

THE TEACHING PROFILE OF MATRICULATION COLLEGE SCIENCE TEACHERS IN MALAYSIA

NOORAI DAYAKOB & RABIATUL ADAWIAH AHMAD RASHED

***ABSTRACT:** Teaching is an important process in order to produce a meaningful learning. As an intermediate program, every teacher in Matriculation College should be able to produce an effective teaching process, particularly in teaching Science which is full with abstract concepts. To achieve that, Science teachers need the teaching profile as a guidance to develop a flexible, creative, and innovative teaching process. As a result, the learning process will meet the students' need and the objectives of twenty-first century education. Therefore, the purpose of this study is to identify the teaching profile and sub-profile patterns of matriculation Science teachers in Malaysia. For this purpose, 344 Science teachers from eight Matriculation Colleges were selected. Data was collected by using questionnaire as a main instrument. The finding showed that the professional knowledge and the professional attitudes dominate the profile patterns. While the sub-profile patterns dominated by pedagogical content knowledge and relationship among colleagues. It is also safe to say that the professionalism profile will be the ultimate key towards upgrading teachers' quality, the quality of the teaching process as well as the quality of the product that is the students. This study suggests that the dominated profile and sub-profile show the matriculation teachers' strength in teaching Science.*

***KEY WORDS:** Teaching profile, Science teacher, teacher's knowledge, professional knowledge, professional practices, professional attitudes.*

INTRODUCTION

The higher learning institutions, such as teaching colleges or universities, play a significant role in producing excellent and efficient teachers. Ample training and experience can ensure an effective teaching environment. Moly Lee (2002) notes that the quality of teacher education does not depend on the quality of students or the teacher trainers but more on the content and the methods of training received. The efficacies of the training given to the trainees determine the level of excellence a teacher possesses (Yaakub Yusuf, 1980; Norani Yaakub & Nik Noriah Nik Ibrahim, 1992; and Ramlah Mohammad, 2001).

According to R. Nacino-Brown, F.E. Dan Oke and D.P. Brown (1989), an intensive and comprehensive training is able to produce professional teachers in terms: (1) subject matter knowledge; (2) students' development principles; (3) general knowledge; (4) pedagogical knowledge; (5) positive attitudes; and

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(6) readiness in adapting teaching with the students' needs, tools and classroom environment.

Therefore, after undergoing the training, it is hoped that the teachers are able to become professionals who are capable of handling the teaching and learning effectively and efficiently, as well as being responsible in every action they take regarding to the classroom environment.

THE TEACHING PROBLEMS

However, predicaments and problems regarding teaching have always been the most discussed agenda. These problems faced by both new teachers as well as experienced ones (Bahagian Pendidikan Guru, 1997). This evidenced when experienced teachers are not able to master the suggested teaching methodologies (Indra Devi, 1997). According to Tajul Arifin Noordin and Nor'aini Dan (1997), the teachers are still lacking in terms of teaching approaches and teaching strategies. Often, the teachers act as knowledge disseminator, only distributing knowledge to a mass audience (students) in a controlled environment (Nor Azlan Ahmad Zanzali, 1995/1996). Thus, they become a "flat profession" (Myers & Myers, 1995) whereby they only disseminate knowledge without taking into account the level of students' development and abilities.

Moly Lee (2002) has discussed similar scenario in her research where the findings show that teachers are incapable in catering various students' needs in the classroom. For example: (1) lack of ability in determining whether students comprehend what is being taught; (2) unable to cater students with different abilities; (3) focused only on teaching students as a "whole class" rather than on individual student, resulting in weaker students lagging behind and stagnating outstanding students; (4) lack of skills in evaluating students and making diagnosis; (5) unable to detect students' weaknesses; and (6) unable to rectify students' mistakes or give prompt responses.

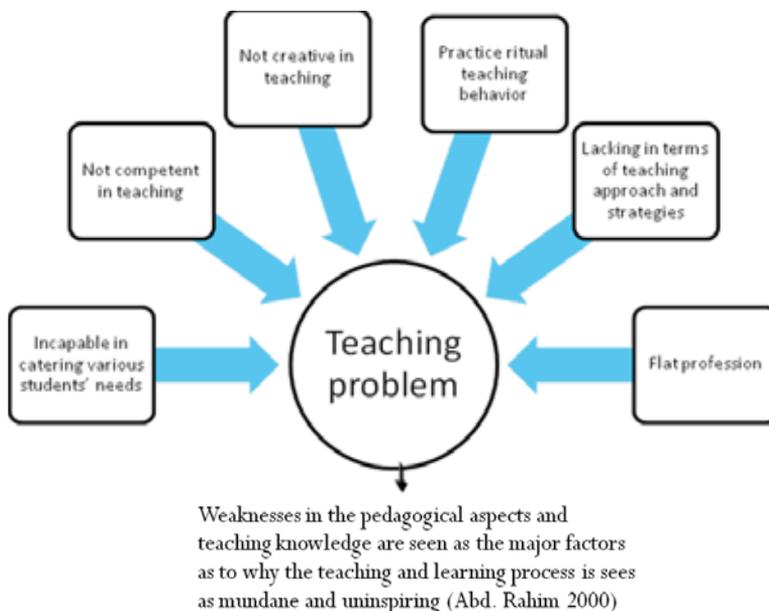
Because of those weaknesses, various problems will crop up, such as loss of control in the classroom, passive and unresponsive students (Tan & Lourdasamy, 1992). Those weaknesses will affect the teaching performance.

The same predicament even occurs in the matriculation level whereby students' performance used as an indicator to measure the teachers' efficiency in teaching. Syed Anwar Aly Mohd Abdu Bakar (2000) in his research states that the performance in the Science subjects for the *Sijil Pelajaran Malaysia* (High School Examination) and matriculation levels is downright worrying. In addition, the IPPTN (*Institut Penyelidikan Pendidikan Tinggi Negara* or Research Institute of National High Education) Report (2004) also highlights that the academic performance of matriculation students are at the average level. Because of this, once the students enter the higher educational institutions, their achievement is subsequently lower than those who enter the institutions after the STPM (*Sijil Tinggi Pelajaran Malaysia*). The situation is definitely challenges the credibility of

the matriculation teachers in dispersing knowledge and basic skills, especially those teaching in the Science stream.

The IPPTN Report (2004) also concludes that teachers who are less committed in teaching as well as teachers who do not vary their teaching methods are some of the factors that contribute to the students' average performance. Othman Lebar (2000) cites that ineffective Science teaching centered on memorizing and rewriting facts that simplified. This situation produces teachers who are unaware of the suitable teaching techniques and this affects their performance in teaching. As a result, students will eventually become bored and uninterested in learning Science, which inevitably affect their performance.

Although the teachers have ample knowledge and experience in teaching, they seem inadequate in executing an effective teaching and learning process (Tajul Arifin Noordin, 1990). It appears that they are lacking the capabilities of carrying out the teaching process. The failure to execute teaching efficiently will somehow affect students' development and performance. The weaknesses in the pedagogical aspects and teaching knowledge are seen as the major factors as to why the teaching and learning process is seen as mundane and uninspiring (Abd. Rahim Abd. Rashid, 2000).



Therefore, a teaching profile is highly needed. The profile should be able to illustrate how far the teachers' knowledge is, the extent to which they have the expertise in practicing the knowledge as well as the teachers' attitudes in improving their teaching and learning. The profile can also act as an indicator of teachers'

performance in teaching. This profile also enable teachers always be aware of their own development and progress and at the same time able to develop students' potential to the optimum level without ignoring the students' abilities. The objective of this paper aims is identifying the patterns of the teaching profile and sub profile among the matriculation Science teachers.

TEACHING PROFILES

Teaching is an important activity in every class. An effective teaching will aid in students' learning process. As a professional teacher, he/she needs to ensure that learning process to be inspiring and takes place in conducive surroundings. With the principle that each teaching could help and maximize learning outcomes as well as the students' comprehension, teachers need a practical teaching guideline. This guideline will help teachers in building a conducive learning environment that will inevitably increase students' motivation to learn. As H. McBer (2000:29) points out that they create environments which maximize opportunities to learn in which pupils are motivated to learn.

Thus, in making sure the teaching Science process will optimize students' learning, two teaching models have been utilized: *Pedagogical Context Knowledge* by J. Barnett and D. Hodson (2001); and *Professional Standard for Highly Accomplished Teachers of Science* by the Australian Teacher Association (ASTA, 2001). These models stress on how to be an excellent Science teacher. Based on these models, a teaching profile has been developed that consists of three profiles and each profile has its own sub profile. The table below illustrates the profiles and sub profiles.

Table 1:
 Components of Teaching Profile and Sub Profiles

Profile Components	Sub Profile Components
Professional Knowledge	Students' knowledge and development. Pedagogical content knowledge.
Professional Practice	Teaching strategies practice. Assessment practice.
Professional Attitudes	Attitudes towards the reflection process. Relationship among colleagues. Teachers' commitment.

Source: Adapted from ASTA (2001); and Barnett & Hodson (2001).

The identified profiles and sub profiles will help the matriculation Science teachers in self-development in terms of their knowledge, skills, and attitudes towards teaching. Simultaneously, the profiles also will give a positive impact on the teaching performance and at the same time upgrading the college's quality level as an excellent learning organization.

METHODOLOGY

Matriculation college is a pre-university college. The purpose of this college is to benefit the students when they further their studies in university. Students with good result in *Sijil Pelajaran Malaysia* (High School Examination) will enter this college. It is one year program.

Eight matriculation colleges have been selected for this study. They are Johor Matriculation College, Melaka Matriculation College, Negeri Sembilan Matriculation College, Perak Matriculation College, Kedah Matriculation College, Pulau Pinang Matriculation College, Pahang Matriculation College, and Perlis Matriculation College. All these colleges situated in the Peninsular Malaysia and are under the Ministry of Education.

The sample of this study consists of 344 Science teachers. Even though some of the questionnaires given out are not returned, the number of questionnaires obtained is ample enough in representing the population of the matriculation Science teachers, as the total number of Science teachers is 439. The sample taken represents 78.4% of the total population.

This study utilizes the survey method by using questionnaires as the main research instrument. The questionnaire divided into two sections which are A and B. Section B is further divided into three sub-sections, as detailed in table 1.2.

Table 1.2.
Questionnaires

Section	Sub Section
A	Teachers' Demographic Data
B	1. Professional Knowledge. 2. Professional Practices. 3. Professional Attitudes.

Section A allows the researcher to obtain background information on the respondents such as gender, age, experience, academic qualifications, and teaching specialization; while in section B consists of items used to measure profile such as:

- i. Professional knowledge with two sub profiles:
 - Students' knowledge and development.
 - Pedagogical content knowledge.
- ii. Professional practices with two sub profiles:
 - Teaching strategies practice.
 - Assessment practices.
- iii. Professional attitudes with three sub profiles:
 - Attitudes towards reflection process.
 - Relationships among colleagues.
 - Teachers' commitment.

The findings from the pilot study illustrates that each variable in this study achieves a high Alpha Cronbach value which is between 0.700 and 0.950.

FINDINGS

According to the data obtained, the mean score recorded for each profile is 4.0760 (professional knowledge); 3.8620 (professional practices); and 4.1093 (professional attitudes). In comparing these three mean scores, it is clear to see that the mean for the professional attitudes scores the highest and followed by the mean score for professional knowledge. On the other hand, the mean for professional practices shows the lowest score. By using the one-way ANOVA test, the findings show significance difference at the 5% significant level. Refer to table 1.3. as follows:

Table 1.3.
 One Way ANOVA Test for Teaching Professionalism Profile

	Total of Squares	df	Mean Squares	F	Sig
Between Group	12.245	2	6.122	47.154	0.000*
Within Group	132.044	1017	0.130		
Total	144.289	1019			

* Significant at the 5% significant level.

A Post Hoc test is done following the difference. Findings show that the significant difference occurs between the professional knowledge and professional practice; and between the professional practices and professional attitudes at the 5% significant level. However, there is no significant difference found between professional knowledge and professional attitudes. Refer to table 1.4. as follows:

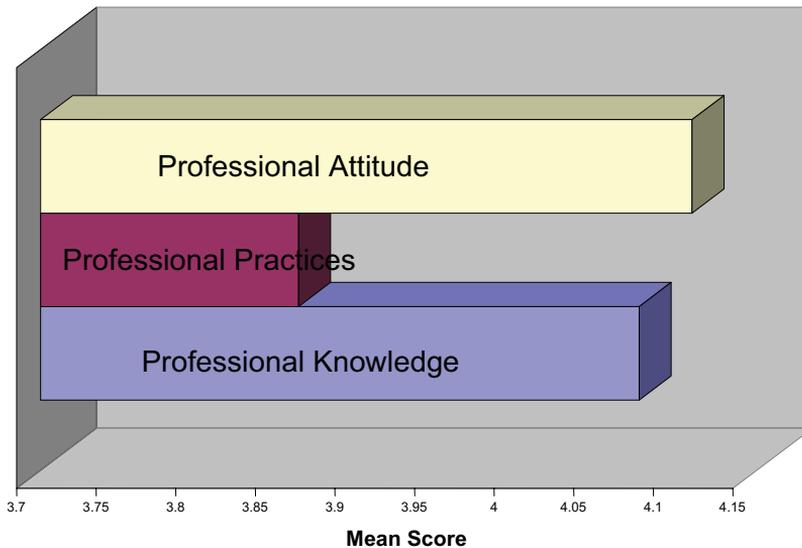
Table 1.4.
 A Post Hoc Test on Professionalism Profile

Group (I)	Group (J)	Sig
Professional Knowledge	Professional Practices	0.000*
Professional Practices	Professional Attitudes	0.953
Professional Attitudes	Professional Attitudes	0.000*

*Significant at the 5% significant level.

Therefore, the findings show that the matriculation Science teachers' profile is dominated by the professional knowledge and professional attitudes. Both profiles shape the patterns of the profiles of the matriculation Science teachers. Although the professional practice does not dominate the profiles' development, it is still valid, based on the mean score it obtained. The pattern of the professionalism profile of teaching is shown in figure 1.1. as follows:

Figure 1.1.
The Pattern of Teaching Profile of Matriculation Science Teacher



In identifying the patterns of the sub profiles for professional knowledge, students' knowledge and development, the mean score obtained is 4.0062; while the pedagogical content knowledge is 4.1461. The high mean scores show the respondents agree that students' knowledge and developments as well as the pedagogical content knowledge are vital in their teaching process. Through the *t-test*, finding showed a significant difference between both sub profiles at the significant level of 5%. Table 1.5. showed the differences.

Table 1.5.
The *t-test* for Professional Knowledge

Sub Profile for Professional Knowledge	Mean	Sig (2-tailed)
Students' knowledge and development	4.0062	0.000*
Pedagogical content knowledge	4.1461	

* Significant at the 5% significant level.

The result showed that the sub profile for the professional knowledge of these Science teachers is dominated by the pedagogical content knowledge.

Sub profile for the professional practices showed a high mean score i.e. 3.8010 (teaching strategies practices) and 3.9222 (assessment practices). This illustrate that respondents practice the teaching strategies and assessment constantly, hence the high mean values. Through the *t-test*, finding shows a significant difference between both elements at the significant level of 5%. Table 1.6. showed the differences.

Table 1.6.
 The *t*-test for Professional Practice

Professional Practice Subprofile	Mean	Sig (2-tailed)
Teaching strategies practices	3.8010	0.001*
Assessment practices	3.9222	

* Significant at the 5% significant level.

The findings showed that the pattern for sub profile was dominated by the assessment practices.

While in the professional attitudes, the mean scores for each sub profile are as relatively high i.e. 4.0236 in reflection process, 4.1637 for relationships with colleagues, and 4.1106 for commitment. The findings clearly illustrate that the teachers agree upon the importance of reflection, relationships among colleagues, and commitment in upgrading their professionalism. The one-way ANOVA test shows a significant difference in the 5% significant level. Refer to table 1.7. as follows:

Table 1.7.
 One Way ANOVA Test for Professional Attitudes

	Total of Squares	df	Mean square	F	Sig
Between Group	3.903	2	1.952	9.603	0.000*
Within Group	206.683	1017	0.203		
Total	210.586	1019			

* Significant at the 5% significant level.

The Post Hoc test analysis illustrates that there is a significant difference between the reflection process and the relationships with colleagues at the 5% significant level. On the other hand, there is no significant difference found between the relationships with colleagues and commitments as can be seen in table 1.8.

Table 1.8.
 The Post Hoc Analysis for Professional Attitudes

Group (I)	Group (J)	Sig
Attitudes toward the reflection process	Relationship among colleagues	0.000*
Teacher's commitment	Commitments	0.051
The relationships among colleagues	Commitments	0.156

* Significant at the 5% significant level.

Hence, the significant difference shows that the dominant sub-profile for teachers' professional attitudes is the relationships with colleagues.

By looking at the analysis of the findings, it can be summed up that the teaching sub profiles are dominated by the pedagogical content knowledge and the relationships with colleagues.

DISCUSSIONS

The dominance of the professional knowledge shows that the matriculation Science teachers need this profile in executing their teachings. With a sound professional knowledge, the teachers are able to deliver their teachings with ease and confidence without compromising the students' needs and abilities. They also can change the ritual teaching behaviors which assume students as empty vessels that needed to be filled with information and concepts to more responsive teaching behavior. This teaching practice will help teachers to become more conscious and alert towards their surroundings, especially in upgrading themselves as knowledge disseminators, the students as recipients, and the teaching resources as the main knowledge. They will definitely possess the survival concepts in executing the teaching and learning process in an interesting learning environment (Salleh Abd. Rashid, 2003). That concept will help teachers to be more energetic and lively in the class.

The dominance of the professional knowledge will also help the teachers to be more aware of their self-development. In addition, the teachers will be able to develop interactive teaching, focusing not only on substantive and syntactic knowledge but also in making sure that the knowledge is applicable and relevant in the students' everyday life. According to Juslimah Jani (2000), interactive teaching will provide the appropriate motivation for the students to be more interested in their learning. As stated by L. Abrahamson (2009:1), this interactive teaching "*serves to jolt the students into action*".

Thus, this profile could definitely shape teachers into becoming more committed towards their teaching process so that the students will gain the optimum knowledge. In short, the teaching and learning of Science will become more engaging and effective, and teachers become more creative in the classrooms (Craft, 2002).

Findings show that the pedagogical content knowledge dominates the professional knowledge profile. The dominance illustrates that the teachers are aware of this knowledge in their teaching process. However, findings also show that teachers are still focusing in the use of concrete examples and students' problems in their teaching representations; whereas according to D. Quinn (1994), the list of other teaching representations such as mnemonic devices, body movements, story telling, and simulation among others are in exhaustive. This finding showed most of them knows about those two representations but didn't know about others representation.

Without a doubt, these teachers are aware of and focus on the pedagogical content knowledge in their teachings. The awareness comes from the assumptions that the Science subject is dry and difficult as it consists of many abstract concepts. As I.C. Rovegno (1992) claims that the pedagogical content knowledge is vital in the teaching process. In addition, it is also a specific field for the teachers (Turner-Bisset, 2004). Although the use of representations is quite limited for the teachers involved in this study, the teachers are indeed aware of its importance in the teaching process as an element that is beneficial to the learners.

The dominance of the professional attitude shows that teachers are concerned that their attitudes could give a positive impact on their ways of thinking and their actions. The teachers will continue striving for excellence and minimizing their weaknesses in teaching. Thus, the professional attitude will help the teachers to appreciate in upgrading the students' performance as well as the teachers' professionalism.

The relationship with colleagues dominates the sub-profile for professional attitudes. This illustrates that teachers possess admirable teamwork spirit. Each teacher needs to view their colleagues as an interdependence community, collaborating to build a successful community. A positive interdependency can help to elevate and develop the potential of each individual in the community (Othman Lebar, 2000). Positive interdependency allows teachers to help one another in solving teaching problems. Collaboration helps teachers to overcome their own weaknesses. Therefore, effective teaching would certainly help the learners achieve their learning targets in this globalization era.

It can be summed up that the Science teachers have amicable relationships with their colleagues. A good and sound relationship helps in developing a tight and close-knit collaborative nature. Mohd. Sahandri Gani Hj. Hamzah (1998) opines that collaboration and understanding are vital in increasing teachers' professionalism. The dominating sub-profile will motivate teachers to collaborate and work together in exchanging information and solving problems. These findings corroborate with the study by Abdul Rashid Mohamad and Zurida Ismail (2000/2001) which show that good relationships among teachers equal good working environment whereby members help one another. The study by Yeow Kwai Tam *et al.* (1999) illustrate that colleagues are able to influence teachers' development through peer teaching, attention giving, excellent work ethics, and other. Teachers working together will minimize each other's weaknesses and maximize each other's strengths. Pertaining to that, an amicable relationship need to be nurtured so as to make sure a collaborative and cooperative environment is built.

It seems that the teachers are not too concerned with the professional practices profile. However, in truth, the teachers need to give more focus on this profile as without it there will be gaps on how teaching processes are carried out, on the effectiveness of the processes as well as on the assessment processes of students' understanding. Therefore, looking at the findings of this study, it is vital for teachers to give more emphasis and attention to the professional practices' profile to ensure that the quality of the teaching process can be enhanced. A high quality of teaching leads to an optimum level of students' comprehension.

Both the professional knowledge and professional attitudes inevitably needed by the matriculation Science teachers to ensure the best teaching process delivered. Although the professional practices do not dominate the profile patterns, the importance of the practices in the teaching process cannot be taken lightly. Teachers disseminate the knowledge through their own unique practices. If the practices neglected, the knowledge will just become dormant theories, without any practice at all.

CONCLUSION

The professionalism profile is able to contribute positively towards increasing the quality of the educational institutions. It will definitely aid the teachers to be more proactive and highly motivated in improving and advancing themselves with latest knowledge and skills to be used in teaching effectively. This will also produce teachers who are more susceptible to their students' developments and needs. The teachings produced should be geared towards enhancing and enriching the students' potentials and not just "filling in" students with knowledge. In addition, a high quality teaching should be able to produce high quality students, especially those needed in the 21st century as knowledge workers.

To sum it all up, it is safe to say that the professionalism profile will be the ultimate key towards upgrading teachers' quality, the quality of the teaching process as well as the quality of the product that is the students. The success will reflect on the teachers' professionalism whereby teachers are seen as a highly qualified teaching force that is capable in producing highly intellectual students.

REFERENCES

- Abd. Rahim Abd. Rashid. (2000). *Model dan Pendekatan Pengajaran Sejarah KBSM*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
- Abdul Rashid Mohamad & Zurida Ismail. (2000/2001). "Pengalaman Belajar-Mengajar Guru-guru Pelatih USM" in *Jurnal Pendidik dan Pendidikan*, 17, pp.41-56.
- Abrahamson, L. (2009). "What is Interactive Teaching?". Also available at <http://www.bedu.com/interactive.html> [accessed in Pulau Pinang, Malaysia: on 20 January 2010].
- ASTA [Australian Science Teacher Association]. (2001). *Australian Science Teacher Journal*, 49(4). Canberra: ERIC.
- Bahagian Pendidikan Guru. (1997). *Penilaian Kendiri Peserta Kursus dalam Perkhidmatan terhadap Kursus dalam Perkhidmatan*. Kuala Lumpur: Bahagian Pendidikan Guru KPM [Kementerian Pelajaran Malaysia].
- Barnett, J. & D. Hodson. (2001). "Pedagogical Context Knowledge: Toward a Fuller Understanding of What Good Science Teachers Know" in *Science Education*, 85(4), pp.426-453.
- Craft, A. (2002). *Creativity and Early Years Education: A Life Wide Foundation*. London: Continuum.
- Indra Devi a/p Shanmuganathan. (1997). "Kesediaan Sekolah untuk Melaksanakan Kurikulum Baru Sains Sekolah Rendah" in *Jurnal MPIK*, 15, pp.15-25.
- IPPTN [Institut Penyelidikan Pendidikan Tinggi Negara] Report. (2004). *Kajian Prestasi Akademik Pelajar Lulusan Matrikulasi di Institut Pengajian Tinggi Awam*. Pulau Pinang: USM [Universiti Sains Malaysia].
- Juslimah Jani. (2000). "Teras Pengetahuan Mengajar Guru Matapelajaran Pendidikan Jasmani". Also available at <http://ppp.upsi.edu.my/ewancana> [accessed in Pulau Pinang, Malaysia: on 23 February 2007].
- Lee, Moly. (2002). "Teacher Education in Malaysia: Current Issues and Future Prospects" in *Teacher Education: Dilemmas and Prospects*. London: Kogan Paper, pp.58-67.

- McBer, H. (2000). "Research into Teacher Effectiveness: A Model of Teacher Effectiveness" in NCES [National Center for Educational Statistics]. *American's Teacher: Profile of a Professional*. New York: NCES.
- Mohd. Shahandri Gani Hj. Hamzah. (1998). "Perbandingan Pola Komitmen Kerja Guru Pelatih dengan Pola Pengajaran dalam Praktikum". *Unpublished Ph.D. Thesis*. Bangi, Selangor Darul Ehsan: Fakulti Pendidikan UKM [Universiti Kebangsaan Malaysia].
- Myers, C.B. & L.K. Myers. (1995). *The Professional Educator: A New Introduction to Teaching and School*. New Jersey: Wardsworth Publishing Co.
- Nacino-Brown, R., F.E. Dan Oke & D.P. Brown. (1989). *Curriculum and Instruction: An Introduction to Method of Teaching*. London: MacMillan Publishers.
- Noor Azlan Ahmad Zanzali. (1995/1996). "Isu-isu Berterusan dalam Pendidikan Matematik" in *Jurnal Pendidik dan Pendidikan*, 14, pp.20-39.
- Noorshah Saad. (2002). *Teori dan Perkaedahan Matematik*. Kuala Lumpur: Prentice Hall, edisi kedua.
- Noraini Yaakub & Nik Noriah Nik Ibrahim. (1992). "Wawasan 2020: Program Praktikum dalam Pembentukan Guru Cemerlang" in *Minggu Budaya dan Wacana Pendidikan I*. Kota Bahru, Kelantan: Maktab Perguruan Kota Bahru.
- Othman Lebar. (2000). "Kreativiti dan Inovasi dalam Pendidikan Guru: Kepimpinan Profesional dan Akademik dalam Pendidikan guru Alaf Baru" in *Prosiding Seminar Kebangsaan JPPG*, pp.75-87.
- Quinn, D. (1994). "Pedagogical Content Knowledge: Four High School Teachers Reflect on Their Teaching". Also available at <http://www.aere.edu.au/a4pap/quind94402.txt> [accessed in Pulau Pinang, Malaysia: on 20 June 2003].
- Ramlah Mohammad. (2001). "Pre-service Training of Mathematics Teachers in Malaysia: Problem Based Learning" in *Jurnal Pendidikan Guru*, 14. Kuala Lumpur: Bahagian Pendidikan Guru KPM [Kementerian Pelajaran Malaysia], pp.13-18.
- Rovegno, I.C. (1992). "Learning to Teach in a Field-Based Methods Course: The Development of Pedagogical Content Knowledge" in *Teaching and Teacher Education*, 8(1), pp.69-82.
- Salleh Abd. Rashid. (2003). "Pemikiran Profesional Keguruan terhadap Kurikulum dan Pengajaran". Also available at <http://www.mpbl.edu.my/inter/penyelidikan.pdf> [accessed in Pulau Pinang, Malaysia: on 23 February 2007].
- Syed Anwar Aly Mohd Abu Bakar. (2000). "Hypothesis Acquisition: Deductive Reasoning and Concept". *Paper presented in the Symposium Pendidikan Sains dan Teknologi in Pulau Pinang, Malaysia*, on 3 March and 2 April.
- Tajul Arifin Noordin & Nor'aini Dan. (1997). "Pendidikan Sains dan Matematik Menuju Abad ke-21: Realiti, Cabaran, dan Harapan" in *Prosiding Seminar Kebangsaan Pendidikan Sains dan Matematik*, pp.105-112.
- Tajul Arifin Noordin. (1990). *Pendidikan: Satu Penilaian Semula*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
- Tam, Yeow Kwai *et al.* (1999). "Pengaruh Persekitaran terhadap Perkembangan Guru ke Arah Kecemerlangan" in *Jurnal Pendidikan*, 24, pp.87-102.
- Tan, Sok Kim & Lourdesamy. (1992). *Issues and Problems in Teacher Education: An International Handbook*. New York: Greenwood Press.
- Turner-Bisset, R. (2004). *Pengajaran Pakar*. Kuala Lumpur: Institut Terjemahan Negara Malaysia Berhad.
- Yaakub Yusuf. (1980). "Kualiti Guru: Peranan dan Harapan". *Paper presented in the Seminar Penilaian Kurikulum*. Kuala Lumpur: Bahagian Pendidikan Guru KPM [Kementerian Pelajaran Malaysia], pp.50-67.