learning materials effectively	3.14	.775
7. Use of existing knowledge of the students in teaching	3.27	.662	27. Method to make reflection, identify problems and overcome them	3.13	.771
8. Use of information-based teaching approaches	3.30	.601	28. The construction of good e-learning materials for teaching	3.19	.739
			29. Method to find and select the appropriate e-learning material	3.17	.731
			30. Method to give students the opportunity to practice practical skills	3.25	.641

31. Method to maintain learning momentum through teaching arrangement	3.17	.660
32. Application of pure values in teaching and learning	3.41	.670
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N = 109		

Section F: Assessment Level of Mentoring

Table 11 shows the percentage level of assessment by the trainee teacher on the mentoring and supervision process received by mentor in ensuring the improvement and development of the PCK during the teaching practice at the school.

Table 11: Assessment Level of Mentoring

Percentage Range	Number	Percent (%)
20.00	4	3.7
30.00	4	3.7
40.00	22	20.2
50.00	31	28.7
60.00	34	31.9
70.00	8	7.4
80.00	5	3.7
90.00	1	.9
Total	109	100

VII. CONCLUSIONS

The teaching practice program is a good platform to ensure that students pursuing studies in the teaching program have sufficient knowledge of the students and the learning, curriculum and teaching strategies of those experienced in the school environment. In this aspect, they are experienced teachers or more precisely the mentor who will guide the trainee teacher throughout the teaching practice program.

The percentage of mentoring assessment level is still low although there is a PCK formation in the trainee teacher. From the percentage statistics, the researcher found that further research should be carried out to clarify in more detail the role of the actual teacher in ensuring the mentoring and supervision especially in improving and developing PCK. Additionally, further studies need to look at the factors that contribute to the formation of the PCK. This is because the level of evaluation based on mean is at a positive level.

ACKNOWLEDGMENT

The authors would like to acknowledge the support to trainee teachers from the Degree in Information Technology Education (ISMP-AT20) at Sultan Idris Education University (UPSI) who gave cooperation for research participated as a respondent. Thanksful to supervisor Dr.SulaimanSarkawi, who always support to pursue this article and spent time helping and give the guidance. Also thanks to all authors as a reference in this article for the input, data and information.

REFERENCES

[1] Al Ramaiah. (1999). *Kepimpinan Pendidikan, Cabaran Masa Kini. Petaling Jaya: IBS Buku Sdn Bhd. Anderson.*

[2] Ball, D.L. & Feiman-Nemser, S. (1988) Using textbooks and teachers’ guides: a dilemma for beginning teachers and teacher educators, *Curriculum Inquiry*, 18(4), pp. 401–423.

[3] Buell, M., Hallam, R., Gamel-McCormick, M. & Scheer, S. (1999). A survey of general and special inservice needs concerning inclusion. *International Journal of Disability, Development and Education* 46: 143-156.

[4] Cains, R.A. & Brown, C.R. (1996). Newly qualified teachers: A comparative analysis of the perceptions held by B.Ed. and PGCE-trained primary teachers of their training routes. *Educational Psychology* 16: 257-270.

[5] Carlsen, W. S. (1999). Domain of teacher knowledge. Dalam J. Gess-Newsome, & N. G. Lederman (Eds.). *Examining Pedagogical Content Knowledge* (Pg. 133-144). Dordrecht: Kluwer Academic.

[6] Cohen, J. (1960), A coefficient of agreement for nominal scales, *Educational and Psychological Measurement* 20(1), 37-46.

[7] Darling-Hammond, L. & Bransford, J. (2005). Preparing Teacher for a Changing World. In Sulaiman Sarkawi. (2010). *Pengertian Kandungan Pedagogi Guru Pelatih Program Teknologi Maklumat Universiti Pendidikan Sultan Idris*. Thesis Doctor of Philosophy UPSI. Unpublished.

[8] Darling-Hammond, L. (2000). Teacher Quality and Student Achievement: A Review of State Policy Evidence. *Education Policy Analysis Archives*, 8, (1), <http://epaa.asu.edu/ojs/article/view/392/515>.

[9] Feiman-Nemser, S. & Parker, M. B. (1990). Making subject matter part of the conversation in learning to teach, *Journal of Teacher Education*, 41(3), 32-43.

[10] Geddis, A.N. (1993) Transforming subject-matter knowledge: the role of pedagogical content knowledge in learning to reflect on teaching, *International Journal of Science Education*, 15(6), 673–683.

[11] Grossman, P. L. (1990). The Making of a Teacher: Teacher Knowledge and Teacher Education. New York: Teachers College Press. In Sulaiman Sarkawi. (2012). *Pembinaan Piawai Pengetahuan Pedagogi Kandungan Guru ICT di Malaysia*. Thesis Doctor of Philosophy UPSI. Unpublished.

[12] Grossman, P.L. (1989). Learning to teach without teacher education. *Teachers College Record*. 91, 191-207.

[13] Jamaluddin Ramli, Ahmad Johari Sibes, Abdul Rahim Hamdandan Muainah Ismail. (2006). *Bimbingan Guru Pembimbing Terhadap Guru Pelatih Dalam Latihan Mengajar*. Faculty of Education, Universiti Teknologi Malaysia.

[14] Megat Aman Zahiri Megat Zakaria & Nor Kamsiah Kamar ul Jaeh. (2010). *Persepsi Guru Pelatih Terhadap Proses Penyeliaan dan Bimbingan yang diberikan oleh Penyelia Pembimbing bagi Program Latihan Mengajar Universiti Teknologi Malaysia*. Faculty of Education, Universiti Teknologi Malaysia.

[15] Mohamad Najib Abdul Ghafar (1999). *Penyelidikan Pendidikan*. Skudai: Universiti Teknologi Malaysia.

- [16] Norasliza Hassan &Zaleha Ismail. (2008). PengetahuanPedagogiKandungan Guru PelatihMatematikSekolahMenengah.Faculty of Education, UniversitiTeknologi Malaysia.
- [17] Rice, J. K. (2003). Teacher quality: Understanding the effectiveness of teacher attributes. Washington, DC: *Economic Policy Institute*.
- [18] Roehrig, G. H. &Luft, J. A. (2004). Constraints experienced by beginning secondary science teachers in implementing scientific inquiry lessons. *International Journal of Science Education*, 26(1), 3-24.
- [19] RohazaChe Rose. (2010). *MasalahLatihanMengajardalamKalanganPelatihUniversitiTeknologi Malaysia*.UniversitiTeknologi Malaysia.
- [20] Scheffler, I. (1965). The conditions of knowledge.InSulaimanSarkawi.(2010). *PengetahuanKandunganPedagogi Guru Pelatih Program TeknologiMaklumatUniversitiPendidikan Sultan Idris*.Thesis Doctor of Philosophy UPSI.Unpublished.
- [21] Shulman, L.S. (1986). Those who understand: knowledge growth in teaching. *Educational Reseacher*.
- [22] Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-21.
- [23] SulaimanSarkawi. (2010). *PengetahuanKandunganPedagogi Guru Pelatih Program TeknologiMaklumatUniversitiPendidikan Sultan Idris*.Thesis Doctor of Philosophy UPSI.Unpublished.
- [24] SulaimanSarkawi. (2011). *PengetahuanTentangPelajardanPembelajarandalamkalanGuru PelatihTeknologiMaklumat*.Journal of Educational Technology Malaysia. 1(4), 31-41
- [25] SulaimanSarkawi (2011).*PembinaanPiawaiPengetahuanPedagogiKandungan Guru ICT di Malaysia*. UniversitiPendidikan Sultan Idris.Unpublished.
- [26] S,Sarkawi, NM,Salleh, M, Ibrahim. (2012). Development of Pedagogical Content Knowledge Standard for Malaysian ICT Teachers (Pg. 5177-5184).*International Proceeding - 6th.International Technology, Education and Development Conference*. 5-7 March 2012. Valencia, Spain.
- [27] Teaching Training Unit. (2012). *LaporanPenyeliaanLatihanMengajar*.UniversitiPendidikan Sultan Idris.

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