

Invention Subject Teachers' Professional Competence Level in Malaysian Secondary School Based on Self-Assessment

Nur Faeza Abd. Ghafar, Che Ghani Che Kob, A. Shah, Mohd Zaini Osman

Abstract: *Teacher competence plays an important role in teaching and learning. In the context of this study, competence is defined as a professional skill based on the competence dimension of professional attitude, professional knowledge, and professional practice. Therefore, in this study teachers' level of competence for the Inventions subject in Malaysia has been conducted based on the three dimensions mentioned earlier. The respondents of the study were 270 teachers who taught the Inventions subject in the national secondary schools. The quantitative approach was used in this study with descriptive and inferential analysis. Google Form was used in this research as the instrument with five Likert-scales focusing on construct in each dimension of competence. The assessment was conducted as self-assessed by the Inventions subject teachers. The reliability of this instrument is high at Cronbach's Alpha 0.979 on professional practice competence dimension, 0.966 for professional attitude competence dimension and 0.870 for professional knowledge competence dimension. It was found that the dimension of professional attitude competence obtains the highest mean score of 3.99 followed by the dimension of professional knowledge competence with mean score of 3.89 and dimension of professional practice competency with the lowest mean score of 3.82. In summary, the findings show that the Inventions subject teachers' level of competence was moderately high based on their self-assessment. The findings also found that the dimension of professional knowledge competence is the lowest level of professional competence that should be given more attention so that teachers will feel more confident to carry out effective teaching.*

Keywords: *Competency; Invention Curriculum; Education; Assessment*

I. INTRODUCTION

For over three decades, Malaysia is rapidly undergoing structural changes in an effort to evaluate and improve the education system to meet its standards. In this fast-paced modern world, the role of the school has changed and teachers need to improve their knowledge and competence enabling them to follow the era (Mohamed Sani Ibrahim, 2005). Education in the 21st century not only requires educational institutions to produce highly knowledgeable and skilled individual in industry,

technology, management and trades industries but also to be noble, responsible, obedient to God and able to develop society and nation.

Inventions subject teachers play a direct role in instilling students' interest, developing talent and preparing them for tertiary level. This statement is supported by Saedah Siraj and Mohammed Sani Ibrahim (2012), in which the teacher not only plays a key role in delivering knowledge and skills to students, but also responsible for nurturing interests, developing talents and abilities of students. Teachers are the main resources to build analytical, critical, creative thinking skills and to shape individuals who can adapt to changes. This statement is in line with components in the Malaysian Teachers' Competence Standards (MTCS) that teachers in Malaysia must have high competence in the aspect of teachers' professional practice values, knowledge and understanding and teaching and learning skills. (Teacher Education Division (BPG), 2009).

According to the The International Bureau of Education, UNESCO report on The Invention Curriculum: A Malaysian Experience (2001), when the subject was taught in 1995, there was no formally trained teachers in this field. The Inventions subject teachers at need to equip themselves with various skills such as design and technology skills. Currently, Inventions subject teachers are comprised of various undergraduate education backgrounds and the labeling of RC subject teachers is based on a degree that related to design and technology (Curriculum Development Division, 2016). Research that had been done by Curriculum Development Division (CDD), Ministry of Education (MOE) in Teachers' Competence on 3D Computer-Aided Design (CAD) found that 42.9% teachers were option teachers and 57.1% were non-option teachers. The diversity of the teachers first degree background is one of the factors that contribute to the diversity of competence amongst them as well as affect their profession.

The findings of research also proved that there were incompetent teachers to deliver Inventions Curriculum's content. Looking at the importance of professional competence in education, teachers' level of competence should be assessed to ensure that teachers are at the correspondent stage of teachers' professional competence needed. The findings of the study can help in planning to build teachers' capacity despite of teachers' diverse education background. In order to improve teachers, it is very critical to have a clearer picture on teachers' level of professional competence.

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Nur Faeza Abd. Ghafar, Faculty of Technical and Vocational, Sultan Idris Education University, 35900 Tanjung Malim, Malaysia

Che Ghani Che Kob, Faculty of Technical and Vocational, Sultan Idris Education University, 35900 Tanjung Malim, Malaysia

A. Shah, Faculty of Technical and Vocational, Sultan Idris Education University, 35900 Tanjung Malim, Malaysia

Mohd Zaini Osman, Faculty of Technical and Vocational, Sultan Idris Education University, 35900 Tanjung Malim, Malaysia



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This is supported by the statements of Saedah Siraj and Mohammed Sani Ibrahim (2012) that when there is no standard competency in teaching and teacher education programs, problems will occur such as service problems, work stresses, role conflicts, role blurring and also absence of one social support system.

In regard with this, Inventions Subject teachers' level of professional competence which consist of professional attitudes, professional knowledge and professional practice should be done. The question posed in this article is what is the level of Inventions subject teachers' self-assessed professional competence based on the dimensions of professional attitude, professional knowledge and professional practice?

This study contributes to the academic and pragmatic aspects of education. From the academic perspective, this study will contribute to teachers' professional competence studies related in conjunction with the Invention subject. While pragmatically, this study will be able to contribute to the planning, implementation, coordination and evaluation of any activities related to this subject for the purpose of increasing the self-competence and teachers' capacity building.

II. LITERATURE REVIEW

Competence Concept

There were many studies that have been done regarding competence. Kravetz (2008), Boyatzis (1982) and Klemp (1980) agreed to state that a person has an effective or higher performance in their job if they are able to exhibit certain conducive characteristics of a particular work. Spencer and Spencer (1993), which linked to Boyatzis (1982) study, stated that competence as the basic characteristic of an individual that led to the relevance of effective reference and / or high performance criteria in the work or situation. This coincides with Malaysian Teachers' Standard (MTS) concept by Teachers Education Division (TED) defining that the competence of teachers as professional skills based on professionalism value of practice, knowledge and understanding, and also teaching and learning skills. According to Saedah Siraj and Mohammed Sani Ibrahim (2012), teacher competencies include personal, professional and social related matters such as teaching, expertise in subjects, expertise in teaching and learning related theories, managing adaptation learning processes in communities and personalities.

Based on the definitions described above, in the context of this study it can be concluded that the concept of teachers' professional competence is teachers' professional skills in related to professional attitude dimension, professional knowledge dimension and professional practice dimension. These dimensions are major contributing factor to superior level of Inventions subject teachers.

Malaysian Teachers' Competence Standards(Saedah Siraj and Mohammed Sani Ibrahim, 2012)

Literature reviewed done shows that there are various competency models that have been developed and proposed to the specific areas. According toNitin Vazirani (2010), a competency model is a descriptive tool that identifies the

specific roles required to operate within the work, organization or industry. This statement supported by Saedah Siraj and Mohammed Sani Ibrahim (2012) which is the basic principle of teachers' competence model is the performance of a civil service officer will increase if he or she has all the competencies required to carry out their duties and responsibilities. In order to carry out this study, the Malaysian Teachers' Competence Standards (MTCS) (Siraj Saedah and Mohammed Sani Ibrahim, 2012) has been selected as the main referenceto develop the self-assess instrumenton Inventions subject teachers' Professional Competence. The MTCS model is more appropriate and relevant to the latest teaching profession's needs. In addition, this model has taken into account previous models which are also were the main referencesin the development of teachers' professional competence. The high quality of education from professional competence practiced can only be achieved if education is conducted by qualified educators with high competence throughout the service (Rahaila Omar, 2011).

The MTCS model recommended by Saedah Siraj and Mohammed Sani Ibrahim (2012) encompasses three dimensions of teachers' professional competence in performing their duties which are professional attitudes, professional knowledge and professional practice. MTCS has been built with the aim to ensure teachers' quality assurance from recognized institutions. In addition, MTCS is also an effort to improve the quality of education in supporting strategic leadership and creating a quality teacher community. The concept framework for this model is as shown in Figure 1.1.

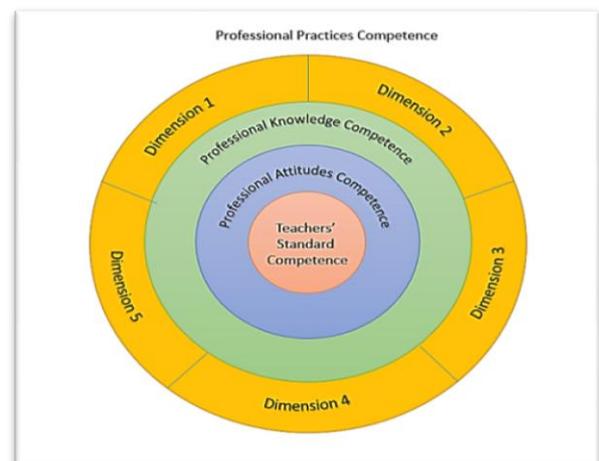


Fig. 1.1 Malaysian Teachers' Competence Standards from Saedah Siraj and Mohammed Sani Ibrahim, 2012

Professional attitude refers to the character that is important to carry out effective teaching. This attitude provides strong values, beliefs and decision-making skills as well as actions in teaching and learning. This standard also describes the attitude and behavior of teachers to facilitate student learning based on the National Education Philosophy (NEP), Teacher Education Philosophy (TEP) and the Malaysian Institute of Profession Ethics Code.

III. CONCEPTUAL FRAMEWORK

Competent teachers in professional attitudes possess and exhibit characteristics such as work collaboratively, committed in the task of educating students, student-oriented actions and decisions, ethical in conducting responsibilities, innovative, caution and sensitive in conducting students, positive in helping and building relationships with others, able to reflect and have professional knowledge.

Competent teachers also need to have professional knowledge in order to maximize their ability to improve student learning outcomes. Knowledge about students, curriculum, subjects, pedagogy and information technology enables teachers to respond on students' needs. Therefore, competent teachers in professional knowledge are able to understand the structure and function of the curriculum in education and its implications for teaching and learning conducted by them. In addition, teachers must be able to understand the purpose, nature and use of various evaluation strategies, understand how information can be obtained through the evaluation process that provides the pattern of instruction. Teachers should be aware that learning is influenced by developments, experiences, abilities, interests, languages, families, cultures and community. Key concepts, content and process of inquiry which are the essence of learning processes and proficient with laws and regulations in education system.

In MTCS model, professional practices are categorized into five main dimensions, namely teachers as facilitators in teaching and learning, assessors and reporting of student learning outcomes, teachers' involvement in professionalism enhancement, teachers' involvement in curriculum development and management, and the formation of collaboration within the school community.

Each dimension in this professional practice is designed to enable teachers to be more focused and guided in determining their level of competence.

The conceptual framework of invention subject teachers' professional competence level in Malaysian secondary schools was built as a foundation of this study. There are two phases in the development of invention subject teachers' professional competence level. Phase 1: Pre-Service while Phase 2: In-Service. Teachers will go through both phases in their teaching profession. Figure 2.1 illustrates the framework in the context of this study. There are three main dimensions that will be evaluated against Inventions subject teachers namely Professional Attitude, Professional Knowledge and Professional Practicewhich was formed in both phases.

In Phase I, Inventions subject teacher will complete themselves with the necessary knowledge, build their skills and attitudes in preparation of becoming a teacher. The teachers' trainees came from three different courses which were Bachelor of Education (Bac.Ed.), the Postgraduate Teaching Course (PTC) and the Diploma of Education (Dip.Ed.). However, majority of the Inventions subject teachers were from two backgrounds of the first degree. They were from engineering and non-engineering degree backgrounds. While in the Phase II of the service, teachers started their career in the teaching profession. Their competence was formed in three dimensions namely Professional Attitude, Professional Knowledge and Professional Practice. Age, geography and teaching experience among variables that influenced the competence level of Inventions subject teachers. While in service, their competence was reinforced with courses or training that they receive. As a result of these two phases, competencies that they built were applied during the teaching and learning session.

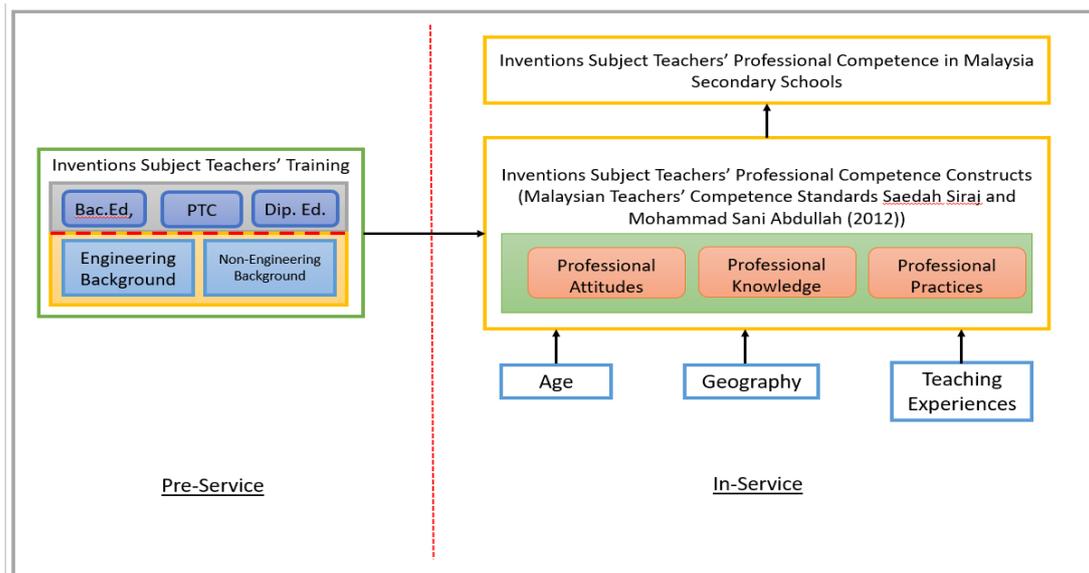


Fig. 2.1 Conceptual Framework of Invention Subject Teachers' Professional Competence Level In Malaysian Secondary Schools

IV. RESEARCH METHODOLOGY

This study was carried out by applying quantitative research design in a survey. Respondents were selected by stratified random sampling because the technique was used because the population showed imbalance characteristics (Creswell, 2005). The Google Form apps was used because it saves cost, information gathering in a short time span and also it can be accessed by using smartphone since there is a good internet access in the country. The large number of respondents to be reviewed also demonstrates the importance of using this method in examining each dimension of the stated professional competence.

Research Instrument

A questionnaire instrument was used for self-assessment respondents consisting of four sections, namely A, B, C and D. Section A is a set of questions aimed at to obtain respondents' demographic information such as gender, age, academic qualifications, teaching experience and teachers' option background.

Section B is a set of questions related to the dimension of professional attitude. There are seven constructs in this dimension: (i) collaborative work ability, (ii) committed in educating and student orientation, (iii) ethical in carrying out responsibilities, (iv) innovative, (v) handling students with caution and sensitivity, (vi) Positive and helpful in building relationships and (vii) able to reflect. A total of 30 items were constructed to test the professional competence level of Inventions subject teachers.

While Section C, the item constructed was to evaluate teachers' competence of their professional knowledge. There are nine items in this competency that generally touch on the teachers' understanding of the curriculum, the evaluation process, the learning strategies and the knowledge of laws and regulations within the context of education.

Section D measures teachers' competence in the the dimensions of professional practices. There are five constructs with 50 items in this section. The constructs are (i) facilitators in teaching and learning activities, (ii) evaluators and reporter of student learning outcomes, (iii) teachers' involvement in professional improvement, (iv) teacher participation in curriculum development and management and (v) cooperation in the school community.

The instrument produced was validated by three experts in the field of educational competence. Meanwhile, the reliability of each constructs was high where the value of Cronbach alpha for the dimension of professional practice competence with the highest value of 0.979, followed by the dimension of professional attitudes competence 0.966 and lastly, the dimension of professional knowledge competence 0.870.

Data Analysis

The questionnaire that was answered by the respondents was then analyzed to obtain the findings in order to achieve the objectives and to answer all the research questions. All sections in the questionnaire were ensured are correctly answered according to the instructions. Analysis the information in were being presented in the form of tables. Data analysis starts after all the scores that need to be

calculated are completed. All data obtained were analyzed using the IBM Statistical Package for Social Science software version of 20th (IBM SPSS v20). The data analysis was based on the objectives and questions set at the beginning of the study.

V. RESEARCH FINDINGS

The analyzes were aimed at addressing all the problems and testing hyphotheses that were initiated at the beginning of the study. The information will not only base on the findings of the analysis but also from the literature reviewed Nunnally & Bernstein (1994) mean score table as outlined in Table 4.1 were used for the purpose of interpreting descriptive data.

Table. 4.1 Mean Interpretation Score

Mean Score	Interpretation
1.00 - 2.00	Low
2.01 - 3.00	Low Moderate
3.01 - 4.00	High Moderate
4.01 - 5.00	High

Source: Nunnally & Bernstein (1994)

Inventions Subject Teachers' Profile Analysis

The analysis and findings of the background analysis of respondents comprising of 270 Inventions subject teachers in Malaysia were detailed in this section as in Table 4.2. Based on the questionnaires, 132 (48.9%) male teachers and 138 (51.1%) female teachers participated in this study. From the age aspect, the majority of Inventions subject teachers involved in this study consisted of age group 31 to 40 years with a total of 178 (65.9%), followed by a group of teachers aged between 41 to 50 years old consist of 57 (21.1%) teachers, 20 to 30 years old consist of 20 (7.4%) teachers and lastly is the age group of 51 to 60 years old group consist of 15 (5.6%). Meanwhile, from the analysis it showed that 167 (61.9%) of the respondents were non-engineering backgrounds while 103 (38.1%) were engineering backgrounds.

The findings of the study on the background of teaching experience found that a total of 9 (3.3%) respondents had less than 1 year teaching experience. Thus, 85 (31.9%) respondents have teaching experience between 1 to 5 years, 103 (38.1%) respondents have 6 to 10 years of teaching experience and 72 (26.7%) respondents have teaching experience more than 10 years.

From the aspect of respondent's teaching option background, there were 108 (40.0%) respondents who were from the Inventions subject option. Meanwhile, 120 (44.4%) respondents were non-option teachers who taught the subject. However, it was found that 42 (15.6%) non-options have been given conversion courses to teach the subject.

Table. 4.2 Background Information on Gender, Age, First Degree Background, Teaching Experience and respondents options

Variables	Categories	Frequency (f)	Percentage (%)
Gender	Male	132	48.9
	Female	138	51.1
Age	20-30 years old	20	7.4
	31-40 years old	178	65.9
	41-50 years old	57	21.1
	51-60 years old	15	5.6
First Degree Background	Engineering	103	38.1
	Non-Engineering	167	61.9
Teaching Experience	Less than 1 Year	9	3.3
	1-5 Years	85	31.9
	6-10 Years	103	38.1
	More than 10 Years	72	26.7
Teachers Options	Option	108	40.0
	Non-option	120	44.4
	Non-option but attended conversion course	42	15.6

Analysis on Inventions Subject Teachers’ Professional Attitudes Competence

There are seven constructs studied in the professional attitudes competence dimension. It was found that the four main constructs most dominated by Inventions subject teachers with the highest mean score were (vi) positive and extend in relationship construct with score 4.13. Followed by (iii) ethical in carrying out responsibilities with an average score of 4.10, (ii) committed in educating and

student-oriented with an average of 4.07 and (i) can work collaboratively with an average score of 4.04. However, there were three constructs studied showed an average high of competence level which were (v) cautious and sensitive in handling students with an average score of 3.90, followed by (vii) capable of reflecting with an average score of 3.90 and (iv) innovative with the lowest score of 3.80. Detailed analysis of professional attitudes competence is shown in Table 4.3.

Table. 4.3 Analysis on Inventions Subject Teachers’ Professional Attitudes Competence

No.	Professional Attitudes Competence Construct	Mean	Mean Interpretations
i.	Can work collaboratively	4.03	High
i.	Committed in educating and student-oriented	4.07	High
i.	Ethical in carrying out responsibilities	4.10	High
v.	Innovative	3.80	Moderate High
v.	Cautious and sensitive in handling students	3.90	Moderate High
i.	Positive and extend in relationship	4.13	High
i.	Capable of reflecting	3.90	Moderate High

Analysis on Inventions Subject Teachers’ Professional Knowledge Competence

Items for Inventions Subject Teachers’ Professional Knowledge Competence were analyzed. It was found that the highest competence for this construct was (viii) knowing the rules of education system with mean score of 4.16 and followed by (iv) knowing what affects learning with mean score of 4.09. Whereas for other items of professional knowledge competence were at moderate high level. The mean score for these items ranges from 3.67 to 4.00. Detailed information on professional knowledge competence construct areshown in Table 4.4. Based on nine items evaluated, Inventions subject teachers’ competence

were at a high moderate level with an overall average mean score of 3.90.

Table. 4.4 Analysis on Inventions Subject Teachers' Professional Knowledge Competence

No.	Professional Knowledge Competence Items	Mean	Mean Interpretations
i.	Understand the curriculum structure, functions and implications	3.90	Moderate High
i.	Understand the objectives, nature and functions of assessment	3.81	Moderate High
i.	Gaining informations from assessment process	3.82	Moderate High
v.	Knowing what affects learning	4.09	High
v.	Knowing the concept and the content of Inventions Subjects Curriculum	4.00	Moderate High
i.	Inquiry based learning	3.94	Moderate High
i.	Knowing professions' scope and law	3.67	Moderate High
i.	Knowing the rules of education system	4.16	High
x.	Sensitives on government's and MOE's policies	3.76	Moderate High

Analysis on Inventions Subject Teachers' Professional Practices Competence

Within the Inventions subject teachers of professional practisecompetence dimension (see Table 4.5), finding show that only one construct reaches a high level of professional practice competency The construct was (v) the formation of cooperation within the school community with an average score of 4.02. However, almost all of the constructs for teachers' professional practices competence dimensions were at moderate high with average score ranging from 3.57

to 3.96. (i) Teachers as facilitators in teaching and learning with an average score of 3.96 was the second highest competence level followed by (ii) appraisers and students' learning outcomes competence construct with an average score of 3.86. Second lowest professional practices competence construct for Inventions subject teachers with the average score of 3.72 was (iii) the involvement of teachers in professional level and the lowest competence level was (iv) teacher participation in curriculum development and management with an average score of 3.57.

Table. 4.5 Analysis on Inventions Subject Teachers' Professional Practices Competence

Nos.	Professional Practices Competence Construct	Mean	Mean Interpretations
i.	Facilitator in Teaching and Learning	3.96	Moderate High
i.	Appraisers and reporters of student learning outcomes	3.85	Moderate High
i.	Teacher engagement in professional improvement	3.72	Mooderate High
v.	Teacher participation in Curriculum development and Management	3.57	Moderate High
v.	Establishment of cooperation in school	4.02	High

VI. DISCUSSION

In general, the main objective of this study is to assess the level of professional competence of Inventions subject teachers in Malaysia based on teachers' self-assessment. The findings of the study have shown that the dimensions of professional attitude competence are the highest competency owned by Inventions Subject Teachers. Followed by professional knowledge dimension and finally the dimension of professional practice.

The Professional Attitude Competence Dimension has shown the highest level of competency score among Inventions subject teachers. When findings from this dimension being detailed,it is found that the Inventions subject teachers are at high levels for the following constructs: (i) collaborative work, (ii) committed in educating and student-oriented, (iii) ethical in carrying out responsibilities and (vi) positive in building relationships.

Meanwhile, moderate high assessment was given to the following constucts which are (iv), innovative (v) conducting students with caution and sensitivity and (vii) able to reflect. Innovative is a construct with a lowest level of professional competence gained by Inventions subject teachers evaluated as teachers, according to De Jong & Den Hartog (2010), low competency on this matter because the teachers evaluated their potential to achieve initiatives in new ideas and useful either in a process, product or method while as has been stated. Most teachers feel it is difficult to produce innovation and only those who are brilliant with high competencies can do it. Meanwhile, the difficulty of Inventions subject teachers cautiously to care for students is because they tend to refer students to counselors or discipline teachers for any problems that arise in the classroom.

According to Dewey (1933), thinking reflection is a thought that requires individuals who are constantly working to find information and knowledge to solve problems that are arousing, committed and always feel responsible in thinking about the problem in more depth and detail. Based on this statement, teachers feel that they do not achieve good competence because they are still unable to solve a problem comprehensively. Reflections and follow-up actions usually refer only to teaching and learning sessions. Therefore, the preparation of training as a learning element is needed in the workplace as described by Collin (2004). Kolb's statement (1984), Barman, Barman and Miller (1996) and Brookfield (1996) also support the statement that workers should be encouraged to reflect on these elements as one way to increase their competence.

In the study, it is found that the Dimension of Professional Knowledge Competence is the second highest competence attained by the Inventions subject teacher after the professional attitude. Arikunto (1993) states that professional competence enables teachers to have a broad and deep knowledge of the fields where they will become expertise as well as mastery of methodology that is mastering theoretical concepts, selecting the right methodology and being able to use them in the teaching and learning process. The teachers found themselves moderately high for this competency. The transformation of the national curriculum generally and the Inventions subject curriculum change began at 2017 is particularly the main factor that causes teachers to feel themselves less competent in this dimension. Changes in pedagogical aspects with the emergence of new learning strategies such as inquiry-based learning and project-based learning are among main factor that caused teachers in need to be proactive and transform from conventional teaching method. This is in line with Sariah's (2016) statement where to achieve the aspirations of the Malaysian Education Development Plan (2013-2025), teachers need to equip themselves with new knowledge, skills and practices that are relevant to development and requirements of century 21st century. Challenges in education now require teachers to constantly increase their professional knowledge so that they have enough knowledge in this profession.

The Professional Practices Competence Dimension has five main constructs that have been assessed. Based on the analysis from respondents' self-assessment, results showed that the construct of (v) the formation of cooperation in the school community is the highest professional practices competence of the teacher. Meanwhile, the Inventions subject teachers assessed themselves as moderately high in professional practices competence in the following constructs (i) facilitators in teaching and learning, (ii) assessor and reporter of students' learning outcomes, (iii) teacher involvement in professional improvement and (iv) teacher participation in development and curriculum management. According to Saedah Siraj and Mohammed Sani Ibrahim (2012), professional practices are dynamic and unrelated to the length of service. A teacher may be at any stage in any level of professional practice competence in their careers. In pragmatic terms, teachers are able to improve their professional practice competence throughout their services. The sharing of best practices in education and

the role of expert teachers can contribute in order to improve the competence of Inventions subject teachers in their professional practice.

VII. PROPOSED FURTHER STUDY

Findings of this study have identified that level of professional competence of Inventions subject teachers in dimensions of professional attitude, professional knowledge and professional practice. Overall, the Inventions subject teachers' level of professional competence is at a moderate high level based on the self-assessment that has been conducted in the study. Further research can be done in the context of different respondents such as senior assistant academic administrator or principals. These administrative respondents will carry out the assessment from the perspective of professional judgement towards their Inventions subject teachers. Different perspectives maybe will lead to different findings that can help to narrow down gap on the study. A part from that, further research on the dimension of professional knowledge of Inventions subject teachers should be expand. The Inventions subject teachers' competence level of professional knowledge can be assessed more effectively if the dimension has a clearer construct and rubric. From the aspect of the methodology of the study, result from the survey method will be stronger if it is combine with other methods such as interviews or observations.

SUMMARY

As a summary, the results of the analysis showed that professional competence is an important element in teaching profession. The findings showed that the Inventions subject teacher's in Malaysia level of professional competence are moderately high level for all three dimensions based on their self-assessment. Professional assessments are needed to get an overview of different perspectives. Strategic plan needs to be implemented to improve the competence of Inventions subject teachers. These plans should start from the pre-service phase continuously to their service phase.

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Invention Subject Teachers' Professional Competence Level in Malaysian Secondary School Based on Self-Assessment

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