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MEASURING PRIMARY SCIENCE TEACHERS' SELF-EFFICACY BELIEFS IN BATANG PADANG, PERAK WITH "PRIMARY SCIENCE TEACHERS' SELF-EFFICACY BELIEFS SCALE"

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ABSTRACT

This research was aimed to measure the primary science teachers' self-efficacy beliefs by using "Primary Science Teachers' Self-Efficacy Beliefs Scale". Causal comparative was used as the research design of this study. The questions of this instrument were adapted from three different instruments and modified for the purpose of this study. Exploratory factor analysis was used to extract the components of the subscales, namely "Pedagogical Knowledge", "Content Knowledge", "Teachers' Effort" and "Student Engagement". The study examined the scores of teachers' self-efficacy by gender, major, years of teaching experience and education qualifications. The weblink of online survey was sent out by email to schools. The sample consisted of 144 primary science teachers in Batang Padang, Perak. *T*-test and ANOVA were used to compare the mean differences of different groups. There was a statistically significant difference between male teachers (M=4.08, SD=0.42) and female teachers (M=3.93, SD=0.39). The *t*-test result also showed statistically significant difference between science major teachers (*M*=4.09, *SD*=0.31) and non-science major teachers (*M*=3.91, *SD*=0.31), *t* (142) =3.34, *p*<.05. ANOVA result showed that there was a statistically significant difference between experienced teachers who have more than six years of teaching experience (M= 4.09, SD= 0.27) and novice teachers who were teaching at their first to third year (M= 3.87, SD= 0.32), *F* (2, 141) = 3.123, *p* = .47. On the contrary, there was no statistically significant difference spotted between primary science teachers who possessed different education qualifications regarding their self-efficacy. In conclusion, there was a statistically significant difference in science teachers' self-efficacy beliefs among teachers of different gender, years of teaching experience and major, while no statistically significant difference were spotted between teachers of different education qualifications. In The findings suggested that experienced teachers should provide mentorship to novice teachers, while policy makers should make sure that only science major teachers will be teaching in science since experienced teachers and science major teachers scored higher in science teachers self-efficacy beliefs.

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PENGUKURAN KEPERCAYAAN EFIKASI DIRI GURU SAINS SEKOLAH RENDAH DENGAN MENGGUNAKAN "SKALA KEPERCAYAAN EFIKASI DIRI GURU SAINS SEKOLAH RENDAH" DI BATANG PADANG, PERAK.

ABSTRAK

Kajian ini bertujuan untuk mengukur kepercayaan efikasi diri guru sains sekolah rendah dengan menggunakan "Skala Kepercayaan Efikasi Diri Guru Sains Sekolah Rendah". Kajian perbandingan sebab-akibat digunakan sebagai reka bentuk kajian. Soalan instrumen ini diperoleh daripada tiga instrumen yang berbeza dan diubah suai untuk tujuan kajian ini. Kaedah analisis faktor penerokaan (EFA) digunakan untuk mengekstrek komponen instrumen, iaitu "Pengetahuan Pedagogi", "Pengetahuan Kandungan", "Usaha Guru" dan "Penglibatan Pelajar". Kajian ini mengkaji skor kepercayaan efikasi diri guru mengikut jantina, major, tahun pengalaman mengajar dan kelayakan pendidikan. Alamat web soal selidik dihantar ke sekolah melalui e-mel. Sampel dalam kajian ini terdiri daripada 144 guru sains sekolah rendah di Batang Padang, Perak. *T*-test dan ANOVA digunakan untuk membandingkan perbezaan min antara kumpulan yang berbeza. Keputusan *t*-test menunjukkan perbezaan signifikan secara statistik antara guru lelaki (*M*=4.08, *SD*=0.42) dan guru wanita (*M*=3.93, *SD*=0.39), *t* (142) = 2.40, *p*<.05. Keputusan *t*-test juga menunjukkan perbezaan signifikan secara statistik antara guru-guru yang majornya sains (*M*=4.09, *SD*=0.31) dan guru-guru yang majornya bukan sains (*M*=3.91, *SD*=0.31), *t* (142) =3.34, *p*<.05. Keputusan ANOVA menunjukkan perbezaan signifikan secara statistik antara guru berpengalaman yang mempunyai lebih dari enam tahun pengalaman mengajar (M= 4.09, SD= 0.27) dan guru baru yang mengajar pada tahun pertama hingga ketiga (M= 3.87, SD= 0.32), *F* (2, 141) = 3.123, *p* = .47. Sebaliknya, tiada sebarang perbezaan signifikan secara statistik yang ditunjukkan antara guru sains yang mempunyai kelayakan pendidikan yang berbeza. Kesimpulannya, perbezaan signifikan secara statistik didapati dalam skor kepercayaan efikasi diri guru sains antara guru-guru yang berbeza dari segi jantina, tahun pengalaman mengajar dan major, sementara tidak ada perbezaan signifikan secara statistik didapati antara guru-guru yang berbeza dalam kelayakan pendidikan. Dapatan kajian ini mencadangkan bahawa guru yang berpengalaman harus memberikan bimbingan kepada guru-guru baharu, sedangkan pembuat dasar harus memastikan bahawa hanya guru-guru yang majornya sains mengajar dalam subjek sains memandangkan guru-guru yang berpengalaman dan guru yang majornya sains mendapat skor yang lebih tinggi dari segi kepercayaan efikasi diri guru sains.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CFA	Confirmatory Factor Analysis
CIE	Cambridge International Examinations
EFA	Exploratory Factor Analysis
KMO	Kaiser-Meyer-Olkin
KPM	Malaysian Ministry of Education
KSSR	Primary School Standard Curriculum
MOE	Ministry of Education
OECD	The Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
PISMP	Program Ijazah Sarjana Muda Perguruan
PPPM	Pelan Pembangunan Pendidikan Malaysia
SPM	Sijil Pelajaran Malaysia
TIMSS	Trends in International Mathematics and Science Study
TPACK	Technology Pedagogical and Content Knowledge
TSES	Teachers' Self-Efficacy Scale
U.S.A	United States of America

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CHAPTER 1

"INTRODUCTION"

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1.1 Introduction

This chapter starts with the background of the study. Next, the importance of science teachers' efficacy in helping the development of science education was being illustrated. Research objectives were listed down followed with research questions. Conceptual framework was included as the structure of this research.

1.2 Background of The Study

People have always endeavoured to govern the incidents that have an impact on their lives. By gaining control over the events, people can control their lives to what they prefer, and prevent the unpleasant upcoming phenomenon. There were times when

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people had a narrow apprehension on the ways to control their world and chose to believe in supernatural agents. Now that human has gained the knowledge and the ability to exercise control over the events, the practice of personal control has developed to improve their lives. It is this belief that they can produce desired outcomes of their actions by rendering them the motivation to act. Hence, efficacy beliefs are the major basis of action (Bandura, 1997).

Self-efficacy belief is a theory derived from Social Learning Theory, which was developed by the renowned Canadian psychologist Albert Bandura. Bandura (1977) agreed upon the idea that the changes of a person's behaviour is claimed to have a direct correlation with his or her perceived self-efficacy. Self-efficacy was also defined as the beliefs of people about their personal capabilities to complete tasks and reach goals at designated levels (Bandura, 1994). The interesting theory brought by Bandura stated that people with high self-efficacy have faith in themselves to achieve a target, and they prone to interpret challenging tasks as something which they will be proficient at but not something to be avoided.

Bandura then amended Social Learning Theory into Social Cognitive Theory (Levin, Culkin & Perrotto, 2001). Social Learning Theory was renamed as Social Cognitive Theory mainly to emphasize that personal factors in three forms, namely cognitive, affective and biological events, behavioural, and environment influences are the three major moulds of human behaviour. The personal factors, behaviour and environmental influences are the fundamental concept of Bandura's (1986) reciprocal determinism, which they create interactions that result in a triadic reciprocality. The reciprocal nature of the determinants of human functioning allows therapeutic and

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counselling efforts to be engaged at personal, environmental or behavioural factors. For example, educators can improve their student's emotional states by giving positive encouragements to develop optimistic self-beliefs and habits of thinking (personal factors), inculcate academic skills and self-regulatory practices (behaviour), and provides a friendly atmosphere and classroom structures that help to enhance student's success (environmental factors).

Self-efficacy beliefs are so powerful that it gains control of human thought, feelings, and actions (Bandura, 1986). Human motivation, well-being, and personal accomplishment are so much decided by self-efficacy beliefs. This is because people will persevere when facing predicaments only if they believe that their actions can bring about the consequences they aspire. Bandura stated that self-efficacy beliefs cover nearly every aspect of our lives deciding whether we think optimistically or become vulnerable to stress and depression.

People construe the results of their achievements based on the value of their knowledge and skills. For example, grade B on a term paper would have two different meanings for an "A student" and for a "C student". The grade B disappointed the former and deteriorated his confidence in writing, while the grade B delighted the latter and boosted his writing confidence (Pajares, 2002).

Bandura (1997) claimed that "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2). We can predict a person's behaviour by looking at the self-efficacy beliefs a person holds better than looking at the actual capabilities the person has. This is because self-

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efficacy beliefs help a person to decide what actions to be carried out. The prediction of course should be made by incorporating the knowledge and skills the person has.

This explains the reason why people who are talented often suffer self-doubt while those who possess only little skills being over-confident. Beliefs always mismatched with reality, and people are normally affected by their beliefs when they engage with the world (Pajares, 2002). Consequently, people's attainments will be better predicted by their self-efficacy beliefs rather than by their former achievements and knowledge or skills they possess. Indeed, people would not be successful if they only have high self-efficacy beliefs, but don't possess necessary skills and knowledge.

People who possess high level of efficacy establish a higher goal to be achieved, and show endurance while facing challenges, they view failure as the consequences of having insufficient knowledge or effort which can be overcome. Nonetheless, people who have low self-efficacy beliefs will give up easily and fall easy victim to stress and depression.

Persistent with the original idea of self-efficacy, Tschannen-Moran and Woolfolk Hoy (1998) explained teacher's self-efficacy as how teachers judge their ability to engage their students in learning, including students who have low motivation. Researchers have discovered that the behaviour and learning of students are related with the characteristics of teachers. Teachers with high self-efficacy beliefs generally have the capability to guide their students to outperform the students in other classes.

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1.3 Problem Statement

Teachers' work load has become an alarming issue in Malaysia. More teachers are leaving their profession as they are overwhelmed by the paperwork and massive amounts of work at school. This problem has gone so bad that 45% of young graduates leave their position after two years as a teacher (Khair, 2016). Despite their interest in teaching, lack of professionalism, collegiality, and administrative support are all the challenges that trigger them to leave their position (Inman & Marlow, 2004).

When compared with the other occupations, teachers are the group of people who work under extreme pressure (McCharthy, 2009; Friedman, 2003). Due to the tension, 73% of Malaysian teachers was reported to have moderate to high intention of quitting their job (Ding, 2000). Research showed Malaysian Teachers experience stress when they have to deal with students' misbehaviours, lacking the external supports, parents' insufficient collaboration, occupational stressors, and negative feelings (Shim, 2012). Teachers not only have to teach, they are overwhelmed by never ending work load and duties (Rashid, Abdul Rahman, and Yunus, 2017). With teachers who are not contented with their jobs teaching our young generations, it will eventually have a negative impact on the organisation (Harpaz, 1983).

Self-efficacy has great influence in the way teachers manage stress. Teachers who have low-self efficacy are reported to have higher levels of stress (Betoret, 2006). Research has found that teachers who have lower self-efficacy tend to quit teaching carrier (Harris & Sass 2007). Moreover, self-efficacy is a deciding factor of teachers' job satisfaction (Caprara et al, 2003). Teachers with high self-efficacy have great ability

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to cope with stress (Gibson & Dembo, 1984), thus can help to reduce the number of teachers resigning from their position. It is also reported that teachers who are high in efficacy has less chance to experience burnout (Zee & Koomen, 2016). Therefore, the researcher wanted to examine the level of Science Teachers' Self-Efficacy in Batang Padang, Perak.

1.4 Research Objective

Many researchers have checked upon the science teachers' self-efficacy in the past. Despite the abundance evidence showing that teachers' efficacy has great effect on the achievement in education, the literature reveals that little is known about science teachers' efficacy in Malaysia. Consequently, this research aims to find out the score of self-efficacy of primary science teachers in the district of Batang Padang, Perak. The results will provide useful information about the efficacy of science teachers related to their gender, major course, years of teaching experience and qualifications.

The general objective of this research is to design a new scale and examine the score of self-efficacy of primary science teachers in Batang Padang, Perak. The specific objectives of this research are:

1. To design a new scale by adapting items from other instruments to measure primary science teachers' self-efficacy and find out the underlying factors
2. To measure the score of primary science teachers' self-efficacy.
3. To examine the differences of science teachers' self-efficacy by gender,
4. To examine the differences of science teachers' self-efficacy by major course,

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5. To examine the differences of science teachers' self-efficacy by years of teaching experience and
6. To examine the differences of science teachers' self-efficacy by education qualifications.

1.5 Research Questions

The purpose of this study is to design a scale to examine the differences of teachers' efficacy related to their gender, age, graduate course, years of teaching experience and qualification levels. Five research questions stated below defined the present study:

1. What are the underlying factors that are presented in the newly developed "Primary Science Teachers' Self-Efficacy Scale"?
2. What is the score of science teachers' self-efficacy among Science teachers?
3. Are there any differences in the scores of science teachers' self-efficacy according to their gender?
4. Are there any differences in the scores of science teachers' self-efficacy according to their major?
5. Are there any differences in the scores of science teachers' self-efficacy according to their years of teaching experience?
6. Are there any differences in the scores of science teachers' self-efficacy according to their education qualifications?

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1.6 Hypothesis

Based on the research objectives, hypotheses of the research were as below:

Research Question 3: Are there any differences in the scores of Science teachers' self-efficacy according to their gender?

H_0: There is no difference between the scores of science teachers' self-efficacy of male and female science teachers.

Research Question 4: Are there any differences in the scores of Science teachers' self-efficacy according to their major?

H_0: There is no difference between the scores of science teachers' self-efficacy of teachers who are science major and non-science major.

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Research Question 5: Are there any differences in the scores of Science teachers' self-efficacy according to their years of teaching experience?

H_0: There are no differences between the scores of science teachers' self-efficacy of teachers with different years of teaching experience.

Research Question 6: Are there any differences in the scores of Science teachers' self-efficacy according to their education qualifications?

H_0: There are no differences between the scores of science teachers' self-efficacy of teachers with different education qualifications.

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1.7 Conceptual Framework

Previous findings revealed that several personal factors of teachers could affect teachers' efficacy. Among the personal factors were education qualifications, years of teaching experience, major and gender.

Previous research also revealed that experienced teachers have higher self-efficacy than novice teachers in teaching (Tschannen- Moran and Woolfolk Hoy, 2007). It was explained that as experienced teachers gain more mastery experience than novice teacher, they outperformed novice teachers in instructional strategy and efficacy for classroom management.

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Nonetheless, previous research had different results when compared the teachers' self-efficacy between male and female teachers. There were research suggested that male teachers have higher teachers' self-efficacy (Ng, 2012; Riggs, 1991; Sadkers, 1986) while there were also research suggested that female teachers have higher teachers' self-efficacy (Aurah & McConnell, 2014; Wright & Holttum, 2010). On the other hand, some proposed that the differences of male and female teachers' scores in self-efficacy were merely a consequence of cultural differences (Azar, 2010; Bandura, 1997).

Ample research studies showed that teachers who are major and non-major in Science scored differently in subject matter knowledge, pedagogical content knowledge and efficacy levels. The research carried out by Kamtet, et al. (2009) in Thailand showed that teachers who had bachelor's degrees in science scored better in subject

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matter knowledge than those who had bachelor degrees in other majors. Research conducted by Joseph (2010) revealed that science majors scored significantly higher in Personal Science Teaching Efficacy (PSTE) compared to their non-major counterparts. Previous research suggested there are correlation between subject matter knowledge, pedagogical content knowledge and the level of efficacy a teacher hold (Abitt, 2011; McKinney, 2015; Rohaan, Taconis, & Jochems, 2012; WH. E. H. & Sutikno, 2015).

The researcher found that there are primary science teachers who hold different education qualifications in Batang Padang, Perak including diploma, B.Ed, and M.Ed.A research conducted in Nigeria showed that secondary school science teachers who are qualified, by this means who have a B.Ed. scored better than those who are not qualified (Oghenesuvwe & Igwebuike, 2013). It is also found that more qualified with M.Ed. teachers can engage students and have better instructional strategies than a less qualified teachers with B.Ed. (Lekhu, 2013; Shaukat & Iqbal, 2012). Results from most of the research indicated that there are significant differences between teachers who possess different education qualification, often teachers who have higher education qualification scores better in self-efficacy scales.

1.7. 1 Components That Contributed to the Level of Science Teachers' Self-Efficacy

Since self-efficacy is a something that cannot be easily measured, the underlying factors should be discovered by using factor analaysis. Before the factor analysis is conducted, previous studies suggested several components that could possibly contributed to the

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self-efficacy of teachers. Hence, the items that were included in the new scale are multifaceted. From the previous studies, researcher found that subject matter knowledge is one of the basis to build teachers' self-efficacy (Muijs & Reynolds, 2001). It is noted that teachers who possess ample science content knowledge would have higher self-efficacy to teach in science (Cantrell, Young, & Moore, 2003). They not only have the enthusiasm to teach, they as well set a challenging yet achievable goals to be reached by their students (Ashton & Webb, 1986). Therefore, subject matter knowledge should be one of the components and the other components were to be found after factor analysis is being conducted. The conceptual framwork is illustrated in Figure 1.1 below.

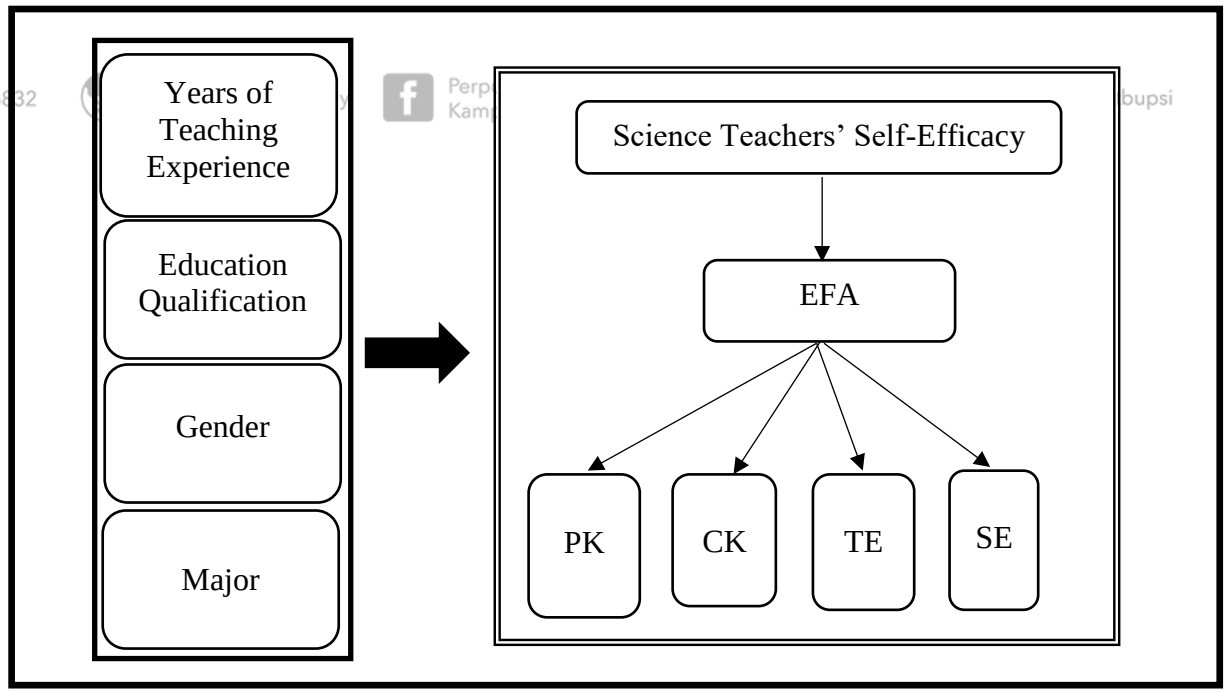


Figure 1.1. Conceptual Framework of The Research

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1.8 Significance of The Study

The process of reviewing the previous studies revealed that the education in Malaysia is at a lower position compared to the other countries. Although research from Zuraidah (1999) stated that Selangor's Science Teachers had high self-efficacy, but when compared to countries like New Zealand and England, teachers in Malaysia had lower scores (Berg & Smith, 2014). It is crucial to find out the teachers' efficacy level of science teachers.

Malaysian teachers were also found to be under pressure. This problem has gone so bad that 45% of young graduates leave their position after two years as a teacher (Khair, 2016). Malaysian teachers are concerned about the class sizes and the attitudes of parents (Berg & Smith, 2014). When teachers have a lot of concerns, teaching process will be difficult. Self-efficacy beliefs of a person determine the efforts that will be exerted and the sustainability of a person when facing challenges (Bandura, 1997).

Facing the challenges of transformation in the National Curriculum and the stress to squash in the upper ranking in international assessment, science teachers in Malaysia better have high self-efficacy as an asset. The responsibilities of creating engaging learning environments that encourage cognitive development rely on the expertise and self-efficacy of teacher (Bandura, 1997).

This study will redound to the science education by looking at the self-efficacy judgment of science teachers and give information to the ministry about the strengths and weaknesses of teachers in Batang Padang, Perak.

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1.9 Scope and Limitations of The Study

There are some limitations in this study. First, the participant population will be gained through a sample. The participants consist of science teachers who are teaching in primary schools in Batang Padang, Perak. The researcher drawed the participants from schools which have phones, so that the school authorities are available and convenient to reach. Thus, the study findings cannot be generalised to the entire population of science teachers but can only represent the primary science teachers in Batang Padang, Perak. Other science teachers in other states and countries may have a different level of self-efficacy.

Second, this research is only examining the self-efficacy of primary science teachers and will not identify the sources of teachers' efficacy. Therefore, the way to increase teachers' self-efficacy is unobtainable from this research.

Third, this research utilises a self-reporting instrument which can have bias since respondents will probably not answer the questions as they see themselves, but as what they would want themselves to be.

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1.10 Operational Definitions

The following terms and definitions are included in this research.

Science-teachers' self-efficacy: the teachers' judgment of their own capabilities in pedagogical knowledge, content knowledge, teachers' effort and students' engagement.

Pedagogical knowledge: a type of knowledge that is unique to teachers and is based on the manner in which teachers relate their pedagogical knowledge (what they know about teaching) to their subject matter knowledge (what they know about what they teach).

Content Knowledge: is subject expertise of a subject.

Teachers' Effort: learning is the process of involving all students in activities that encourage them to develop a deeper understanding of content by working with and reflecting upon the material being presented

Students' Engagement: the ability of teachers to get the students' attention, activate the students' curiosity, interest, optimism, and passion when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education

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CHAPTER 2

"LITERATURE REVIEW"

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2.1 Introduction

This chapter illustrates a brief introduction of the primary science curricula and science teachers in Malaysia. The importance of primary science teachers' efficacy in implementing the new curricula, Standard Curriculum Primary School (KSSR) and KSSR Review were discussed. Self-concept, self-confidence and self-esteem is being elucidated to separate the idea from self-efficacy. The significance of teachers' self-efficacy, characteristics of teachers with different levels of efficacy and the efficacy of different groups of teachers are discussed based on previous research.

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2.2 Primary Science Curriculum in Malaysia

Malaysia has now undergone a transformation in National Curriculum which was a decision of the Cabinet Follow-up Meeting No.6/2008, chaired by the Honorable Minister of Education on 23rd of May 2008. The implementation of education transition from New Primary Schools Curriculum (KBSR) to Primary School Standards-Based Curriculum **(**KSSR) is an improvement to ensure that students have the relevant knowledge, skills and values for facing the challenges of the 21st century and upcoming challenges (MOE, 2012).

Primary education in Malaysia is divided into two stages, where stage one comprises of Year 1 to 3, while stage two comprises of Year 4 to 6. In KBSR, subject Science was not a subject included in stage 1, but only taught to the students in stage 2. Nevertheless, the introduction of KSSR lead to the introduction of the subject Science and Technology into both stages of primary education.

The subject Science and Technology is a combination of Science, Design and Technology, and Information and Communication Technology. It aims to foster students' interest in Science and Technology and develops creativity and innovation through experience and investigation. Students are envisaged to have mastered scientific skills, thinking skills and practice scientific attitudes and values after learning the subject (MOE, 2015).

More recent in 2017, subject Science and Technology which was introduced in 2011 has been reviewed. The name of the subject was changed from "Science and

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Technology" to "Science". Structure of the syllabus is being remained, but new contents are added to follow the global trend. Besides, teaching and learning pedagogy based on higher order thinking skills (HOTS) is still being emphasized, students are expected to be well-equipped with skills such as communication, critical thinking, creativity (Monon, 2016)

2.3 Science Teachers in Malaysia

This section discusses about the intake of teachers, the pre-service training program and ongoing professional development.

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2.3.1 Selection of Teachers

Teachers have either gone through the training by joining The Bachelor of Teaching Programmes, Post-graduate Education Courses or Diploma in Education Courses (UNESCO, 2013). For Bachelor of Teaching Programmes, requirements of the candidate to apply are to have a distinction in any five subjects and a credit in Malay Language in Sijil Pelajaran Malaysia or Malaysian Certificate of Education Examminations. Candidates will also have to pass an interview to be selected to join the teaching program. Furthermore, (Osman & Kassim, 2015). They will also be evaluated based on their attitude, aptitude for teaching, and personality. In recent times, the ministry has started to priorities applicants with seven distinctions. This shift in

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selecting high-performers in the teaching course is a promising step towards the country who only accepted top 10-30% students like Finland, Singapore and South Korea.

2.3.2 Pre-Service Training and Ongoing Professional Development

The ministry raised the qualification of primary teachers from a diploma to a bachelor's degree. To make this requirement a promising result, allowances have been provided by the ministry for the in-service teachers to further their education. In 2010, there were 31% of primary teachers who held a Bachelor's degree. The numbers of primary teachers with a Bachelor's degree is envisaged to be increased over time. Nonetheless, it is revealed that there are still 41% of science teachers in Malaysia do not possess a Bachelor degree as of 2015 (Boo, 2015). However, trainee teachers will not be receiving any allowance starting from June 2018. It was the government decision as they wanted teacher trainee to become more like universities students, which they apply for scholarships or loan from National Higher Education Fund Corporation (Chin, 2017).

Science, Technology and Innovation Ministry agency (Mosti) released a report titled "Science Outlook 2015: Action towards Vision" which stated that 70% of teachers who entered the degree program to pursue a Bachelor of Education failed to meet the requirements upon having at least 3 distinctions in SPM. The quality of science teachers has been questioned as they are disputed to have not adequately equipped with the compulsory knowledge and orientation for effective subject delivery (Boo, 2015).

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2.4 The Importance of Primary Science Teachers' Efficacy in Implementing KSSR

Vision 2020 envisage Malaysia as a scientifically literate society, and we have only a few years ahead to achieve this objective, is this an achievable 'Malaysian Dream', or it is just a goal which could never be reached? While questioning the feasibility of the noble ambition, we need to start nurture our next generation to fulfill the needs of this modern society, especially in the labor market.

Most able candidates would not put teacher as their first choice as a carrier. Despite the policies of the Ministry of Education's expects to draw the best in their training institutes, teaching profession is still one of their final options (OECD, 2013). If Malaysia were to tide over the difficulties and to position our ranking above the average, strong manpower would need to be armed to the teeth, we need excellent teachers to do this supreme job. Government sketches out the curriculum, and teachers are the forces to implement all the policies. However, are teachers in Malaysia able to work their way out to achieve the goal? To answer that question, verifying teachers' self-efficacy belief seems to be an interesting subject to be studied.

Self-efficacy belief is depicted as "People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" by Bandura (1986). Self-efficacy belief gives an account of how far people would push themselves against difficult circumstances (Bandura, 1977). In other words, if teachers have high self-efficacy, much effort will be exerted while facing this new era challenges. Since teachers' self-efficacy is significant to the development in education, research on the teacher's self-efficacy is practical to determine our success

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in the future.

2.5 Self-Efficacy by Bandura and Schunk

This section discusses about the meaning of self-efficacy by Bandura and Schunk.

2.5.1 Bandura

Self-efficacy has been defined by Bandura (1986) as an individual's judgment of personal competency to perform the courses of action which are essential to achieve designated types of performance. Self-efficacy beliefs of a person determine the efforts that will be exerted and the sustainability of a person when facing challenges (Bandura, 1997).

There are many ways that strong sense of efficacy can enhance human achievement and individual success. People with high self-efficacy beliefs set higher goals and perform more challenging task. Their beliefs in themselves cultivate intrinsic interest and deep concentration in activities.

When facing difficulties, they view the difficult tasks as challenges to be mastered instead of threats to be kept away from. To them, failures are due to deficient knowledge and skills, and these deficiencies are acquirable with hard work. Thus, they stick with their goals, recover quickly and strive even harder to reach their goals. Such

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efficacious outlook generates personal accomplishments, lessen stress levels and also diminish the exposure to depression.

On the contrary, people with low self-efficacy will shun from challenges and difficult task, they are low on commitment and aspiration. When facing obstacles, they highlight their own deficiencies, the complication of the problems, and all kinds of undesirable outcomes rather than focus on how to complete their tasks effectively. When failures and setbacks occur, they recover slowly and lose faith in their self-efficacy. They give up easily and are vulnerable to anxiety and depression.

2.5.2 Schunk

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Schunk (1985) comments that students who judge themselves as having low sense of efficacy for acquiring cognitive skills will shy away from tasks, while students who are more efficacious will involve themselves enthusiastically in tasks.

Self-efficacy also can influence the students' motivation. Students with higher sense of efficacy pay greater effort and stick with the tasks longer than those who doubted their own competencies (Schunk, 1981).

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2.6 Teachers' Self-Efficacy

The term self-efficacy was later being adopted by Gibson and Dembo (1984) as teachers' self-efficacy. It is proposed to be the teachers' judgement on their capability as an educator to have an effect on students' performance (Ashton, 1984; Gibson & Dembo, 1984). Teachers' self-efficacy is also defined as the certainty of their influence on students' learning, without excluding students who have problems in learning (Guskey & Passaro, 1994). Teachers who have higher self-efficacy will help students to learn more when compared with those teachers who don't believe in themselves (Ashton and Webb, 1986).

Tschannen-Moran and Hoy (1998) proposed that the task and also the teachers' competencies will defined a teacher self-efficacy. The task refers to whether the teacher thinks it is an easy or difficult task while the teachers' competencies means the self evaluation of the teaching competences to an assignment. When the efficacy is being established by a teacher, the efficacy will manipulate the teachers when setting target. It also determines how much effort a teacher will put to reach the target and also a teacher's determination in achieving goals when encountering predicament.

Teachers' efficacy judgment is a cynical process Tschannen-Moran, Hoy and Hoy, 1998). When teachers have high self-efficacy, they give their best shot and are diligence to reach a goal, which induce more desirable accomplishment, and it literally boost their self-efficacy. Conversely, low self-efficacy teachers give less effort and throw in the towel without doubt, which results in less satisfying outcomes, and it turns out to diminish teachers' self-efficacy (Woolfolk & Davis, 2006).

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Teachers' efficacy beliefs have a very strong relation with the teachers' time investment in teaching, teacher's ambition and also the target they set. Teachers who posses high self-efficacy would do detailed plans, organize well, and eager to teach (Muijis & Reynolds, 2001). When teachers teach in a subject area where they have higher sense of efficacy, they tend to spend more time on it. However, facing the subjects which they have low self-efficacy, the reaction from most teachers is to shun away and spend less time on it (Riggs, 1995).

2.7 Collective Efficacy

The term of teachers' efficacy has established into collective teacher efficacy. Collective teacher efficacy is the perception of teachers that the effort exerted collectively involving the teachers in the school as a whole that will have a progressive impact on student learning (Brinson & Steiner, 2007). The effect of collective teacher efficacy on student is strong as every point rated for the collective efficacy score is equivalent to an increase of 8.5 student achievement scores (Goddard, Hoy and Woolfook Hoy,2002). Moreover, schools with higher scores of collective teacher efficacy seem to involve parents more in schools since teachers' confidence to confront with parents who disapprove school or have different goals (Ross & Gray, 2006).

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2.8 Theoretical Models

Self-efficacy, multidimensional model of teacher efficacy, and sources of self-efficacy were discussed in this section.

2.8.1 Self-efficacy

Tracing back the theoretical model of self-efficacy leads us to the work of social cognitive psychologist, Albert Bandura, who believed that human behaviour is influenced by both internal and external factors (Bandura, 1989, 1997, 1999). He proposed that human is an agent who deliberately makes changes in life by taking actions (Bandura, 2001). The behavior shown by a person is affected by triadic reciprocal determinism as shown in Figure 2.1, which suggested that human achievement is determined by the interactions between one's behaviours, thoughts and beliefs as well as environmental conditions (Bandura, 1997).

The following figure is from Bandura (1999, p. 6)

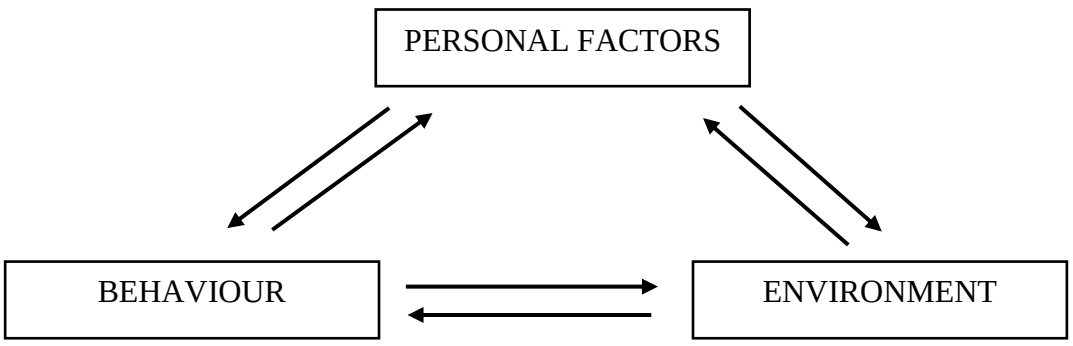


Figure 2.1 The Triadic Reciprocal Relationship Between Personal Factors, Behavior and Environment by Bandura (1986)

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2.8.1.1 Personal Factors ↔ Behaviour

The model shows that personal factors, behaviour and environment are interacting and influencing one another bidirectionally (Bandura, 1989). The relationship between personal factors and behavior explains that thought and belief shape a person's behaviour. The effects brought by the actions subsequently regulate the emotional reactions (Bandura, 1986).

2.8.1.2 Environment ↔ Personal Factors

The interactive relation between environment and personal characteristics indicates that people establish their prospects, beliefs and feeling through modeling, instruction and social persuasion (Bandura, 1986). Individuals of dissimilar age, size, race, sex and physical attractiveness also receive different reactions from their social environment (Lenerer, 1982).

2.8.1.3 Behaviour ↔ Environment

This bidirectional relationship indicates that behaviour changes environmental conditions and is then changed by the environment it creates. Due to the bidirectional relationship, people influence the environment and at the same time being influenced by the environment (Bandura, 1989). People who are aggressive create hostile

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environment while people who are friendly create amiable environment. The environment then decides the behaviour of people.

The theory of reciprocal determinism is similar as the relationship between teacher efficacy and its factor (Pajeras, 1996). Bandura (1986) proposed that personal factors can influence the level of teachers' self-efficacy beliefs. The personal factors which could influence a teachers' self-efficacy are the teachers' age, gender, teaching experience and level of education qualification (Chin et al., 2013; Tschannen-Moran and Woolfolk Hoy, 2007). Hence, the researcher wanted to scrutinise how demographic differences of teachers differ in their score of efficacy.

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2.8.2 Multidimensional Model of Teacher Efficacy

In 1998, Tschannen-Moran, Hoy and Hoy sort out the conceptual strands about teacher efficacy and came out with an integrated model as shown in Figure 2.2.

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The following figure is from Tschannen-Moran, Hoy &Hoy, (1998, p. 228)

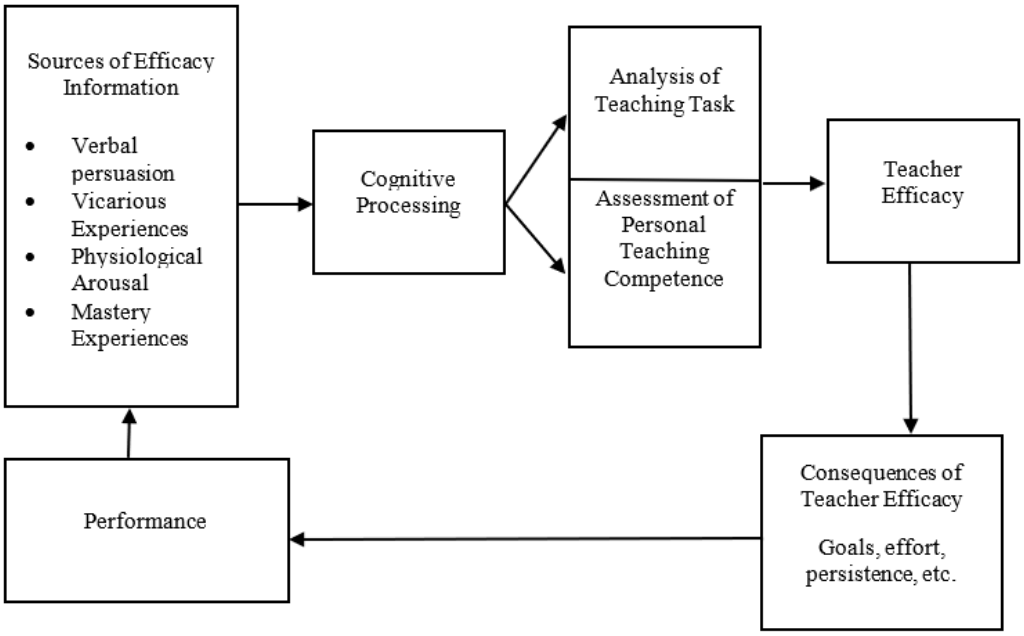


Figure 2.2 Multidimensional Model of Teacher Efficacy

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2.8.2.1 Cognitive Process

Teacher efficacy is created through the four sources of self-efficacy which are mastery experiences, vicarious experiences, verbal persuasion and emotional & physiological states. The cognitive processes of the teacher control how they analyse their teaching task and assess their own capability which conversely forms teacher efficacy (Tschannen-Moran, Hoy and Hoy, 1998).

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2.8.2.2 Teaching Task Analysis and Its Content

Analysis of teaching task is the teachers' evaluation on the problems they are facing and what is mandatory for them to reach a goal in the teaching situation. The analysis involves a few factors like students' enthusiasm in learning, teaching strategies, while contextual factors include the environment brought by teacher colleague and school management. (Tschannen-Moran, Hoy and Hoy, 1998). Gist and Mitchell (1992) proposed that the analysis is especially noticeable for novice teachers while experienced teachers tend to depend on their past similar experiences (as cited in Tschannen-Moran, Hoy and Hoy, 1998). As stated earlier, task analysis directs the formation of teacher self-efficacy. Hence, the researcher suppose there should be a difference of self-efficacy between novice and experienced teachers and this prompt me to find out.

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2.8.2.3 Assessment of Personal Teaching Competence

A very popular scale created by Gibson and Dembo (1984) named "Teacher Efficacy Scales" was intended to examine the level of teacher self-efficacy beliefs. The scale measures two factors, which are (a) personal teaching efficacy and (b) general teaching efficacy. Personal teaching efficacy measures the teacher's sense of belief in the skills and knowledge in facilitating student learning. On the contrary, the general teaching efficacy which corresponds to what Bandura called teaching outcome expectancy measures whether teachers have faith in themselves to be able to induce positive outcomes on student's learning, including students who are unenthusiastic.

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Teaching competence can be drawn from questions that judge on teachers' current functioning, which will provide the prediction of the teachers' future capability (Tschannen-Moran, Hoy and Hoy, 1998). In this research, a questionnaire with 39 questions has been designed for the teachers to make judgement on their competency in teaching tasks. Teacher efficacy can also differ in different context beliefs (Bandura, 1993), therefore, the questions involved in the questionnaire are multifaceted.

2.8.2.4 Teachers' Self-Efficacy

The performance of the teachers provides new mastery experiences and then form the future efficacy beliefs and these processes happen cyclically. Teachers who have greater efficacy show greater effort. On the contrary, teachers who have lower efficacy show less effort.

Teacher efficacy has proved to be an important factor in improving teacher education and promoting education transformation (Ashton, 1984). Generally, teacher efficacy describes the teachers' judgment or beliefs of their abilities in students' engagement and learning, including students who have learning difficulties. It is also related to the positive performance of students, teachers and school (Tschannen-Moran, Hoy & Hoy, 1998). Teachers' self-efficacy determines their motivation and thus affects the learning environment they create and the level of achievements of their students. Consequently, self-efficacy functions as an essential contributor to the academic development. For this reason, the researcher wanted to examine the efficacy of primary science teachers in Batang Padang, Perak.

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Teachers who are high in self-efficacy often use inquiry methods, small group learning activities and open-ended questions more than low self-efficacious teachers. High-efficacious teachers are also more open to new ideas, more willing to innovate, they pay more attention to low motivate students, and they are also less likely to experience stress and burnout (Brouwers & Tomic, 2003; Ross & Bruce, 2007).

2.8.3 Sources of Self-Efficacy

The four fundamental sources that contribute to self-efficacy are mastery experiences, vicarious experiences, social persuasion and physiological and emotional states. The most effectual source is mastery experiences or known as performance outcomes as shown in Figure 2.3.

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The following figure is from Bandura (1997, p.5)

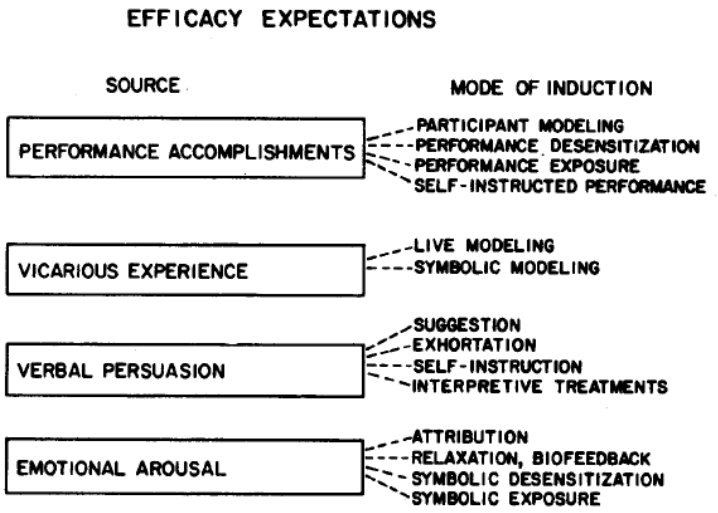


Figure 2.3 Major Sources of Efficacy Information and The Principal Sources Through which Different Modes of Treatment Operate

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Mastery experiences also known as one's own performance experiences, which are the biggest and most effective source of self-efficacy (Bandura, 1997). Performance outcomes are the positive or negative past experiences that can affect personal competencies in performing a given task. People may judge themselves as capable or not to do something by taking their past experiences into consideration, and the past experiences will be analysed to decide on their self-efficacy beliefs (Bandura, 1994). People who have performed well in the previous task gain efficacy and will perform well too in the similarly associated task (Bandura, 1977).

Bandura (1997) stated that when people successfully perform a task, they build a robust belief in their efficacy. On the contrary, failures lead to efficacy deterioration, especially when failures happen before one has firmly established the sense of self-efficacy. When people have victories come too easily in their lives, they will be easily get frustrated by failures. The only way to gain a resilient sense of efficacy is by devoting perseverant effort to overcome difficulties. Some obstructions and setbacks in life teach a lesson that success generally involves sustainable efforts. When people have gained confidence that they have what it takes to succeed, they stick with their goals in the face of challenges and quickly recovered from adversities, to become a stronger person.

According to Bandura (1997), the second source of self-efficacy is derived from vicarious experiences provided by social models. Social models are people who are very similar to the observer. Vicarious experiences are the experiences of observing the social models behaviour and the outcomes of the behaviour. These experiences that

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seeing the success of the models drive the observers to believe that they too can attain success at similar activities.

Observing someone else who is very similar to ourselves handling a task successfully with persistent effort would help us to raise our self-efficacy that we are likely to succeed if we put as much effort as well. The degree of persuasiveness of the model's successes and failures depends on the similarity of the model with the observer. The more similar the model is, the greater the impact is. While looking at the models that are very dissimilar would not influence a person's self-efficacy to change. People not only raise their self-efficacies by looking at social models, they learn through their behaviour, thinking and gain knowledge and skills for managing environmental demands from social models who have the capabilities that they wanted very much (Bandura, 1994).

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The third source of self-efficacy is social persuasion (Bandura, 1997). Parents, teachers, colleagues and peers contribute the beliefs that one has what it takes to succeed either verbally or non-verbally. When people are being verbally persuaded that they have the capabilities to master certain activities they are more probable to give greater effort and perseverance in the activities when facing difficulties. Nonetheless, high beliefs of self-efficacy are not easy to be installed by social persuasion alone. When people undergo unrealistic boots in efficacy, they immediately lose faith in themselves when facing disappointing results. Disappointing results will immediately dispirit a person's self-efficacy when impractical expectations were given. Not only so, people who have been persuaded that they lack capabilities are more likely to shun challenging activities and give up without hesitation in the face of obstructions. In other

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words, when comparing with the first two sources of self-efficacy, instilling high beliefs by social persuasion is tough, but deteriorating beliefs can be easily done.

To be a great efficacy builder, conveying positive appraisals alone is not enough to increase a person's self-efficacy. Situations that bring victory must be structured and it is crucial to avoid placing people in situations too early where they might fail. Self-improvement is measured as success instead of triumphs over others. Even though social persuasion is not as strong as the other sources, teenagers are more often influenced by the opinions of people around them (Pajares, 2002).

The last source of self-efficacy ascribes to a person's physical and emotional states such as anxiety, stress and mood states. (Bandura, 1997; Pajares, 2002). When one has positive emotions about a task, the self-efficacy increases, while negative thoughts and emotions such as fear and stress will decrease self-efficacy. Consequently, by improving physical and emotional states of a person can raise self-efficacy beliefs. Stress and tension are interpreted as signs of vulnerability to inefficacy. Fatigue, aches and pains are considered as physical debility when people are involved in activities where strength and stamina are needed. Mood also plays a role in affecting people's judgments of their efficacy. Generally, positive emotions increase self-efficacy beliefs while negative ones deteriorate self-efficacy. The important point is not the strength of negative feeling, but the interpretation of it by the individual (Schunk & Zimmerman, 2007). People who are high in self-efficacy tend to regard their state of affective arousal as stimulating catalyst of success, while those who are overwhelmed by their self-doubts view their arousal as an impediment. Thus, self-efficacy can be modified by altering negative emotional proclivities and reducing people's stress.

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2.9 Self-Concept, Self-Confidence, and Self-Esteem

Self-efficacy has always been confused with the term self-concept, self-confidence and self-esteem. The following explanations are intended to clarify each term to avoid unambiguous understanding of the readers.

2.9.1 Self-Concept

According to Frank (2016), self-concept is the description people have of themselves. The description may not be a precise portrayal of them, but it is about what people believe in themselves. Self-esteem and self-efficacy have a big influence on self-concept. As people gain self-esteem and efficacy, their concept about oneself inclined to positive description and vice versa. There are some neutral aspects of the self-concept like "I don't dance" without any appraisal of whether it is positive or negative.

Self-concept is how people see themselves and it is shaped by the experiences and appraisal. It is how people rate about the accuracy of descriptive statements to themselves. Nonetheless, the theory is concerned with global self-images, but failed to predict behaviour (Bandura, 1977). When compared with self-efficacy, self-concept is weaker and ambiguous in predicting behaviour (Pajeres & Kranzler, 1995).

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2.9.2 Self-Confidence

Self-efficacy and confidence are two distinctive terms as explained by Bandura (1997): "Confidence is a nondescript term that refers to the strength of belief but does not necessarily specify what the certainty is about. I can be supremely confident that I will fail at an endeavor. Perceived self-efficacy refers to belief in one's agentive capabilities that one can produce given levels of attainment. A self -efficacy assessment, therefore, includes both an affirmation of a capability level and the strength of that belief. Confidence is a catchword rather than a construct embedded in a theoretical system. Advances in a field are best achieved by constructs that fully reflect the phenomena of interest and are rooted in a theory that specifies their determinants, mediating processes, and multiple effects. Theory-based constructs pay dividends in understanding and operational guidance. The terms used to characterize personal agency, therefore, represent more than merely lexical preferences" (p. 382). Self-efficacy, a professional term is related to people's behaviour and their judgment about personal competencies in certain task, whereas self-confidence, in plain language, has a less precise definition and indicates a person's trust on a wider range of own strength.

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2.9.3 Self-Esteem

The term self-esteem and perceived self-efficacy are frequently used interchangeably as though they embodied the same concept. Actually, self-efficacy and self-esteem are

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dissimilar as self-efficacy is the personal appraisal of capability while self-esteem is the judgments of self-worth.

The beliefs of one's capabilities have no association with whether one likes or dislikes oneself. People might have low efficacy at certain activity but not experience any loss of self-esteem because they do not devote their self-worth in that activity. On the other hand, people might have high efficacy at certain activity but gain no self-esteem or pride in it. Nonetheless, people are more inclined to develop their abilities in activities that raise their self-esteem.

Self-esteem or self-liking do not result in high achievements performances. High achievers may not enjoy having high self-esteem as they set higher targets which are not easily fulfilled. While some people have high self-esteem since they do not set high targets or they gain their esteem from other sources rather than personal accomplishments.

People need high self-efficacy to be able to sustain the effort they exert when facing difficulties. Consequently, self-efficacy can predict the goals and performance of people, but self-esteem can predict none of it (Mone, Baker & Jeffries, 1995).

2.9.4 Interactions of Self-Concept, Self-Confidence, Self-Esteem and Self-Efficacy

Self-esteem is the judgement of oneself, it's the feeling people about them overall and the dignity a person has. We could gain self-esteem when we have completed

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something. While self-efficacy is the belief of the capability of a person to complete a task. Self-efficacy could use to predict the behaviour of a person as people set their goals according to the level of their efficacy. Self-confidence is a combination of self-esteem and self-efficacy. When we believe we can achieve a task, and we achieved it, then our self-confidence will be boosted. On the other hand, self-confidence and self-esteem construct self-concept, which is how people describe themselves. Even though the description may not be accurate, it is how you claimed yourself to be.

2.10 Characteristics of Teachers in Association With Their Level of Self-Efficacy

2.10.1 Characteristics of Teachers with High Self-Efficacy

Jerald (2007) identified that teachers with high self-efficacy tend to display greater levels of planning and organization. They are also more willing to try out new ideas and methods in teaching to meet the students' need. Persistent and resilient are the attitudes teachers' with higher sense of efficacy exhibit in face of impediments. When students make mistakes, high efficacious teachers are less judgmental and will not simply hand over problematic students to special education.

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2.10.2 Teaching Methods of Teachers with Self-Efficacy

Students have different learning style, one method of teaching is not enough to to meet all of the students' need. According to Cousins and Walker (2000), trying out new ideas of teaching methods is a strength and practice which teachers' with high efficacy sense hold. As teachers have higher sense of efficacy in teaching science, they are more willing to apply inquiry methods than traditional way of teaching (Ashton & Web, 1986). Joern (2009) studied the differences of teachers to see how well they can teach by applying inquiry methods using "teaching science as inquiry instrument". Findings revealed that teachers who have master degree and science major had better scores.

Quite the reverse, low self-efficacy teachers would just demonstrate and do chalk-and-talk instead of carrying out hands-on science activities, they prone to use traditional teaching methods which is unsymetric with the constructivist classroom and not suitable to this advanced age (Mulholland &Wallace, 2001). Higher self-efficacy teachers are also more likely to learn new strategies and to persist if initial implementations are less than prefect (Haney, Czerniak, & Lumpe, 1996).

High self-efficacy teachers are prone to use different methods in their lessons. Their willingness and confidence in trying out various instructions increases as their self-efficacy judgement increases (Allinder, 1994). A research from Coladarci (1992) stated that the higher the self-efficacy the teachers, the more dedicated to teaching they are. The advantage for student is they will have gain mastery experiences if they have a high efficacy teacher (Woolfolk, Rosoff, & Hoy, 1990).

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2.10.3 Subject Matter Knowledge in Association with Teachers' Self-Efficacy

Subject matter knowledge is one of the basis to build teachers' self-efficacy (Muijs & Reynolds, 2001). It is noted that teachers who possess ample science content knowledge would have higher self-efficacy to teach in science (Cantrell, Young, & Moore, 2003). They not only have the enthusiasm to teach, they as well set a challenging yet achievable goals to be reached by their students (Ashton & Webb, 1986).

High levels of subject matter knowledge and science teaching experience are the keys which contribute high levels of personal self-efficacy for teaching science (Velthuis, Fisser, & Pieters, 2014). If teachers' sense of efficacy for their subject matter knowledge is high, teachers may be confident in answering student questions and providing explanations, which would likely lead to direct teaching, explanation, feedback, and re-teaching in their classes.

The result is consistent with a research carried out by Sangueza (2010), he found that low levels of science teaching self-efficacy often associated with poor science experiences and low content knowledge, whereas participations who have positive relationship with science and higher level of content knowledge will obtain higher levels of efficacy. Not only subject knowledge matters in contributing high level of self-efficacy among teachers, it is reported that science laboratory competencies also have a significant relationship with teachers' perceptions of their self-efficacies in science teaching too (Mihladiz, Duran, Isik, & Ozdemir, 2011).

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2.10.4 High Self-Efficacy and Low Self-Efficacy Teachers React in Face of Predicament

Teachers who scored high in self-efficacy judgment are more probably to tackle and investigate problems and get the answer (Woolfolk & Hoy, 1990). They are more student-centered which they give autority to the students mainly because they are able to handle students who are working on different assignments (Midgley, Feldlaufer, & Eccles, 1989). Students need encouragement from teachers to achieve goals. As long as teachers are persistent to help students, students will get ready and be prepared to accept challenges. They will attempt to attain the goal which is acceptably difficult and significant to them (Erez & Zidon, 1984).

Overall, science teaching efficacy can be explained as teacher's belief about their ability to teach science effectively and to affect student achievement (Ramey-Gassert, Shroyer & Staver ,1996).

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2.11 The Level of Self-Efficacy of Teachers of Different Demographic Background

2.11.1 The Level of Self-Efficacy of Novice and Experienced Teachers

Experienced teachers are always claimed to have higher self-efficacy in teaching. The research done by Tschannen- Moran and Woolfolk Hoy (2007) proved this thought no wrong by checking the self-efficacy beliefs of novice and experienced teacher' using Teacher Sense of Efficacy Scale (TSES). The results explained that as experienced

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teachers gain more mastery experience than novice teacher, they outperformed novice teachers in instructional strategy and efficacy for classroom management. Furthermore, they had more teaching resources over the period of their teaching and they are also being supported by administrator.

2.11.2 The Level of Self-Efficacy of Male and Female teachers

There were also many research conducted to test the difference of self-efficacy between male and female teachers. Riggs (1991) discovered that males in both in-service and pre-service sample excelled their female's counterparts on self-efficacy test for science teaching. Ng (2012) studied the self-efficacy of Singapore female primary Science teachers compare to their male counterparts. He claimed that male teachers have higher PSTE scores relative to female teachers, given that the difference was not significant. Male teachers also attained higher STOE score than female although the result was again not significant. Even though the data does not support the claim that male teachers have higher self-efficacy than female teacher, it is believed that the phenomenon is exhibiting this tendency. The reason behind male teachers having higher efficacy was suggested by Sadkers (1986) that male teacher-students received more feedback from mentor and thus results in discriminatory in both the quality and quantity of classroom interactions between male and female students. Meanwhile, another research discovered that there was a low relationship between gender and teachers' perceptions of their personal science teaching efficacy beliefs (Abdelmoneim & Hassan, 2012).

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Nonetheless, in a research that studied the science teacher efficacy beliefs of elementary pre-service teachers in U.S.A and Kenya indicates that in US, the female students outperform the male students on PSTE. The explanation for this result which inconsistent with other research is that female teachers have the ability to adjust themselves when facing different students' needs compared with males teachers. It is believed that teachers' classroom management skills are linked with their personal teaching efficacy (Aurah & McConnell, 2014). However, the results of female teachers surpass male teachers in their self-efficacy is incompatible with the long history of research (Wright & Holttum, 2010).

Since the science teachers' self-efficacy scores of genders vary at different geological areas, it will be interesting to examine the scores compared between different genders in Batang Padang, Perak.

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2.11.3 The Level of Self-Efficacy of Science Major and Non-Major

The ample research studies showed that teachers who are major and non-major in Science scored differently in subject matter knowledge, pedagogical content knowledge and efficacy levels.

The research carried out by Kamtet, et al. (2009) in Thailand showed that teachers who had bachelor degrees in Science scored better in subject matter knowledge than those who had bachelor degrees in other majors. Research conducted by Joseph

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(2010) revealed that science majors scored significantly higher in Personal Science Teaching Efficacy (PSTE) compared to their non-major counterparts.

Previous research suggested there are correlation between subject matter knowledge, pedagogical content knowledge and the level of efficacy a teacher hold (Abitt, 2011; McKinney, 2015; Rohaan, Taconis, & Jochems, 2012; WH. E. H. & Sutikno, 2015). When teaching beyond their expertise area, teachers encounter challenges owing to the lack of subject matter knowledge and pedagogical content knowledge (Mizzi, 2013). Perhaps the sufficient knowledge of Science teachers in subject matter knowledge and pedagogical content knowledge have contributed to their high level of efficacy when compared to non-major teachers. The different quality between Science teachers who are major and non-major are obvious as they showed different scores in terms of subject matter knowledge, pedagogical content knowledge and self-efficacy. This triggers my interest to check upon the level of efficacy of these two groups of teachers.

When student teachers in Malaysia are graduated from the institute and being posted to the work place, due to the problem of insufficient trained science teachers, teachers who are non-majors have to teach in Science even they have no educational backgrounds in teaching science subjects (Osman, Halim, & Meerah, 2006). This implementation leads me to find out what is the differences of efficacy level between science majors and non-majors.

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2.11.4 The Level of Self-Efficacy of Teachers With Different Education Qualification

The researcher finds that there are primary science teachers who hold different education qualifications in Batang Padang, Perak including diploma, B.Ed, and M.Ed.. Boo (2015) reported that nearly half, or 41% of science teachers in Malaysia do not hold a Bachelor's degree, according to a report by a national think tank Academy of Sciences Malaysia (ASM). Looking at the results from previous studies, there are different opinions and different findings on whether Science teachers with higher education qualification scores better in terms of subject matter knowledge, teacher-efficacy and helping students to achieve better results.

A research conducted in Nigeria showed that secondary school science teachers who are qualified, by this means who have a B.Ed. scored better than those who are not qualified (Oghenesuvwe & Igwebuike, 2013). It is also found that more qualified with M.Ed. teachers can engage students and have better instructional strategies than a less qualified teachers with B.Ed. (Lekhu, 2013; Shaukat & Iqbal, 2012).

Results from most of the research indicated that there are significant differences between teachers who possess different education qualification, often teachers who have higher education qualification scores better in self-efficacy scales. Since science teachers in Batang Padang have different education qualifications, it will be fascinating to compare their level of efficacy in teaching science.

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2.11.5 The Level of Self-Efficacy of Science Teachers in Different Countries

Zuraidah (1999) carried out a research to determine the science teachers' efficacy in Selangor, Malaysia. The research was intended to determine the teacher's efficacy in teaching various areas of the primary science curriculum. From the research, Zuraidah found that science teachers had high self-efficacy in instructing science knowledge of a variety areas of the science curriculum. In other words, teachers in Selangor believed that they are able to coach students in acquiring science process skills, manipulative skills and thinking skills very well. Zuraidah also asserted that the level of science teaching efficacy is not related to a teacher's major and year of teaching. It doesn't matter if a teacher is graduate as having mathematics as their major course, or having just a few years of teaching experience, they might have high level of science teaching efficacy.

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Teachers' self-efficacy is not new for researchers. There were a lot of studies that have been carried out to examine the teachers' efficacy level. One interesting research was conducted to compare the teachers' self-efficacy between Malaysia, New Zealand and England. Even though Zuraidah argued that Malaysian teachers have high self-efficacy, results showed that Malaysian students scored lower of confidence in teaching than the other countries (Berg & Smith, 2014). Speaking about the reason, Malaysian pre-service teachers stated their worries on the criticism from parents and the waywardness from children. It is confirmed that the attitudes of parents in urban areas are very different from the parents in rural areas. This research indicates that Malaysian teachers' self-efficacy beliefs were far more behind from their counterparts and needed to be reviewed.

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Ross (1988) pointed out that when teachers are working in their expertise with obedience students, they show high self-efficacy. Other factors which have an positive effect on the teachers' self-efficay when school environment is collaborative and harmonious and when the teachers don't have too much workloads in hands.

From the previous research, we can conclude that a strong sense of efficacy can actuate higher motivation, make a person to perform with greater effort, and being resilience over the career span. Based on the literature reviews, it is found that teachers' efficacy can be vary among teachers who have different demographic background. As of today, we can hardly find any research checking science teachers' self-efficacy in Malaysia. Verifying science teachers' self-efficacy is essential to ensure that teachers in Malaysia have the quality in teaching science. Therefore, the researcher wanted to measure the efficacy of Science teachers regarding their gender, major course, years of teaching experience and education qualifications.

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CHAPTER 3

"RESEARCH METHODOLOGY"

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3.1 Introduction

This chapter outlines the research methodology of the study. The aim of this research is to measure the self-efficacy of science teachers in Perak. Besides, the self-efficacy beliefs will be compared with teachers of different gender, major course, years of teaching experience and education qualifications. The methodology that were used have been clarified in depth, including the research design, instrument, sample, data collection and methods of data analysis.

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3.2 Research Design

Of all the accessible research design, to find the level of science teachers' self-efficacy, causal comparative research design has been used to answer the research questions.

People use causal-comparative research design to recognise the affiliation between independent variable and dependent variable when the researcher has no control over the independent variable. Even though relationship can be found by using causal-comparative, we can only say that it is a suggested relationship because we do not have control over the independent variables. (Maheshwari, 2018; Salkin, 2010). Despite that, the relationships were still being measured and were applied to infer the outcome of the research.

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This research compares the level of efficacy of two or more groups of subjects based on their gender, major course, education qualification and years of teaching experience. The researcher cannot control the independent variables presented in this research, which are gender, major course, education qualifications and years of teaching experience. The independent variables were beyond control, thus causal-comparative research was used. The intention of using causal-comparative research was to find out whether the independent variable influence the dependent variable.

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3.2.1 Limitations

While implementing the research design of causal-comparative is beneficial in finding the relationships between independent variable and dependent variables, it does have some limitations (Salkind, 2010). In this research, when the independent variables like male and female are being compared, other variables but gender could possibly affect the dependent variable too. For example, when the researcher finds male having higher scores of teachers' self-efficacy, it might not because of the gender differences, but maybe the male participants simply having higher education qualifications or years of teaching experience.

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3.2.2 Research Approaches

The two basic research approaches are quantitative and qualitative approach. The researcher generalised the data in a quantitative form, applying the inferential approach to form a database from which to conclude the efficacy of primary science teachers in Batang Padang, Perak. Inferential approaches mean survey research where the researcher studies a sample of population to define the characteristics, subsequently concluded that the population holds the same characteristics (Kothari, 2004).

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3.2.3 Research Progress

Research process involves the sequence of actions or the phases required to execute the research (Kothari, 2004). In this research, the researcher uses the research process suggested by Carlo (1986). However, the process is modified to suit the current research. Figure 3.1 illustrates the research process.

The research started by defining the questions, where scores of teachers' self-efficacy of primary science teachers in Batang Padang will be compared by gender, graduate course, years of teaching experience and education qualifications.

The concepts and theories of science teachers' self-efficacy which introduced by Albert Bandura were being reviewed. Previous studies on self-efficacy also being revised as to gain a better insight on this topic.

To design the efficacy scale, the researcher has referred to "Guide for constructing self-efficacy scales" written by Bandura (2006), where he included in his book *Self-Efficacy Beliefs of Adolescent*. Items from STEBI-A, TSES and TPack were also derived to make up the 39 items of the new instrument. The following steps are selecting sample, collecting and analysing data. The report were written in Chapter 5 of the research.

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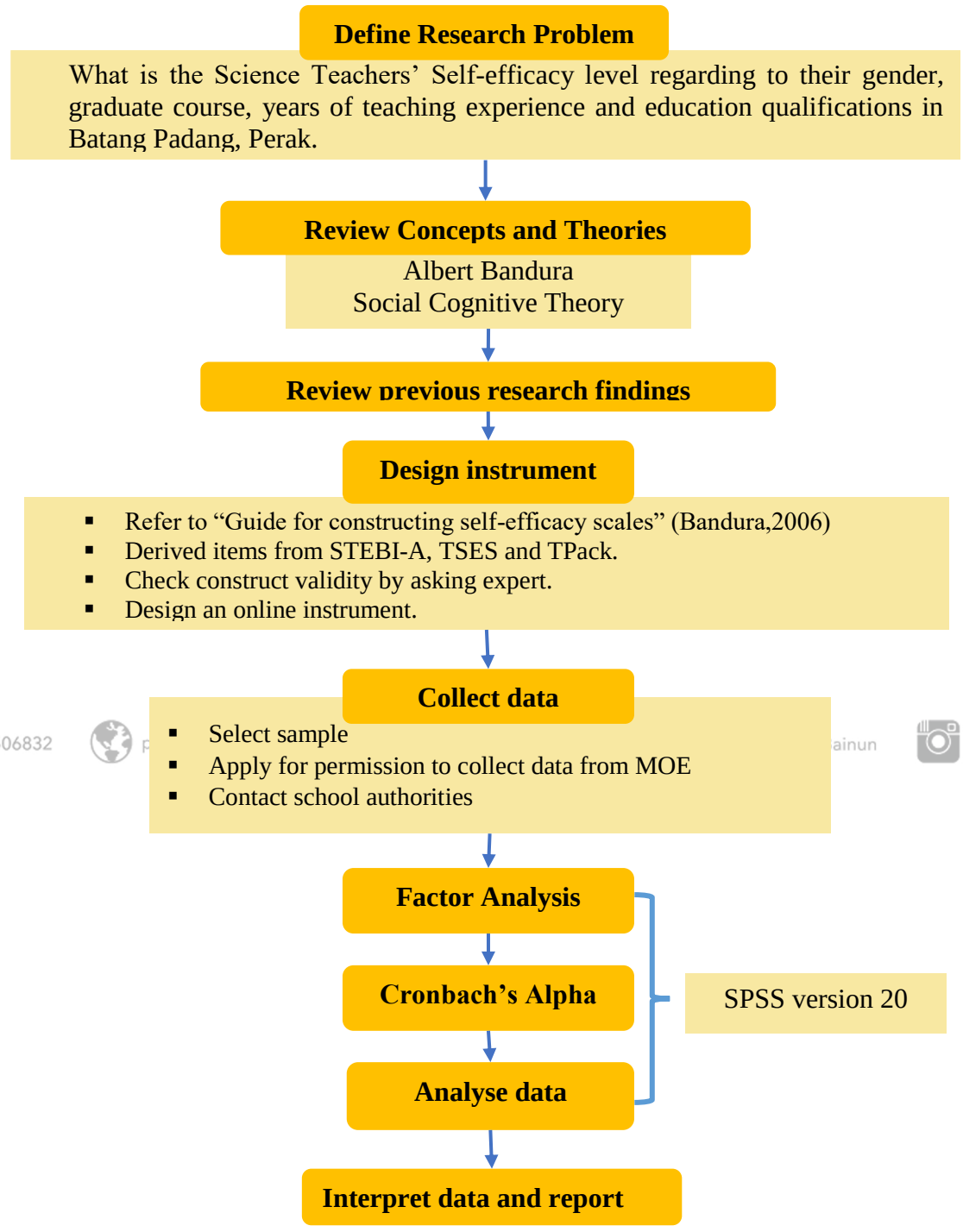


Figure 3.1. Research Process in Flow Chart

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3.3 The Population

The population of the research comprised of the science teachers from the district Batang Padang, Perak. The district has a total of 95 National primary schools, including 53 Malay schools, 23 Chinese schools and 18 Tamil schools. The actual amount of Science teachers in this district remained unknown since the statistics are not provided by the Ministry of Education.

Each of the participants in this study has gone through the teacher training program at government-funded universities or Institute of Teacher Education. Thus, they are all qualified teachers. The identity of the participants in this study is completely anonymous. Appendix B shows the list of schools in Batang Padang, Perak with school codes.

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The schools with bolded words are schools that do not have a phone number and internet connection to reach. To avoid inaccessibility, the schools with no phone number and internet connection have been eliminated and were not selected as the research sample. Having the inaccessible schools being removed from the list, there were a remaining of 39 Malay schools and 10 Tamil schools, the number of accessible Chinese schools stayed unchanged, which is 23 of it, which make up a total of 72 schools.

The researcher assumed that each school has 3 science teachers, which make up an estimated number of 216 teachers as the population.

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3.3.1 The Sample

The primary schools in Malaysia are comprised of national schools and national-type schools (JPN, 2017). To make sure that the sample chosen can accurately represent the population, stratified sampling is used to guarantee representation of the subgroups of the schools. Stratified sampling involves intentionally choosing participants from every subgroup.

The researcher referred to the steps of stratified sampling suggested by Gay, Mills & Airasian (2012) as shown below:

1. Identify and define the population.
2. Determine desired sample size.
3. Identify the variable and subgroups for which you want to guarantee a specific representation.
4. Classify all members of the population as members of one of the identified subgroups.
5. Randomly select (using a table of random numbers) an equal number of individuals from each subgroup.

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The researcher used Sample Size Calculator to determine appropriate sample size, the purpose is to ensure that the sample can precisely reflect the target population. The researcher uses the sample size calculator at http://www.surveysystem.com/sscalc.htm. The confidence level is set to be 95%, while the confidence interval or margin of error is four. The confidence interval (also known-as margin of error) is the reported plus-or-minus figure. The researcher uses a

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confidence level of four, which indicates that, if 50% of the sample picks an answer, the researcher can be "sure" that 46% (50-4) and 54% (50+4) of the entire relevant population between would have picked that answer.

The sample size calculated is 159, which means the researcher have to select sample from 53 schools, if each school is estimated to have 3 science teachers. The researcher collected data only from schools with phone to ensure accessibility. The 72 accessible schools covered 54.2% of Malay schools, 31.9% of Chinese schools, and 13.9% of Tamil schools.

The name of schools that were being list down in subgroups with a code in a table, the lottery method of simple random sampling was used to draw schools from each subgroup. Random number generator was used to select schools, the selected schools are presented in bolded texts. The researcher used random number generator from the website http://stattrek.com/statistics/random-number-generator.aspx.

The estimated sample should compose of 159 teachers from 53 schools as, thus the data will be collected from 29 Malay schools, 17 Chinese schools and 7 Tamil schools, where I assumed that each school has 3 Science teachers available. Among the estimated 159 teachers as the sample, 144 of them have responded. The respond rate was 66.67%. Researcher has different views on the response rate of online survey. Watt et al. (2002) stated the general response rate of online surveys should be 32.6%, Dommeyer et al. (2007) reported the response rate to be 43%, Richardson (2005) suggested 50% while Baruch (1999) stated 55.6% as the acceptable response rate.

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Regardless of the differences of suggestions, the researcher have achieved an acceptable response rate as 66.67%, which exceeded the recommended rate.

Figure 3.2 shows the procedure for selecting a stratified sample based on the types of national schools in Malaysia. The lists of schools that are selected to be the sample of this research are in Appendix B. The school codes in the list are fixed by the District Education Office.

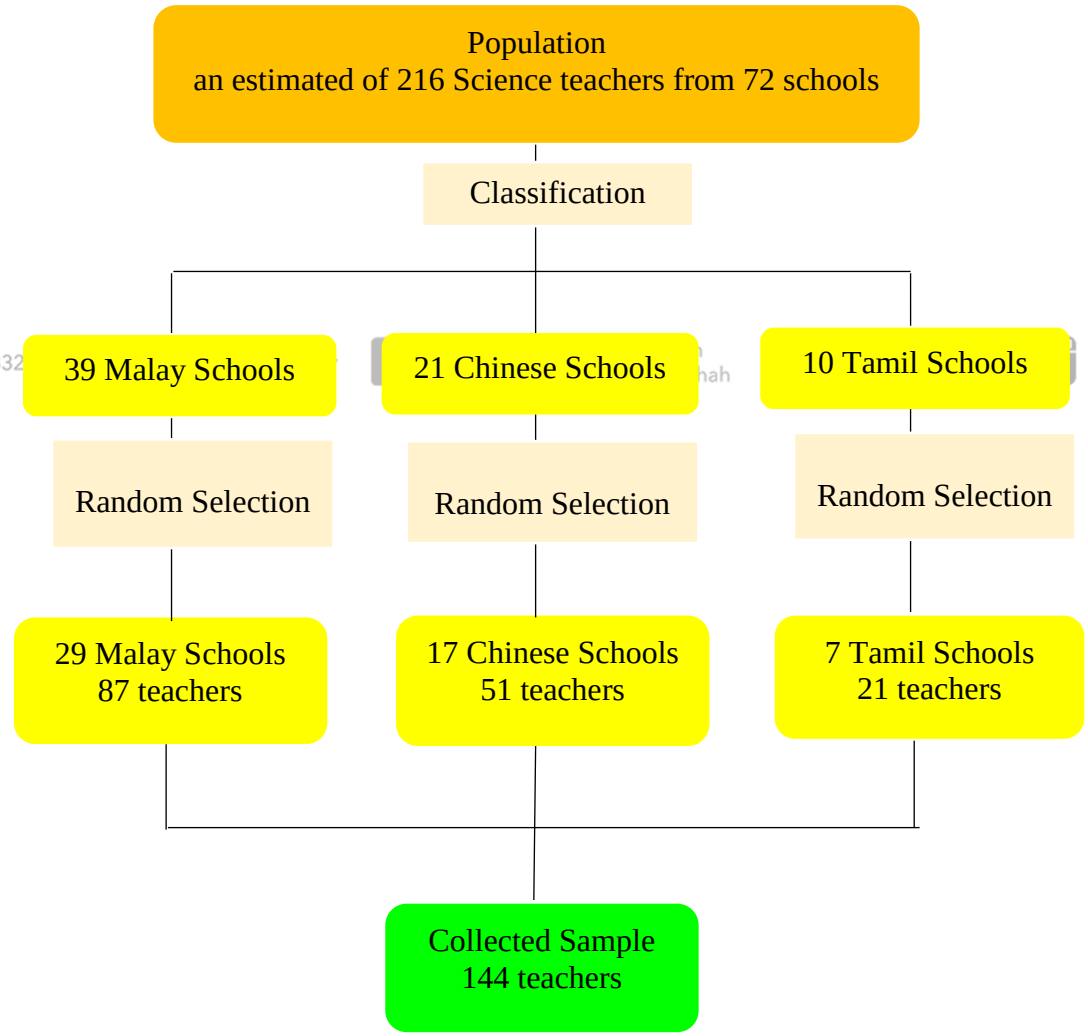


Figure 3.2. Procedure for selecting a stratified sample based on the types of national schools

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3.4 Instrument

A few literatures have been reviewed to guide the researcher in developing the instrument. Table 3.1 below shows the information of the instruments that were designed to examine teachers' efficacy. These instruments have presented an impression for the researcher to include the conceivable items and factors structures for the newly developed primary science teacher self-efficacy scale. Since the researcher derived most of the questions from STEBI, 5 point-Likert Scale questionnaires has been employed.

Table 3.1

Teaching Self-Efficacy Instruments from Different Studies

Author	Instrument	N. of Items	Scale	Constructs
Gibson & Dembo (1984)	Teacher Efficacy Scale	16	6- point Likert type scale	▪ Personal teaching style ▪ General teaching efficacy
Riggs & Enochs (1990)	Science Teaching Efficacy Belief Instrument (STEBI)	25	5- point Likert type scale	▪ Personal science teaching efficacy (PSTE) ▪ Science teaching outcome expectancy (STOE)
Bandura (2006)	Bandura's Teacher Self-Efficacy Scale	30	9- point Likert type scale	▪ Instructional self-efficacy ▪ Disciplinary efficacy ▪ Influence on decision making ▪ Influence on School resources ▪ Enlisting parental involvement ▪ Enlisting community involvement ▪ Creating a positive school climate

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Author	Instrument	N. of Items	Scale	Constructs
Tschannen-Moran & Hoy (2001)	Ohio State Teacher Efficacy Scale	24	9- point Likert type scale	▪ Efficacy for instructional strategies ▪ Efficacy for classroom management ▪ Efficacy for student engagement
Teo (2009)	Teaching Technology Self-efficacy	16	7- point Likert type scale	▪ Basic teaching skills ▪ Advanced teaching skills ▪ Technology for pedagogy ▪ Constructive use of technology

So,Evans & Stroble (2012, p25.466.5)

Bandura (2006) suggested that when constructing self-efficacy items, it should accurately reflect the perceived capability. Thus, items should be phrased in terms of can do rather than will do. The self-efficacy assessment should also be linked to the behavioral factors which people are able to control. A good assessment is ought to be tailored to activity domains and multifaceted so that the scales can be predictive and provide insights into the dynamics of behaviour.

Table 3.1 shows that researchers designed the instrument based on the primary notion of self-efficacy thus enabled them to assess in different setting and circumstances. For examining the level of self-efficacy by gender, major course, years of teaching experience and education qualification, the researcher decided to develop a more suitable questionnaire.

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The existing questionnaire of Science Teachers Self-Efficacy Beliefs Instrument – (Form A) which designed by Riggs and Enochs (1990) was too general. This research intended to find out differences between the participants more specifically to know their fields of strengths and weaknesses. Thus, questions were added in from other scales which are related to teachers' self-efficacy and hoped to sort teachers' self-efficacy into a few subscales by using EFA. Questions were chosen by the researcher by selecting the questions from different components as Bandura stated that a good questionnaire should be multifaceted. By using this newly adapted questionnaire, the researcher will be able to look closely to the participants' differences more specifically by comparing them using different components.

The instrument of this research is an instrument with items derived from 3 scales related to Science teachers' self-efficacy. The 3 scales are Science Teachers Self-Efficacy Beliefs instrument (STEBI – form A), Teachers' Sense of Efficacy Scale (TSES), and Technological Pedagogical Content Knowledge Survey (TPACK). Basically, all the items from STEBI- form A were being selected. Nonetheless, since the items TSES has almost the same questions as those from STEBI-A, only 5 items from TSES were taken to avoid repetition. Appendix A shows the questionnaire that will be used in this research.

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3.4.1 Descriptions of The Original Instruments

3.4.1.1 Science Teachers' Self-Efficacy Beliefs Instrument Form – A (STEBI – A)

There are two subscales in the STEBI A, intended to check the level of in-service teachers, were entitled Personal Science Teaching Efficacy Belief Scale and Science Teaching Outcome Expectancy Scale. The STEBI-A was designed as a five-point Likert-scale questionnaire.

The instrument consists of 25 statements, 14 are positively-written while 11 negatively written. The Personal Science Teaching Efficacy Belief subscale (α=0.92) consisted of 13 items whereas the Science Teaching Outcome Expectancy subscale (α=0.77) consisted of 12 items (Riggs & Enochs, 1990).

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Table 3.2 shows the items in the categories of Personal Science Teaching Efficacy Beliefs Scales and Science Teaching Outcome Expectancy Scale.

Table 3.2

List of Items Derived from STEBI-A

Personal Science Teaching Efficacy Belief Subscale (13 items)	
Item 2	I will continually find better ways to teach science.
Item 3	Even if I try very hard, I will not teach science as well as I will most subjects.
Item 5	I have various ways and strategies of developing my understanding of science.

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Personal Science Teaching Efficacy Belief Subscale (13 items)	
Item 6	I am not very effective in monitoring science experiments.
Item 8	I generally teach science effectively.
Item 12	I understand science concepts well enough to be effective in teaching elementary science.
Item 17	I find it difficult to explain to students why science experiments work.
Item 18	I am typically able to answer students' science questions.
Item 19	I wonder if I have the necessary skills to teach science.
Item 21	Given a choice, I would not invite the principal to evaluate my science teaching.
Item 22	When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.
Item 23	When teaching science, I usually welcome student questions.
Item 24	I do not know what to do to turn students on to science.
Science Teaching Outcome Expectancy Subscale (12 items)	
Item 1	When a student does better than usual in science, it is often because the teacher exerted a little extra effort.
Item 4	When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.
Item 7	If students are underachieving in science, it is most likely due to ineffective science teaching.
Item 9	The inadequacy of a student's science background can be overcome by good teaching.
Item 10	The low science achievement of some students cannot generally be blamed on their teachers.
Item 11	When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher.
Item 13	Increased effort in science teaching produces little change in some students' science achievement.
Item 14	The teacher is generally responsible for the achievement of students in science.
Item 15	Students' achievement in science is directly related to their teacher's effectiveness in science teaching.

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Science Teaching Outcome Expectancy Subscale (12 items)	
Item 16	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.
Item 20	Effectiveness in science teaching has little influence on the achievement of students with low motivation.
Item 25	Even teachers with good science teaching abilities cannot help some kids to learn science.

3.4.1.2 Teachers' Sense of Efficacy Scale (TSES)

There are 5 additional items taken from Teachers' Sense of Efficacy Scale, it is considered a reliable and valid instrument (Tschannen - Moran & Hoy, 2001). The TSES is of 9-point Likert type, the point of each item was calculated by assigning 1 point to "totally disagree" and 9 points to "totally agree". Nonetheless, 5-point Likert scale will be used to calculate for the scoring of TSES items to match the STEBI-A scoring scale.

Tschannen-Moran and Woolfolk Hoy (2001) created and validated the Teachers' Sense of Efficacy Scale (TSES). The instrument has also been considered as more congruent and similar to the self-efficacy theory comparing other scales (Klassen et al., 2011). Klassen et al. (2009) validated the instruments using cross-cultural samples from five countries: Canada, Cyprus, Korea, Singapore, and the United States, the scale was shown to have good reliability and validity. However, for the purposes of the present study, only 5 of the items will be drawn from this scale to avoid repetition

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of items with the STEBI-A and TPACK. Table 3.3 shows the list of items derived from TSES.

Table 3.3

List of Items Derived from TSES (long form)

Item derived from TSES
I can control disruptive behaviour in the classroom and science laboratory.
I can motivate students who show low interest in science school work.
I can help foster student's creativity in science class.
I can use a variety of assessment strategies.
I can provide an alternative explanation or example when students are confused.

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3.4.1.3 Technological Pedagogical Content Knowledge Survey (TPACK)

The instrument is a reliable and valid (Schmidt et al, 2009). The instrument integrated 3 kinds of knowledge which are technology, pedagogy, and content (Thompson & Mishra, 2008). For the research purpose, only items regarding to pedagogy and content knowledge will be drawn from this survey. Items about technology was not being drawn from TPACK as a part of the newly developed instrument because the previous instruments in checking the level of efficacy have never included the teachers' efficacy in dealing with technology. Furthermore, there were some other available instruments designed purposely to check the teachers' efficacy in using technology. A total of 9 items that are suitable for the research purpose were derived from the original instrument.

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Table 3.4

List of Items Derived from TPACK

Content Knowledge
I have sufficient knowledge about science.
I can use a scientific way of thinking.
I have various ways and strategies of developing my understanding of science.
Pedagogical Knowledge
I know how to assess student performance in a classroom.
I can adapt my teaching based upon what students currently understand or do not understand.
I can adapt my teaching style to different learners.
I can use wide range of teaching approaches in a classroom setting.
I am familiar with common student understandings and misconceptions.
I can select effective teaching approaches to guide student thinking and learning in science.

3.4.2 Validity and Reliability of The Instrument

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The use of questionnaire as a method to collect data does not certainly mean that the researcher is able to obtain reliable and valid indication of one's belief. There are cases when the items measure a totally dissimilar construct (Ratray & Jones, 2007). Two statistical methods used to ensure the validity and reliability of the questionnaire were exploratory factor analysis and Cronbach's alpha.

The construct validity of a questionnaire was tested with factor analysis (Ratray & Jones, 2007). While Conbrach's alpha was be used to test the reliability of the instrument. Besides, the researcher received help from lecturers from University Pendidikan Sultan Idris to assess the face validity of the instrument. Item 8 in the STEBI- A was suggested to change from a negative statement to a positive statement, thus appearing unambiguous and easier for participants to respond. Furthermore, the

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term ‘craft’ in item 24 from TSES was suggested to be replaced by the word ‘develop’. Table 3.5 shows the modifications of items.

Table 3.5

Items Before and After Modification.

Items Before Modification	**Items After Modification**
Item 8 from STEBI-A I generally teach Science ineffectively.	I generally teach Science effectively.
Item 24 from TSES When teaching Science, I can craft good questions for my students.	When teaching Science, I can develop good questions for my students.

3.5 Data Collection

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Data has been collected after the researcher received a permission letter from the Ministry of Education. Primary science teachers in the Batang Padang answered the questionnaire via allcounted.com through this link https://www.allcounted.com/s?did=cahb86v 2oblxf&lang=en_US. The link was provided to them by an email sent to all the schools as shown in Appendix C.

Although the researcher planned to collect data from 159 participants, the data collected has only reached 144. According to Barlett, Kotrik & Higgings (2001), the minimum returned sample size for a population of 216 is 102 if the alpha is set to be .01 with margin of error =.03. Thus, the researcher concluded that the amount of data collected is enough to be analysed.

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Table 3.6

Table for Determining Minimum Returned Sample Size for a Given Population Size for Continuous and Categorical Data

Population size	Sample Size					
	Continuous data (margin of error=.03			Categorical data (margin of error=.05		
	alpha=.10 t=1.65	alpha=.50 t=1.96	alpha=.01 t=2.58	p=.50 t=1.65	p=.50 t=1.96	p=.50 t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250

Barlett, Kotrik & Higgins (2001, p.48)

3.5.1 Data Collection Procedures

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Data was collected using a three-phase framework procedure. In phase one, school administers involved in the research were being contacted through phone calls. Phase two was be executed after the approval from schools to participate in the research, where the participants complete the online questionnaire. Phase three took place before data analysis that the researcher checks to see the respond rates.

Phase 1:

This phase of data collection focused on communication with the Ministry of Education and the schools' Principle involved in the research. An application letter was first sent to the Ministry of Education for carrying out the research. After getting approval, the principals were being contacted through phone calls and emails with an initial letter

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which the details and advantages joining the research were included. The researcher also explained the timeline for data collection. The initial letter is in Appendix C.

Phase 2:

The participants were informed about the link of online questionnaire by the school principal. Before answering questions, the participants read through the information about the study and assurance of anonymity and confidentiality. The instructions were given as the opening of the questionnaire. By following the instructions, participants then answered the questions based on their beliefs.

Phase 3:

Response rates of participants were checked, phone calls were made to remind and encourage schools with low response rates.

3.6 Data Analysis

This section describes the procedures used in analysing the data. The data was analysed using SPSS Version 19 computer software. Factor analysis was carried out to lower the numbers of variables. Then, the data collected was analysed to answer the research questions.

The research questions were answered by finding the mean score of the self-efficacy. The remaining questions were to examine the differences of teachers' self-

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efficacy related to their gender, graduate course, teaching experiences and education qualification. Once the data from the online questionnaire ware analysed, it was interpreted to answer the research questions. Conclusions which are related to the objectives of the research were drawn from the data. The dependent variable of this research was teacher efficacy, while the independent variables were the demographic factors of the teachers.

The questionnaire used in this research applied a 5-point Likert Scale response. When come to analysis of descriptive statistics, the respond "uncertain" has an obscure meaning. This issue has caused controversy that Likert-scale should be analysed by using mode or median for central tendency (Jamieson,2004; Jacobson, 2004). Luckily, comprehensive finding has proved that ordinal data like Likert scale can be analysed by using parametric test with the condition that the questions in the scale can be combined to describe a personality trait or attitude. (Boone & Boone 2012; Brown, 2011; Norman, 2010; Sullivan & Anthony, 2013). It answers more accurately than non-parametric test even when the statistical assumptions are violated to an extreme degree (Norman, 2010).

Research questions ware to examine if the levels of efficacy vary among science teachers of different genders, major courses, years of teaching experience and education qualifications. Parametric test was used to compare the difference between each group of teachers. There are 2 types of analysis that can be done to answer the research questions, namely independent sample T-test, and One-Way ANOVA. Independent sample T-test is used when the researcher compare means between two independent groups while One-way ANOVA is used when there are more than 2 independent groups

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(Field,2009). The dependent variables of this research were the scores of primary science teachers' self-efficacy scale and its subscales. Table 3.7 shows the types of analysis used in this research.

Table 3.7

Types of Analysis Used in This Tesearch to Compare the Primary Science Teachers' Self-Efficacy

Independent Variable	Dependent Variable	Types of analysis to answer the research question.
Gender Major Course Education Qualification	Primary Science Teachers' Self-Efficacy Scale ▪ Pedagogical Knowledge Subscale ▪ Content Knowledge Subscale ▪ Teachers' Effort Subscale ▪ Student Engagement Subscale	Independent Sample T-test
Years of Teaching Experience		One-Way ANOVA

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3.6.1 Assumptions of Independent Sample T-Test and ANOVA

The assumptions to be met for performing an independent sample t-test and ANOVA including the data should be normally distributed, equal variances between group and having an amount of at least 30 sample per group (Field, 2009). As the sample size of this research is >30, the central limit theorem holds true. Thus, the data can be assumed to be normal (Kwak & Kim, 2017; LaMorte, 2016). Furthermore, ANOVA is a robust test, it can tolerate data that is non-normal (Blanca, Alarcon, Arnau, Bono & Bendayan, 2017). Levine's Test can be used to check the homogeneity of variance when carry out the independent sample t-test, the data should also be randomly sampled (Field, 2009).

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3.6.2 Reverse Selected Response Values

Reversed scored was performed for the following performed reverse scored to produce consistent values between positively and negatively worded items. Reversing the scores on these items reflected high scores for those teachers who are high in efficacy and low scores for those low in efficacy and outcome expectancy beliefs.

Item 3, 6, 10, 13, 17, 19, 20, 21, 23

In SPSS, this reverse scoring is easily accomplished with the "RECODE" command. For example, recode item 1 with the following command:

RECODE ITEM1 (5=1) (4=2) (2=4) (1=5)

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3.6.3 Numerical Counts or The Frequencies of The Demographic of Samples

There were 6 questions in the questionnaire which collects demographic information of the respondents. These questions helped the researcher to get information on the respondents' school, age, gender, major course, years of teaching experience and education qualification. Table 3.8 shows the demographic information of the respondents.

Table 3.8

Demographic Information of The Participants

Variable	Category	*n*	Percentage (%)
Gender	Male	32	22.2
	Female	112	77.8

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continued

Variable	Category	*n*	Percentage (%)
Major Course	Science	48	33.3
	Others	96	66.7
Teaching Experience	New	61	42.4
	Inexperienced	17	11.8
	Experienced	66	45.8
Education Qualification	Non-degree holder	37	25.7
	Degree-holder	107	74.3

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CHAPTER 4

"FINDINGS"

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4.1 Introduction

This research intended to compare the level of primary science teachers' self-efficacy of different demographic background by using the questionnaire "Primary Science Teachers' Self-Efficacy Scale" adapted from different instruments. In this chapter, data collection, demographics, answers of the research questions and a summary were included in detailed.

4.2 Research Question 1: What are the Underlying Factors that are Presented in the Newly Developed "Primary Science Teachers' Self-Efficacy Scale"?

Factor analysis acts as a tool to summarize data in order to interpret the relationships and patterns within the measurements. In plain words, factor analysis simplifies a large

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amount of observable variables as to smaller number of unobservable variables. Based on shared variance, variables with high intercorrelations will be regrouped into clusters called factors (Young & Pearce, 2013). In this research, factor analysis helps to answer the first research questions by extracting the underlying factors of the main scale.

4.2.1 Sample Size for Factor Analysis

There are a lot of writing about the required sample size resulting in many 'rules of thumb'. The common rule suggests that 10-15 participants is needed for each variable (Field, 2009). However, Mac Callum, Widaman, Zhang and Hong (1999) suggested that common rules of thumb regarding sample size in factor analysis are invalid. Meanwhile, they claimed that to assure good recovery of population factors, it is dependent largely on level of communality. Table 4.1 shows the necessary sample size according to the level of communality.

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Table 4.1

Sample size required referring to its communality

Communalities	Sample size
> 0.6	> 100
0.5	100 – 200
<0.5	>500

The researcher uses a sample size of 144 in the research. Thus, if the communality is found to be in between 0.5, the data should be allowed to interpret with factor analysis.

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4.2.2 Assumptions for Factor Analysis

There are a few assumptions to follow when performing exploratory factor analysis including the level of measurement should be interval or ratio. Researcher should be using random sampling in the research. There must be univariate and multivariate normality within the data and also an absence of univariate and multivariate outliers (Field, 2009). While labelling a factor, it should have not less than 3 variables (Tabachnick & Fidell, 2007). A heterogeneous sample is suggested to be used instead of homogeneous samples since the latter lower the variance and factor loadings (Kline, 1994).

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4.2.3 Types of Factor Analysis

The two techniques of factor analysis are Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis and (CFA). EFA helps to discover the pattern and load variables into factors while CFA helps to test hypotheses and confirm the relationship between factors and the underlying variables (Child, 2006).

In this research, EFA was used to discover the pattern of 39 questions derived from 3 different instruments that could measure primary science teachers' self-efficacy. Based on the responses from participants, EFA helps to determine the underlying constructs for a set of measured variables (Suhr, 2006). EFA is also a technique use for variable reduction which help to identify the number of latent constructs including unique factors which errors are caused by unreliability in measurement (Child, 2006).

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With the newly created factors, EFA helps to provide means of explaining variation among variables. Simplifying large amounts of data into fewer and more meaningful variables, factor analysis achieves parsimony (Field, 2009).

4.2.4 Process of Conducting Factor Extraction

There are 3 steps involved in Factor Analysis, including extraction, rotation and interpretation.

4.2.4.1 Extraction

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The process of extraction allows the researcher to determine the number of factors which explain the observed covariation matrix within the data set. Obeying the rules of parsimony, we extract fewest number of factors to explain the largest number of observable variables. The extraction of factors can be done by referring to the eigenvalues, parallel analysis and observing scree plot.

4.2.4.2 Eigenvalue

Each factor has its own eigenvalue that states something about the amount of variance in the observed indicators that can be explained by the latent factor. Only those latent factors with sufficiently high eigenvalues or above 1 will be retained to explain as much variance in observed indicators as possible (Field, 2009).

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By using SPSS, it is suggested that we retain only the components with eigenvalue >1 (Kaiser, 1960), 7 factors have been extracted from the dataset. Despite the popularity of this method, it has the tendencies to overestimate or underestimate the number of factors (Zwick & Velicer, 1986). The result was shown in Table 4.2.

Table 4.2

SPSS Suggesting 7 Factors to be Extracted with Eigenvalue > 1

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings
Component	Total	% of Variance	Cumulative %	Total
1	11.133	33.737	33.737	11.133
2	2.777	8.414	42.151	2.777
3	2.112	6.401	48.552	2.112
4	1.566	4.746	53.299	1.566
5	1.252	3.793	57.091	1.252
6	1.173	3.553	60.644	1.173
7	1.129	3.422	64.066	1.129
8	.982	2.976	67.043	

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4.2.4.3 Parallel analysis

According to Horn (1965), when the value of eigenvalues from dataset, which shown in Table 4.2 are larger than the mean eigenvalues calculated by parallel analysis, the factor will be retained. By using the parallel analysis engine available at http://analytics.gonzaga.edu/parallelengine/, the factors that should be retained appeared to be 3 factors as shown in Table 4.3. The first three bolded factors should be retained as the initial eigenvalues shown in Table 4.2 were larger than the mean eigenvalue in Table 4.3 for only the first three factors.

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Table 4.3

Parallel Analysis Revealed 3 Factors to be Extracted by Retaining Only When the Eigenvalue from The Data Set are Larger Compared to The Mean Eigenvalue Calculated by Parallel Analysis

Component or Factor	Mean Eigenvalue	Percentile Eigenvalue
1	**2.038345**	**2.205689**
2	**1.893402**	**1.970923**
3	**1.780402**	**1.863133**
4	1.690184	1.773270
5	1.603064	1.667820
6	1.532108	1.600041
7	1.460599	1.527005
8	1.391489	1.444138
9	1.333221	1.386809

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4.2.4.4 Scree Plot

The graph plotted with eigenvalue (Y-axis) against the factor which it is associated (X-axis) is called a scree plot (Field, 2009). We can also decide the factors that should be extracted by looking at the point of inflexion, or the elbow of two straight line in the scree plot, only the factors to the left of the point of inflexion will be extracted (Field, 2009; Rahn, 2012). Scree plot revealed that there are four factors that can be extracted. The number of factors extracted should not be too many or too few as we do not want to have error variance or leave out important common variance (Costello & Osborne, 2005; Yong & Pearch, 2013).

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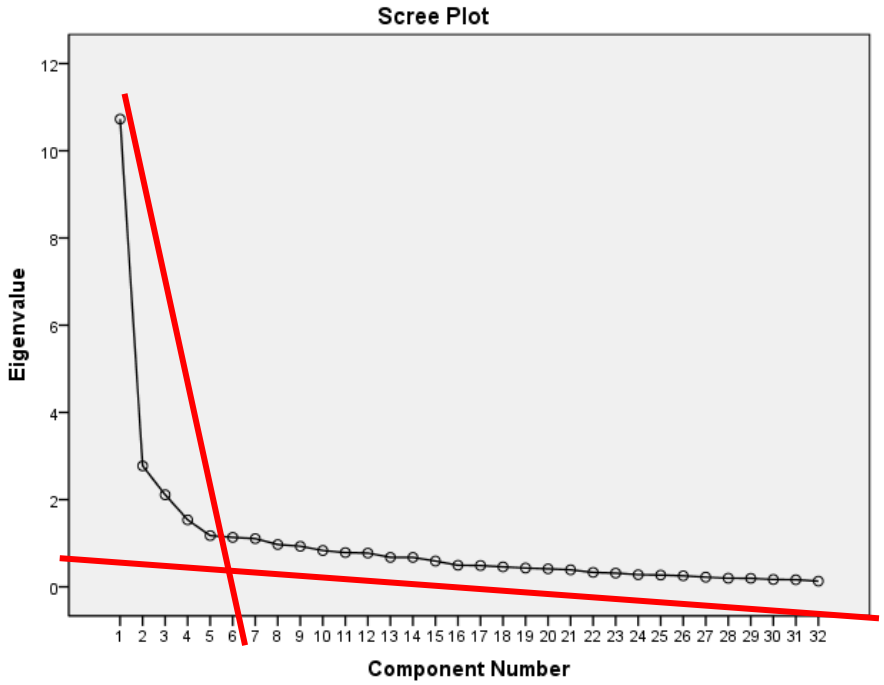


Figure 4.1 Scree Plot Suggested 4 Factors to be Extracted

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4.2.5 Factor Extracted

In order to get the most desirable number of factors to be extracted, the researcher have to pick a solution by forcing SPSS to extract the factors by hand (Field, 2009; Young and Pearce, 2013). After several attempts of extracting the components, the researcher found that 4 factors should be extracted since the items loaded on each factor clustered together can be well-interpreted. Variables with low communalities which are less than 0.2 has been eliminated (Child, 2006). In this case, the researcher has eliminated 6 variables from the questionnaire. The variables were 7, 9, 10, 11, 20, 22,32.

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4.2.6 Rotation

There are two types of rotation which are orthogonal and oblique rotation. Since the underlying factors are related or correlated to each other, oblique rotation will be used in this research. Tabachnick and Fiddell (2007) claimed that if correlation exceed.32, oblique rotation should be applied. There were correlations exceed .32 as shown in the correlation matrix in Table 4.4.

Table 4.4

Component Correlation Matrix of the Factors

Component Correlation Matrix				
Component	1	2	3	4
1	1.000			
2	.388	1.000		
3	.148	.216	1.000	
4	.422	.314	.187	1.000

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Sampling adequacy for the principal component analysis conducted was reported to be KMO=0.87, KMO values for individuals variables were >.7, which is desirable as it is higher than 0.5 (Field, 2009; Hair et al., 2006). Barlett's test of spericity shows that the results are significant, $p<0.001$.

Table 4.5

Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Spehericity value

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.869
Bartlett's Test of Sphericity	Approx. Chi-Square	2582.798
	Df	528
	Sig.	.000

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4.2.9 Interpretation

Table 4.6 shows the table of the factor loadings of each item on the components. Items 32, 30, 1, 25, 21 and 24 can be seemed to have loaded highly on more than 1 factors. However, only factors loading greater than 0.4 which were interpreted as suggested by Stevens (1992). Therefore, only item 1 and 21 will be perceived as "noisy items" with loadings greater than 0.4 loaded on more than 1 factors. The researcher decided to load the item according to the highest factor loadings and tried to identify a common themes and see if the item can be related to it. For item 1, factor seemed to have loaded more on component 3. In addition, the items loaded on component 3 were more related to item 1 which were mainly about the effects brought by teachers' effort. For item 21, the loadings were higher on component 4 compared to component 2, it was also seemed to have a common theme with the other items on component 4. Table 4.6 shows the factor loadings of each item on each component.

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Table 4.6

Factor Loadings of Each Items of "Primary Science Teachers Self-Efficacy Beliefs Scale"

Pattern Matrix[a]				
	Component			
	1	2	3	4
Q34 I know how to assess student performance in a classroom.	.884	.052	.041	-.293
Q29 I can use a variety of assessment strategies.	.729	.049	.047	-.069
Q35 I can adapt my teaching based upon what students currently understand or do not understand.	.696	-.184	.102	.220
Q27 I can control disruptive behaviour in the classroom and science laboratory.	.648	-.015	-.048	-.017
Q37 I can use wide range of teaching approaches in a classroom setting.	.633	-.057	.141	.214
Q36 I can adapt my teaching style to different learners.	.631	.015	.062	.185
Q33 I have various ways and strategies of developing my understanding of science.	.619	.159	-.074	.049
Q32 I generally teach science effectively.	**.461**	**.348**	**.178**	**-.074**
Q38 I am familiar with common student understandings and misconceptions.	.442	.033	.093	.265
Q39 I can select effective teaching approaches to guide student thinking and learning in science.	.410	.285	-.157	.301
Q30 I can provide an alternative explanation or example when students are confused.	**.400**	**.111**	**-.068**	**.367**
Q19 I wonder if I have the necessary scientific skills to teach science.	-.045	.824	.026	-.065
Q12 I understand science concepts well enough to be effective in teaching elementary science.	.063	.806	.030	-.033
Q18 I am typically able to answer students' science questions.	.068	.769	-.064	-.058
Q31 I have sufficient knowledge about science.	.136	.734	-.107	.041
Q5 I know the steps necessary to teach science concepts effectively.	-.030	.695	.129	.086
Q6 I am not very effective in monitoring science experiments.	-.010	.624	.238	.021
Q17 I find it difficult to explain to students why science experiments work.	-.087	.545	.143	.042
Q8 I can use a scientific way of thinking.	.190	.537	.217	.018
Q23 When teaching science, I usually welcome student questions.	.341	.517	-.036	.022
Q2 I will continually find better ways to teach science.	.051	-.032	.761	.092

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Pattern Matrix[a]				
	Component			
	1	2	3	4
Q4 When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.	.015	.169	.706	-.028
Q3 Even if I try very hard, I will not teach science as well as I will most subjects.	.169	.173	.614	.026
Q1 When a student does better than usual in science, it is often because the teacher exerted a little extra effort.	**-.148**	**.424**	**.548**	**.054**
Q13 Increased effort in science teaching produces little change in some students' science achievement.	.201	-.090	.467	.297
Q14 The teacher is generally responsible for the achievement of students in science.	-.043	-.094	.111	.779
Q15 Students' achievement in science is directly related to their teacher's effectiveness in science teaching.	.024	-.037	.160	.655
Q16 If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	-.020	.037	.235	.575
Q28 I can motivate students who show low interest in science school work.	.349	.036	-.060	.486
Q26 I can help foster student's creativity in science class.	.246	.174	-.039	.472
Q25 I know what to do to get through the most difficult students.	**.144**	**.349**	**-.228**	**.462**
Q21 When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.	**-.022**	**.450**	**-.250**	**.460**
Q24 When teaching science, I can develop good questions for my students.	**.105**	**.390**	**-.037**	**.426**

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 10 iterations.

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The last step of factor analysis is interpretation which the researcher named the factors. Variables clustered on component one represents pedagogical knowledge with 11 items, component two was content knowledge with 9 items, component three was teachers' efforts with 5 items and component four was students' engagement with 8 items. Cronbach's alpha for each component were α= 0.89, 0.89, 0.77 and 0.82 respectively.

Pedagogical knowledge is the teachers' comprehension of the techniques of teaching and learning. This is the knowledge teachers possess when they understand their students' characteristics, the way to assess their students' progress and apprehension on learning theories and the way to implement it in the classroom (Koehler & Mishra, 2009). On the other hand, content knowledge is the subject matter knowledge teachers possess without involving any teaching skills (Kleickmann et al, 2013).

Questions clustered in this questionnaire intended to check upon teachers' efficacy in the subject matter. Teachers effort is another factor extracted from the questionnaire, it represents if teachers believe their effort pays off by increasing students' performance and their willingness to improve their own teaching.

The last subscale represented teachers' efficacy in student engagement. According to Fredricks, Blumenfeld and Paris (2004), there are 3 types of engagement including behavioural engagement, emotional engagement and cognitive engagement. It is also explained as the students' involvement in the learning activities which help them to achieve positive results (Krause and Coates, 2008). Therefore, the questions in

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this factor can help to examine teachers' efficacy in involving students in the learning activity and achieving desired outcomes. Table 4.7 shows the subscales with their communalities.

Table 4.7

Subscales of "Primary Science Teachers Self-Efficacy Beliefs Scale"

	Component			
	1 Pedagogical knowledge	2 Content Knowledge	3 Teacher's Efforts	4 Students' Engagement
Q34 I know how to assess student performance in a classroom.	.884			
Q29 I can use a variety of assessment strategies.	.729			
Q35 I can adapt my teaching based upon what students currently understand or do not understand.	.696			
Q27 I can control disruptive behaviour in the classroom and science laboratory.	.648			
Q37 I can use wide range of teaching approaches in a classroom setting.	.633			
Q36 I can adapt my teaching style to different learners.	.631			
Q33 I know the steps necessary to teach science concepts effectively.	.619			
Q32 I generally teach science effectively.	.461			
Q38 I am familiar with common student understandings and misconceptions.	.442			

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continued

	Component			
	1 Pedagogical knowledge	2 Content Knowledge	3 Teacher's Efforts	4 Students' Engagement
Q39 I can select effective teaching approaches to guide student thinking and learning in science.	.410			
Q30 I can provide an alternative explanation or example when students are confused.	.400			
Q19 I wonder if I have the necessary scientific skills.		.824		
Q12 I understand science concepts well enough to be effective in teaching elementary science.		.806		
Q18 I am typically able to answer students' science questions.		.769		
Q31 I have sufficient knowledge about science.		.734		
Q5 I have various ways and strategies of developing my understanding of science.		.695		
Q6 I am not very effective in monitoring science experiments.		.624		
Q17 I find it difficult to explain to students why science experiments work.		.545		
Q8 I can use a scientific way of thinking.		.537		
Q23 When teaching in science, I usually welcome students' questions.		.517		
Q2 I will continually find better ways to teach science.			.761	
Q4 When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.			.706	

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continued

	Components			
	1 Pedagogical knowledge	2 Content Knowledge	3 Teacher's Efforts	4 Students' Engagement
Q3 Even if I try very hard, I will not teach science as well as I will most subjects.			.614	
Q1 When a student does better than usual in science, it is often because the teacher exerted a little extra effort.		.424	.548	
Q13 Increased effort in science teaching produces little change in some students' science achievement.			.467	
Q14 The teacher is generally responsible for the achievement of students in science.				.779
Q15 Students' achievement in science is directly related to their teacher's effectiveness in science teaching.				.655
Q16 If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.				.575
Q28 I can motivate students who show low interest in science school work.				.486
Q26 I can help foster student's creativity in science class.				.472
Q25 I know what to do to get through the most difficult students.				.462
Q21 When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.		.450		.460

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continued

	Components			
	1 Pedagogical knowledge	2 Content Knowledge	3 Teacher's Efforts	4 Students' Engagement
Q24 When teaching science, I can develop good questions for my students.				.426
Eigenvalues	11.13	2.78	2.11	1.57
% of variance	33.73	8.41	6.40	4.75
α	0.89	0.89	0.77	0.82
Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.				
a. Rotation converged in 10 iterations.				

4.3 Research Question 2: What Are the Scores of Efficacy Among Primary Science Teachers in Batang Padang, Perak?

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This question has been answered by looking at the mean score of each item, the mean scores were then converted into percentage of mean, which 100% as the highest mark. The same was done to "Primary Science Teachers' Self-Efficacy Scale" and the other four subscales. Table 4.8 shows the percentage of mean of each item while table 4.8 shows the percentage of mean of the main scale and subscales.

The two highest scored items by primary science teachers in Batang Padang, Perak were item one and two with 88%, which represents the item in subscale "Teachers' Effort". On the other hand, the lowest scored item was item 25 with 73%, which represents the subscale "Student Engagement".

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Table 4.8

Mean Score and Percentage of Mean for Each Item.

Item	Question	Mean Score	% of mean	SD
1	When a student does better than usual in science, it is often because the teacher exerted a little extra effort.	4.14	88%	.706
2	I will continually find better ways to teach science.	4.42	88%	.510
3	Even if I try very hard, I will not teach science as well as I will most subjects.	4.32	86%	.524
4	When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.	4.18	84%	.633
5	I have various ways and strategies of developing my understanding of science.	3.97	79%	.566
6	I am not very effective in monitoring science experiments.	3.73	75%	.712
8	I can use a scientific way of thinking.	3.94	79%	.545
12	I understand science concepts well enough to be effective in teaching elementary science.	3.90	78%	.672
13	Increased effort in science teaching produces little change in some students' science achievement.	4.15	83%	.398
14	Teacher is generally responsible for the achievement of students in science.	3.97	79%	.541
15	Students' achievement in science is directly related to their teacher's effectiveness in science teaching.	4.03	81%	.487
16	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	3.85	77%	.729
17	I find it difficult to explain to students why science experiments work.	3.73	75%	.692
18	I am typically able to answer students' science questions.	3.92	78%	.604
19	I wonder if I have the necessary scientific skills.	3.88	78%	.646
21	When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.	3.78	76%	.605

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continued

Item	Question	Mean Score	% of mean	SD
23	When teaching in science, I usually welcome students' questions.	3.96	79%	.500
24	When teaching science, I can develop good questions for my students.	3.96	79%	.500
25	I know what to do to get through the most difficult students.	3.65	73%	.703
26	I can help foster student's creativity in science class.	3.80	76%	.643
27	I can control disruptive behaviour in the classroom and science laboratory.	4.10	82%	.546
28	I can motivate students who show low interest in science school work.	3.88	78%	.561
29	I can use a variety of assessment strategies.	3.98	80%	.465
30	I can provide an alternative explanation or example when students are confused.	4.03	81%	.449
31	I have sufficient knowledge about science.	3.72	74%	.752
32	I generally teach science effectively.	3.81	76%	.595
33	I know the steps necessary to teach science concepts effectively.	3.92	78%	.517
34	I know how to assess student performance in a classroom.	4.02	80%	.450
35	I can adapt my teaching based upon what students currently understand or do not understand.	4.08	82%	.324
36	I can adapt my teaching style to different learners.	4.03	81%	.373
37	I can use wide range of teaching approaches in a classroom setting.	4.04	81%	.390
38	I am familiar with common student understandings and misconceptions.	3.99	80%	.502
39	I can select effective teaching approaches to guide student thinking and learning in science.	3.97	79%	.417

Mean score and percentage of mean of "Primary Science Teachers' Self-Efficacy Scale" and its subscale were presented in Table 4. 9. Teachers in Batang Padang scored an average of 79% in the "Primary Science Teachers' Self-Efficacy

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Scale". Among the 4 subscales that are included in the questionnaire, teachers scored the highest in "Teacher's Effort", which was 85%. The second highest was "Pedagogical Knowledge', 80%. While teachers scored equally on both "Content Knowledge" and "Student's Engagement", which was 77%.

Table 4.9

Mean Score and Percentage of Mean of "Primary Science Teachers' Self-Efficacy Scale" and Its Subscale

Scale	Mean	% of mean	Std. Deviation
Science Teachers' Self-efficacy	3.97	79%	0.32
Subscales			
Pedagogical Knowledge	4.00	80%	0.31
Content Knowledge	3.86	77%	0.46
Teacher's Efforts	4.24	85%	0.40
Students' Engagement	3.87	77%	0.40

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Table 4. 10 shows the scores of items in the subscale "Pedagogical Knowledge". Primary science teachers in Batang Padang have the highest efficacy in controlling students' behaviour. This might be because student teacher ratio in government primary schools was reported as 11:5 in 2015 (Department of Statistics Malaysia, 2016). We can see the reason why teachers have no problem in dealing with students' behaviour especially when class sizes in the Batang Padang district are usually small. Science teachers in Batang Padang also scored highly on the item dealing with different students with different strategies. On the other hand, primary science teachers scored the lowest in helping students in understanding of science and they don't think they can teach Science effectively.

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Table 4.10

Mean Score and Percentage of Mean of the Subscale "Pedagogical Knowledge"

	Pedagogical Knowledge Subscale	Mean	% of Mean	Std. Deviation
Helping different types of students and controlling students' behaviour	Q27 I can control disruptive behaviour in the classroom and science laboratory.	4.1	82%	0.55
	Q35 I can adapt my teaching based upon what students currently understand or do not understand.	4.08	82%	0.32
	Q37 I can use wide range of teaching approaches in a classroom setting.	4.04	81%	0.39
	Q36 I can adapt my teaching style to different learners.	4.03	81%	0.37
	Q30 I can provide an alternative explanation or example when students are confused.	4.03	81%	0.45
	Q34 I know how to assess student performance in a classroom.	4.02	80%	0.45
	Q38 I am familiar with common student understandings and misconceptions.	3.99	80%	0.5
	Q29 I can use a variety of assessment strategies.	3.98	80%	0.47
	Q39 I can select effective teaching approaches to guide student thinking and learning in science.	3.97	79%	0.42
Helping students to understanding of science and teach effectively.	Q33 I know the steps necessary to teach science concepts effectively.	3.92	78%	0.52
	Q32 I generally teach science effectively.	3.81	76%	0.6

Scores in the subscale presented in Table 4.11 "Content Knowledge" revealed that the respondents were good at developing their understanding of science, welcome students' questions and can use scientific way of thinking. Nonetheless, respondents scored less in content knowledge especially about science experiment. Respondents also scored the least thinking they have enough knowledge about science.

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Table 4.11

Mean Score and Percentage of Mean of the Subscale "Content Knowledge"

	Content Knowledge Subscale	Mean	% of Mean	Std. Deviation
Good at developing understanding of science, welcome students' questions and use scientific way of thinking.	Q5 I have various ways and strategies of developing my understanding of science.	3.97	79%	0.57
	Q23 When teaching in science, I usually welcome students' questions.	3.96	79%	0.5
	Q8 I can use a scientific way of thinking.	3.94	79%	0.55
	Q18 I am typically able to answer students' science questions.	3.92	78%	0.6
	Q12 I understand science concepts well enough to be effective in teaching elementary science.	3.9	78%	0.67
	Q19 I wonder if I have the necessary scientific skills.	3.88	78%	0.65
Science experiment and knowledge about science.	Q6 I am not very effective in monitoring science experiments.	3.73	75%	0.71
	Q17 I find it difficult to explain to students why science experiments work.	3.73	75%	0.7
	Q31 I have sufficient knowledge about science.	3.72	74%	0.75

"Teachers' Effort" was the subscale that the respondents scored the highest among the four subscales. Table 4.12 shows the mean score and percentage of mean of the subscale "Teachers' Effort". Examining the items of this factor revealed the belief of teachers that they can teach better if they exert greater efforts, which showed in the two items they scored the most. However, they scored the least believing that their efforts will bring improvement in students' achievement. Although the results, 83% was the lowest in this subscale, it exceeded the other highest marks items of the other subscales.

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Table 4.12

Mean Score and Percentage of Mean of The Subscale "Teachers' Effort"

	Teachers' Effort Subscale	Mean	% of Mean	Std. Deviation
They will always improve and believe that they can teach science better if they try hard.	Q2 I will continually find better ways to teach science.	4.42	88%	0.51
	Q3 If I try very hard, I will teach science as well as I will most subjects.	4.32	86%	0.52
	Q4 When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.	4.18	84%	0.63
They don't believe their effort can make an improvement on students' achievement.	Q13 Increased effort in science teaching produces little change in some students' science achievement.	4.15	83%	0.4
	Q1 When a student does better than usual in science, it is often because the teacher exerted a little extra effort.	4.14	83%	0.71

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Table 4.13 shows mean score and percentage of mean of the subscale "Student Engagement". Results showed that the respondents believe they have a responsibility to help in students' achievement and the achievements are related to the teachers' effectiveness. Respondents had the least scores on item regarding their effectiveness in helping difficult students and fostering students' creativity. In fact, item 25 was the item the respondent scored least in the whole questionnaire compared to other items, which was 73%.

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Table 4.13

Mean Score and Percentage of Mean of the Subscale "Student Engagement"

	Student Engagement Subscale	Mean	% of Mean	Std. Deviation
Students' achievement and develop questions.	Q15 Students' achievement in science is directly related to their teacher's effectiveness in science teaching.	4.03	81%	0.49
	Q14 The teacher is generally responsible for the achievement of students in science.	3.97	79%	0.54
	Q24 When teaching science, I can develop good questions for my students.	3.96	79%	0.50
	Q28 I can motivate students who show low interest in science school work.	3.88	78%	0.56
	Q16 If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	3.85	77%	0.73
Helping difficult students and foster students' creativity.	Q26 I can help foster student's creativity in science class.	3.80	76%	0.64
	Q21 When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.	3.78	76%	0.60
	Q25 I know what to do to get through the most difficult students.	3.65	73%	0.70

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4. 4 Research Question 3: Are There Any Differences in The Scores of Primary Science Teachers' Self-Efficacy in Batang Padang According to Their Gender?

Table 4. 14 shows the t-test for comparisons of primary science teachers' self-efficacy in Batang Padang, Perak by gender. Independent sample *t*-test indicated that male teachers was reported to have a slightly higher teachers' self-efficacy (M=4.08, SD=0.42) compared to the female teachers (M=3.93, SD=0.39). The difference was statistically significant t (142) = 2.40, p<.05. The null hypothesis is rejected. The effect

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size was medium, *d* =0.5. Male teachers were also reported to have statistically significant higher scores in pedagogical knowledge (*M*=4.13, *SD*=0.32) than female teachers (*M*=3.96, *SD*=0.30), *t* (142) = 2.75, *p*<.05. The other scale that male teachers have statistically significant higher scores than female was the content knowledge scale, with the result male (*M*=4.01, *SD*=0.41) and female (*M*=3.82, *SD*=0.47), *t* (142) = 2.10, *p*<.05. Among the four factors in the questionnaire, male teachers scored the highest in the teachers' effort (*M*=4.29, *SE*= 0.39) compared to the female teachers (*M*=4.23, *SE*=0.41). However, the difference is not statistically significant *t* (142) = 0.70, *p*>.05. Results also showed that there was no statistically significant difference between male (*M*=3.97, *SD*=0.33) and female (*M*=3.84, *SD*=0.31), *t* (142) = 1.71, *p*>.05 in the students' engagement scale.

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Table 4.14

The Result of T-test for Comparisons of Primary Science Teachers' Self-Efficacy in Batang Padang, Perak by Gender

Scale	Gender	Mean	SD	df	t	Sig.
Science Teachers' Self-Efficacy	Male	4.08	0.42	142	2.40	0.018
	Female	3.93	0.39			
Subscales						
Pedagogical Knowledge	Male	4.13	0.32	142	2.75	0.007
	Female	3.96	0.30			
Content Knowledge	Male	4.01	0.41	142	2.10	0.038
	Female	3.82	0.47			
Teachers' Effort	Male	4.29	0.39	142	0.70	0.483
	Female	4.23	0.41			
Students' Engagement	Male	3.97	0.33	142	1.71	0.090
	Female	3.84	0.31			

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4. 5 Research Question 4: Are There Any Differences in the Scores of Primary Science Teachers' Self-Efficacy in Batang Padang, Perak According to Their Major Course?

Table 4.15 shows the result of t-test for comparisons of primary science teachers' self-efficacy in Batang Padang, Perak by major. Independent sample t-test indicated that teachers who are major in Science were reported to have a slightly higher teachers' self-efficacy (*M*=4.09, *SE*=0.31) compared with the non-major teachers (*M*=3.91, *SE*=0.31). The difference was statistically significant *t* (142) =3.34, *p*<.05. The effect size was large, *d*=.6. The null hypothesis is rejected. For the pedagogical knowledge subscale, science-major teachers (*M*=4.07, *SE*=0.33) scored better than their non-major counterparts (*M*=3.96, *SE*=0.30), there was a statistically significant result, *t* (142) =3.71, *p*<.05. Science-major teachers also scored a statistically significant higher in content knowledge than the non-major teachers, with (*M*=4.06, *SE*=0.36) and (*M*=3.76, *SE*=0.48) for the latter, *t* (142) =3.71, *p*<.05.

Results shows that Science-major teachers scored the highest (*M*=4.38, *SE*=0.41) in Teachers' effort subscale compared with non-major teachers (*M*=4.18, *SE*=0.39), the results was statistically significant, *t* (142) =2.93, *p*<.05. Although Science-major teachers scored higher than non-major teachers in students' engagement subscale with (*M*=3.96, *SE*=0.42) and (*M*=3.82, *SE*=0.39) respectively, the result was statistically not significant, *t* (142) =1.96, *p*>.05.

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Table 4.15

The Result of T-test for Comparisons of Primary Science Teachers' Self-Efficacy in Batang Padang, Perak by Major

Scale	Major	Mean	SD	df	t	Sig.
Science Teachers' Self-Efficacy	Science	4.09	0.31	142	3.34	0.001
	Others	3.91	0.31			
Pedagogical Knowledge Subscale	Science	4.07	0.33	142	2.06	0.041
	Others	3.96	0.30			
Content Knowledge Subscale	Science	4.06	0.36	142	3.71	0.000
	Others	3.76	0.48			
Teachers' Effort Subscale	Science	4.38	0.41	142	2.93	0.004
	Others	4.18	0.39			
Students' Engagement Subscale	Science	3.96	0.42	142	1.96	0.052
	Others	3.82	0.39			

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4.6 Research Question 5: Are There Any Differences in The Scores of Primary Science Teachers' Self-Efficacy in Batang Padang, Perak According to Their Years of Teaching Experience?

One-way ANOVA was used to compare the teacher efficacy of teachers with different years of teaching experience. ANOVA results as shown in Table 4.16 illustrated that there was a statistically significant difference between teachers with different teaching experience F (2, 141) = 10.901, p = .000. The null hypothesis is rejected. LSD post hoc test indicated that teachers who are teaching for more than 6 years has a significantly higher self-efficacy (M= 4.09, SD= 0.27) compared to teachers who are have been teaching for 1 to 3 years (M= 3.87, SD= 0.32) and teachers who are teaching in their forth to fifth year (M= 3.88, SD= 0.88). However, there were no difference spotted

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between teachers who are teaching for their first 3 years with teachers who are teaching at their forth to fifth years. The effect size was large, $\eta^2 = 0.133$.

For the subscale of pedagogical knowledge, ANOVA results showed that there was a statistically significant difference between teachers with different teaching experience F (2, 141) = 3.123, p = .47. By using LSD post hoc test, it was found that the scores of teachers who are teaching at their first 3 years (M= 3.94, SD= 0.29) has a slightly lower pedagogical knowledge compared with teachers who are teaching for more than 6 years (M= 4.07, SD= 0.32). Nonetheless, teachers who are teaching at their forth to fifth years (M= 3.92, SD= 0.32) showed no statistically difference compared with two other groups of teachers.

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ANOVA results also showed that there was a statistically significance difference between teachers with different teaching experience in content knowledge, F (2, 141) = 18.574, p = .000. Results in this subscale showed that teachers who teach more than 6 years (M= 4.08, SD= 0.31) scored statistically higher than teachers who teach for their first 3 years (M= 3.63, SD= 0.52) and teachers who are teaching at their forth to fifth years (M= 3.83, SD= 0.36). Teachers who are teaching at their first 3 years have found to be not statistically different from those who are teaching at their forth to fifth years though.

The results for teachers' effort subscale showed that there was a statistically significant difference between teachers with different teaching experience as well, F (2, 141) = 6.754, p = .022. Teachers who are teaching more than 6 years (M= 4.37, SD= 0.42) were again scored statistically the highest compared to teachers who teach for

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their first 3 years (M= 4.16, SD= 0.36). and teachers who are teaching at their forth to fifth years (M= 4.05, SD= 0.34). Scores of teachers who are teaching for their first 3 years was not statistically different from teachers who are teaching at their forth to fifth year.

ANOVA test also displayed statistically difference in students' engagement subscale score between teachers with different teaching experience, F (2, 141) = 3.94, p = .022. Teachers with 6 or more years of experiences (M= 4.37, SD= 0.42) expectedly scored higher than teachers who are at their first 3 years (M= 4.16, SD= 0.36) and forth to fifth years (M= 4.05, SD= 0.34).

Table 4.16

The Result of ANOVA for Comparisons of Primary Science Teachers' Self-Efficacy in Batang Padang, Perak by Years of Teaching Experience

Scale	Source	*df*	*SS*	*MS*	*F*	*P*
Science Teachers' Self-Efficacy	Between groups	2	1.936	0.968	10.901	.000
	Within groups	141	12.524	0.89		
Pedagogical Content Subscale	Between groups	2	0.592	0.296	3.123	.47
	Within groups	141	13.365	0.095		
Content Knowledge Subscale	Between groups	2	6.402	3.201	18.574	.000
	Within groups	141	24.301	0.172		
Teachers' Effort Subscale	Between groups	2	2.043	1.022	6.754	.022
	Within groups	141	21.330	0.151		
Students' Engagement Subscale	Between groups	2	1.222	0.611	3.940	.022
	Within groups	141	21.861	0.155		

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Table 4.17

The Result of LSD Post Hoc Test for Comparisons of Primary Science Teachers' Self-Efficacy in Batang Padang, Perak by Years of Teaching Experience

LSD	Multiple Comparisons						
						95% Confidence Interval	
Dependent Variable	(I) Teaching Exprience	(J) Teaching Exprience	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Science Teachers' Self-efficacy	0-3	4-5	-.02078	.08174	.800	-.1824	.1408
		>6	-.23692*	.05293	.000	-.3416	-.1323
	4-5	0-3	.02078	.08174	.800	-.1408	.1824
		>6	-.21615*	.08106	.009	-.3764	-.0559
	>6	0-3	.23692*	.05293	.000	.1323	.3416
		4-5	.21615*	.08106	.009	.0559	.3764
Pedagogical Knowledge	0-3	4-5	.02358	.08444	.780	-.1433	.1905
		>6	-.12275*	.05468	.026	-.2308	-.0146
	4-5	0-3	-.02358	.08444	.780	-.1905	.1433
		>6	-.14633	.08374	.083	-.3119	.0192
	>6	0-3	.12275*	.05468	.026	.0146	.2308
		4-5	.14633	.08374	.083	-.0192	.3119
Content Knowledge	0-3	4-5	.19801	.11386	.084	-.4231	.0271
		>6	-.44875*	.07373	.000	-.5945	-.3030
	4-5	0-3	.19801	.11386	.084	-.0271	.4231
		>6	-.25074*	.11291	.028	-.4740	-.0275
	>6	0-3	.44875*	.07373	.000	.3030	.5945
		4-5	.25074*	.11291	.028	.0275	.4740
Teachers' Effort	0-3	4-5	.11688	.10667	.275	-.0940	.3278
		>6	-.20273*	.06908	.004	-.3393	-.0662
	4-5	0-3	-.11688	.10667	.275	-.3278	.0940
		>6	-.31961*	.10579	.003	-.5287	-.1105
	>6	0-3	.20273*	.06908	.004	.0662	.3393
		4-5	.31961*	.10579	.003	.1105	.5287
Students' Engagement	0-3	4-5	.03158	.10799	.770	-.1819	.2451
		>6	-.17697*	.06993	.012	-.3152	-.0387
	4-5	0-3	-.03158	.10799	.770	-.2451	.1819
		>6	-.20856	.10710	.053	-.4203	.0032
	>6	0-3	.17697*	.06993	.012	.0387	.3152
		4-5	.20856	.10710	.053	-.0032	.4203

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4.7 Research Question 6: Are There Any Differences in the Score of Science Teachers' Self-Efficacy According to Their Education Qualifications?

T-test was used to compare the differences in the score of Science teachers' self-efficacy according to their education qualifications. Table 4.18 shows the result of T-test for comparisons of primary science teachers' self-efficacy in Batang Padang, Perak by education qualification. Independent sample t-test indicated that there are no statistically significant differences between teachers holding diploma or lower qualification and degree or higher qualification, with the result (M=3.96, SE=0.22) and (M=3.97, SE=0.35) respectively, t (142) =-0.42, p>.05. Results also showed that there was no statistically significant difference between teachers with diploma or lower and degree or higher in all the four subscales. The null hypothesis is accepted.

Table 4.18

The result of T-test for comparisons of primary science teachers' self-efficacy in Batang Padang, Perak by education qualification

Scale	Major	Mean	SD	df	t	Sig.
Science Teachers' Self-Efficacy	Diploma or lower	3.96	0.22	101.21	-0.42	0.967
	Degree or higher	3.97	0.35			
Pedagogical Content Subscale	Diploma or lower	4.00	0.21	142	-0.15	0.881
	Degree or higher	4.00	0.34			
Content Knowledge Subscale	Diploma or lower	3.86	0.34	93.78	-0.10	0.924
	Degree or higher	3.86	0.50			
Teachers' Effort Subscale	Diploma or lower	4.24	0.41	142	0.00	0.997
	Degree or higher	4.24	0.40			
Students' Engagement Subscale	Diploma or lower	3.86	0.28	142	0.15	0.879
	Degree or higher	3.86	0.44			

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4.8 Summary

Exploratory factor analysis has been used to extract the 39 items questionnaire into 4 factors, namely pedagogical knowledge, content knowledge, teachers' effort and student engagement. Throughout the process, the researcher deleted 4 items from the questionnaire as the communalities of these items were less than 0.2 (Field, 2009). The instrument is a reliable instrument, with Cronbach's $\alpha = 0.94$. The four factors included in this questionnaire all had high reliability, with Cronbach's $\alpha = 0.89, 0.89, 0.77$ and 0.82 respectively.

The overall score of primary Science teachers in this Primary Science Self-efficacy scale was 79%. They scored the best in teachers' effort at 85%, followed by pedagogical knowledge at 80%. The respondents scored the least in both content knowledge and students' engagement at 77%.

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The researcher then answered the research questions by carrying out independent sample T-test for comparing teachers of different gender, major course and education qualification whereas one-way ANOVA for comparing teachers of different teaching experience.

Results indicated that male teachers had statistically higher science teacher's self-efficacy scores (M=4.08, SD=0.42) than the female teachers (M=3.93, SD=0.39). Unsurprisingly, Science-major teachers were reported to have better self-efficacy scores (M=4.09, SE=0.31) compared with the non-science major teachers (M=3.91, SE=0.31). The mean scores of new, inexperienced and experienced teachers were (M=

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3.87, *SD*= 0.32), (*M*= 3.88, *SD*= 0.88) and (*M*= 4.09, *SD*= 0.27) respectively. The self-efficacy scores raise as the years of teaching experience increases. The last comparison made between degree and non-degree holder showed that there was no difference between their self-efficacy, with the result (*M*=3.96, *SE*=0.22) and (*M*=3.97, *SE*=0.35) respectively, *t* (142) =-0.42, *p*>.05, suggesting that degree and non-degree holder were on the same level of self-efficacy.

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Chapter 5

"DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS"

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5.1 Introduction

In this chapter, results from this research will be compared with the previous studies. The findings will be discussed according to the sequence of the research questions. Implications of the research towards schools, teachers and policy makers were discussed then followed by recommendations for the next research.

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5.2 Discussion

5.2.1 Primary Science Teachers' Self-Efficacy Beliefs

Four subscales presented in the Science Self-Efficacy Scale questionnaire showed different scores, where "Teachers' Effort" had the highest score, followed by "Pedagogical Knowledge". The least scored subscales were "Content Knowledge" and "Student Engagement". High efficacy of primary science teachers in "Teachers' Effort" displayed their willingness to exert efforts in teaching Science. This is a characteristic presented in dedicated teachers who strive hard to help students in their learning progress (Mart, 2013). The item that had the highest scores was that they will continually find better ways to teach Science. Same result was obtained from the study carried out by Azar (2002), showing that science teachers always try to find better ways to teach science. This quality of always finding effective ways in teaching is great and teachers like this were called passion contributors by Mart (2013), he claimed that teachers with this quality will enhance students' achievement.

Despite the high efficacy of teachers in "Pedagogical Knowledge", policy makers have to keep upgrading the teachers in terms of new skills to be able to teach in a 21st century learning environment. The government has launched the Primary School Standard Curriculum (KSSR) which determines to embed a balanced set of knowledge and skills such as creative thinking, innovation, problem-solving and leadership (PPPM, 2012). This means teachers must shift from traditional teaching methods to contemporary teaching methods. This implementation starts from readjusting the

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current learning content of education institutions and knowledges of teachers' communities (Guerriero, 2017). Yahya (2013) urged the school administrators to be attentive at the changes in curriculum and ensure that science teachers get the related information. In-house training should be organized to make sure every teacher involves in successfully executing the new curricula.

This study exposed the two subscales that primary science teachers in Batang Padang had lowest in teachers' self-efficacy beliefs, which were "Content Knowledge" and "Student engagement". Several studies also found that the content knowledge of primary science teachers was not contented as there were presented misconceptions in numerous science topics (Rice, 2005; Kartal, Ozturk & Yalvac, 2011). It is hard to get our students on the right path when the educators themselves are not competent enough. Appleton (1995) stated that teachers' content knowledge affects their confidence in teaching. When teachers are not efficient in the science concept, their misconception has a big possibility to carry on towards the students (Kind, 2014).

Research also revealed teachers having better content knowledge assist students to have higher achievement (Voss, Kunter & Baumert, 2011). Regardless the benefits that content knowledge can bring to our education, respondents' result in this subscale seemed disappointing. The result resemblance another study by Tan and Chin (2001), which found that teachers faced confusion in certain science topics and suggested that the teachers' misconceptions were due to the reason they have not fully mastered the science concept.

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Among the items in the subscale of "Content Knowledge", two of the items teachers scored the lowest were about science experiment. Kind (2014), a physics teacher honestly stated her incompetence in planning good experiment in her own research. This is very similar with the result of this study. Students love experimenting (Osborne & Collins, 2000), it's teachers' job to help them create an enjoying environment by providing more chances for students to investigate a problem. Experimenting should be a field that teachers were trained in their program.

When teachers from the PISA and TIMSS top performances countries were examined, it was found that the reason they teach so well was due to their more chances in learning content and pedagogical knowledge compared to other teachers (Guerriero, 2013). Opportunities like courses and workshops should be held by the Ministry of Education if content knowledge of teachers were to be improve. In-service teachers should be provided education to have a better comprehension on science content and have the required skills in conducting science experiment (Azar, 2002). Content knowledge should set as a test for the intake of science teachers to ensure the quality of science teachers.

Primary science teachers in Batang Padang were found to have low efficacy in enhancing students' engagement. This result matched the research from Swan (2011), where teacher students scored the lowest in student engagement. Nonetheless, the blame should not be put on teachers alone as Thompson and Bennett (2011) found that there are a few factors which associated with students' engagement towards science. Factors like socio-economic status and science teachers' shortage were totally beyond the teachers' control. Meanwhile, the study did mention about the ability of hands-on

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activity in promoting students' engagement. Trowler (2006) also stated that students can engage themselves more when the lessons are more student-centered. Thus, if primary science teachers were to increase their teacher efficacy beliefs in engaging students, they should change their teaching style.

5.2.2 Primary Science Teachers' Self-Efficacy of Teachers of Different Gender

Independent sample *t*-test indicated that male teachers were reported to have a slightly higher teachers' self-efficacy (*M*=4.08) compared to the female teachers (*M*=3.93). Research results also indicated that male teachers scored higher in all the four factors presented in the questionnaire, namely pedagogical knowledge, content knowledge, teachers' effort and student engagement. Nonetheless, differences of scores between male and female teachers in teachers' effort and student engagement were not significant. The research result was consistent with Riggs (1991) and Ng (2012) where they discovered that males sample excelled their female's counterparts on self-efficacy test in science teaching. Tok & Tok (2016) also reported higher level of classroom management efficacy beliefs in male novice teachers compared to female. This is not a good thing as the majority of Science teachers in Batang Padang are females. The researcher has collected 112 responses from female teachers but only 32 responses from male teachers. Since most of the teachers are females, it is important to ensure that females can teach as good as their male counterparts. For having enough quantity of teachers is important, quality of teachers should also be assured.

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Riggs (1991) claimed that the reason male teachers having higher Science self-efficacy was the higher expectations people put on them. Furthermore, Odanga, Raburu, & Aloka (2015) concluded in their research that male teachers tend to have more work load, exert more efforts and more resilient at work. Male was also thought to be more confident than woman at nearly every fields that they are involved in (Demirtas & Ozer, 2011). Nonetheless, some proposed that the differences of male and female teachers' scores in self-efficacy were merely a consequence of cultural differences (Azar, 2010; Bandura, 1997).

On the other hand, Kurt, Gungor and Ekici (2014) found that female student teachers scored higher self-efficacy and proclaimed that female teachers are well-suited in the teaching profession. While Jaggernauth and Jameson-Charles (2015) proposed no differences in the level of self-efficacy were found in different gender.

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5.2.3 Primary Science Teachers' Self-Efficacy of Teachers of Different Major

Unsurprisingly, Science-major teachers outperformed their non-major counterparts on the science teacher self-efficacy scale and all the subscales. All the differences were statistically significant except for the result of Student Engagement subscale. The result was consistent with the previous research (Azar, 2009; Joseph, 2010; Kamtet, et al., 2009). However, Zuraidah (1999) in his research asserted that the level of science teaching efficacy is not related to a teacher's major. The inconsistency found between Zuraidah's and this research might because of the year of implementation and geological differences.

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Even though Science-major teachers possess higher self-efficacy in teaching Science, we have got more non-major teachers teaching Science in Batang Padang. The researcher has collected data from 48 Science-majors and 96 non-major by using random sampling. When teachers in Malaysia are graduated from the institute and being posted to the work place, due to the problem of insufficient trained science teachers, teachers who are non-majors have to teach in Science even they have no educational backgrounds in teaching science subjects (Osman, Halim, & Meerah, 2006). Teaching beyond their expertise area, non-major teachers encounter challenges owing to the lack of subject matter knowledge and pedagogical content knowledge (Mizzi, 2013). When this happened, it will have a negative impact on the quality of teachers (Guerriero, 2013). Hence, intake of teacher students should consider the shortages of teachers according to the field that they are teaching.

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Science major outperformed their non-Science major counterparts in content knowledge subscales in this research, as well as the research carried out by Kamtet, et al. (2009) in Thailand which showed that teachers who had bachelor degrees in Science scored better in subject matter knowledge than those who had bachelor degrees in other majors. Brickhouse (1990) proclaimed teachers with better content knowledge can teach better by asking questions, giving explanations in a different way, and offering further explorations in classroom. Content knowledge is a fundamental knowledge that should be presented in Science teachers. Thus, having teachers who were trained to teach Science who are competence in content knowledge will be the best option to have higher quality workforce.

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5.2.4 Primary Science Teachers' Self-Efficacy of Teachers of Different Years of Teaching Experience

The data from this research indicates that, as teachers gain experience from teaching, they gradually increase their self-efficacy. Same results were shown in the other four subscales. Science teachers who were teaching more than 6 years proved to excel their juniors in all subscales. The research result embodied the statement from Bandura (1977), that an agent will have their beliefs changed over the period of their life. Malik and Jumali (2016) examine the efficacy level of female novice and experienced teachers. They found that female experienced teachers have higher self-efficacy, which they scored better in students' engagement, classroom management, and instructional practices. The results were also consistent with the other research which approved that experienced teachers are more effective in education (Rice, 2010). Nonetheless, Zuraidah (1999) in his research asserted that the level of science teaching efficacy is not related to a teacher's years of teaching experience.

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Productivity of teachers was found to have soared up the most during their first year, however, it remained constant after the first year (Rice, 2010). This could be the reason teachers who are teaching at their first 3 years and who teaches more than 6 years differ in their self-efficacy, but no statistically differences were found between teachers who were teaching at their forth to fifth years and teachers who are teaching for more than 6 years.

Experienced teachers had again scored the highest in the Pedagogical and Content Knowledge subscale. Han (2014) explained that experienced teachers gain their knowledge in this field by understanding how their student learn. He also stated that teaching

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experience is the chief attributor to the growth of PCK. Interactions between teachers and students arose the consciousness of teachers in understanding their students learning style and desires (Han, 2014). Gambidau (2012) carried out a research to examine the efficacy of novice science teachers, non-mojor experienced science teacher and major experienced science teachers in teaching science. Her research revealed that science teachers who were major and experienced in teaching science were the only group of teachers which didn't depend on books to get idea regarding science activities.

Research from Okas, van der Schaaf and Krull (2014) found that experienced teachers can apprehend better about students learning more than novice teachers. Experienced teachers were also found to be have better confidence in grading students. On the other hand, novice teachers were found to be weak in assessing and grading students.

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Results from the research indicated that experience teachers had higher efficacy in engaging students. According to Fuller (1970), teachers' development swift from concerning themselves to students as shown in Table 5.1. Experienced teachers thus scored better in engaging students as they concern about students' need while novice teachers concern about themselves which is nothing to do with their teaching. Experienced teachers not only able to improve students' achievement, they can also help students to improve other measures, like making students to attend school more (Kini & Podolsky, 2016).

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Table 5.1

Teachers' Development Model TEACHERS' DEVELOPMENT MODEL BY FULLER (1970)

I	Early phase	0	Concerns about self(non-teaching concerns)
II	Middle phase (competence)	1	Concerns about professional expectations and acceptance
		2	Concerns about one's own adequacy: subject matter and class control
		3	Concerns about relationship with students
III	Late phase (professionalism)	4	Concerns about students learning what is taught
		5	Concerns about students learning what they need
		6	Concerns about one's own (teacher's) contributions to student change

Fuller (1970, p.329)

Overall, the result was supported by the theory proposed by Bandura (1997), stated that as teachers gain more mastery experiences, their self-efficacy level increases. Moore and Swan (2008) suggested that experienced teachers should assist novice teachers by providing mentorship. During the process of mentorship, they would also benefit from the progress (Huling, Resta & Virginia, 2011).

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5.2.5 Primary Science Teachers' Self-Efficacy of Teachers of Different Education Qualifications

The researcher had categorized teachers according to their education qualification into two groups, which are teachers who own a diploma or below diploma such as SPM cert, and degree or higher qualification. Results showed that teachers' education qualification has nothing to do with their level of efficacy.

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Although teachers hold different education qualifications, they've gone through the same procedure to become a teacher in Malaysia. Degree or non-degree holders, teachers in Malaysia need to undergo training under the wing of Institute of Teacher Education. Teachers have either gone through the training by joining The Bachelor of Teaching Programmes, Post-graduate Education Courses or Diploma in Education Courses (UNESCO, 2013). The same level of efficacy found in degree and non-degree holders suggested that all these programs have equal affection towards the teachers in terms of teaching efficacy.

5.4 Conclusion

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This research suggested that primary Science teachers in Batang Padang scored the highest in the Teachers' Effort subscale at 85%, followed by Pedagogical Knowledge subscale at 80%. While Content Knowledge and Students' Engagement subscale were both at 77%. The weaknesses of teachers in content knowledge should be overcome by having more courses and workshops for the teachers to be trained and improved. Although scores in student engagement is a factor that could be affected by socio-economic or science teachers' shortage (Hempden-Thompson & Bennett, 2011), teachers can still use hands-on activity to improve student engagement.

Results of this research claimed that male science teachers had higher self-efficacy than female science teachers in all the subscale, although the differences in teachers' effort subscale and student engagement subscale were not statistically significant. Researchers explained that male teachers have more work load,

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expectations and more resilient at work (Odanga, Raburu, & Aloka, 2015; Riggs, 1991). On the other hand, some proposed that the differences of male and female teachers' scores in self-efficacy were merely a consequence of cultural differences (Azar, 2010; Bandura, 1997).

Even though Science-major teachers in Batang Padang possess higher self-efficacy, there were more non-mojor teachers in Batang Padang. Teachers shortages often caused the education authorities to appoint teachers to teach in the area that they are not familiar with which then deteriorates the quality of teaching (Guerriero, 2013). Thus, education authorities are urged to consider assigning teachers to teach the subjects that they were trained.

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The data from this research indicates that, as teachers gain experience from teaching, they gradually increase their self-efficacy. Research showed that experienced teachers outperformed novice teachers in all subscales. The research result embodied the statement from Bandura (1977), that an agent will have their beliefs changed over the period of their life. Experienced teachers should provide mentorship to the novice teachers as they would also benefit from the progress (Huling, Resta & Virginia, 2011).

Degree holders and non-degree holders scored the same level of efficacy, suggested that all the programs have equal affection towards the teachers in terms of teaching efficacy regardless of their education qualification.

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5.5 Implications of The Research

The researcher elaborated the implications brought by this thesis on schools, teachers and policy makers.

5.5.1 Implication for Schools

Experienced teachers excelled novice teachers in all the subscales. The value of experienced teachers should be fully utilized by providing mentorship for novice teachers thus provide benefits for their colleagues (Kini & Podolsky, 2016). Professional Learning Community should become a trend in all schools where teachers of similar expertise sit together and plan a good lesson. Through the progress, experienced teachers can share their knowledge with novice teachers. Research conducted by See (2013) observed the improvement of novice teachers occurred in terms of pedagogy knowledge, subject matter knowledge and knowledge of context after mentoring was applied. Mentorship not only benefits novice teachers, but mentor teachers could also get advantages as they can improve their own professional competency (Huling, Resta & Virginia, 2011).

Although mentor system can bring advantages to novice teachers, it depends on the willingness of experienced teachers to cultivate them. Mentor was often too occupied to consult their mentee (Martinez, 2008). Therefore, mentor system must be fully implemented for novice teachers to gain advantages. Bandura (1997) claimed that people gain efficacy by seeing a model who is similar to them achieving something.

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Mentorship can benefits novice teachers as they see their senior as a model, and they increase their efficacy by believing they too possess the ability in teaching. According to Bandura (1997), another source of efficacy is vicarious experiences. Thus, school authorities should motivate novice teachers with positive comments when novice teachers did something good, it will aid novice teachers to boost up their efficacy level.

5.5.2 Implications for Policy Makers

Science major teachers are obviously having higher teching self-efficacy in teaching science. Even though science major teacher has higher efficacy beliefs, more non-major teachers were found to be teaching science in Batang Padang, Perak. Guerriero (2013) stated that education systems often solve the problems of teachers' shortages by appointing teachers to teach the subject that they were not trained. Hampden-Thompson and Bennett (2011) found that students engagement has a correlation with the shortage of science teachers. Students enjoyed their lesson more studying in schools that have enough science teachers. The ministry should really plan well in allocating teachers, teacher training courses should be provided based on the teachers' shortage. They should always update with themselves the number of teachers at school with their expertise. Shortage in certain field should be immediately replenished with trained teachers.

Content knowledge was the subscales science teachers scored the lowest in this research. Strengthening content knowledge of science teachers should be a fundamental necessity included in the teacher training program as research proclaimed that teacher

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efficacy can be established by improving teachers' content knowledge (Swackhamer, Koellner, Basile and Kimbrough, 2009). The research also showed that in-service teachers who have attended more than 4 science content courses have higher efficacy. More content courses should be held based on the area that teachers are not confidence enough.

5.5.3 Implication for Teachers

Primary science teachers in Batang Padang had the highest efficacy in the subscale "Teachers' Effort". The item they scored highest was that they will continually find better ways to teach science. Mart (2013) proposed that one of the qualities of great teachers is finding effective ways in teaching. Teacher should keep up their effort when searching for the effective way to teach science.

For example, primary science teachers in Batang Padang should realise their weakness in content knowledge, and strive harder to study science content that is included in the syllabus. Research revealed teachers having better content knowledge can assist students to have higher achievement (Voss, Kunter & Baumert, 2011). Science teachers should see content knowledge as a fundamental knowledge to teach in Science. They should be active in joining courses and workshops.

There should also be a discussion group among teachers, where they can share science pedagogical content knowledge and have intensive discussion in the group when they face problem in teaching. Bandura (1997) stated that one of the source of

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efficacy is vicarious experience, which seeing a symbolic model accomplishment could increase personal self-efficacy. Perhaps the discussion group could be able to bring a fruitful outcome as teachers observing other successful examples in their teaching carrier.

All teachers regardless gender has gone through the same teacher training program in Malaysia. Nonetheless, female primary science teachers in Batang Padang were found to have lower self-efficacy. Female teachers should not perceive themselves as weak and lacking in teaching.

Participants were also found to score lowest in student engagement. The problem can be solved by applying contemporary teaching style, where students get to do hands-on activity and the lesson is more student-centered.

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5.6 Recommendations

The research had examined the level of efficacy of science teachers in Batang Padang. Although the researcher has a clear view on the level of efficacy compared between gender, years of teaching experience, major and education qualification, the sources of the efficacy remained obscure. As Bandura (1997) stated that there are four major sources of self-efficacy, namely mastery experiences, vicarious experiences, verbal persuasion, physiological and emotional states, it will be interesting to find out the source of efficacy that contributes the most and the least to science teachers in this district.

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The research has revealed that male teachers have higher self-efficacy than the female teachers. However, most of the primary science teachers in Batang Padang were females. This phenomenon is not only restricted in this district. In fact, it was reported that the ratio of qualified male applicants to enter the education system were only 35% compared to 65% of female applicants (Utusan Online, 2009). Since majority of the teachers are female, it is crucial to find out why female teachers have lower efficacy and the difficulties that they are facing. Research should further investigate and comprehend the differences presented between male and female primary science teachers in Batang Padang.

There were no differences of level of efficacy between degree and non-degree holder. This result indicated that teachers' education qualification has no relation with the level of efficacy. Since the Science-major teachers excelled non-major, the differences in level of self-efficacy might be caused by the training that teachers got from the program. There are many ways a Malaysian citizen can become a teacher. Post-Degree Teacher Training Course (KPLI) is a course provided by the Ministry of Education which allows degree-holder of other fields to join become a primary school teacher (MOE, 2017). This course can be applied by those who possess non-education degree. Thus, comparison can be made between teachers who were trained in education field or initially from other field of expertise.

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APPENDIX A

Primary Science Teachers' Self-Efficacy Beliefs Scale

School :
Respondent Code Number :
Gender : Male/ Female
Age :
Major/Graduate course : Science/ Others: _____
Teaching Experiences : _____year/years
Highest Education Qualification :

Please indicate your opinion about each of the questions below by marking any one of the 5 responses, ranging from (1) "Strongly Agree" to (5) "Strongly Disagree" as each represents a degree on the continuum. Please respond to each of the questions honestly.

This questionnaire is designed to gain a better understanding of the self-efficacy level of Science teachers in Batang Padang, Perak.

Your answers are confidential.

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. When a student does better than usual in science, it is often because the teacher exerted a little extra effort.					
2. I will continually find better ways to teach science.					
3. Even if I try very hard, I will not teach science as well as I will most subjects.					
4. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.					
5. I have various ways and strategies of developing my understanding of science.					
6. I am not very effective in monitoring science experiments.					
7. If students are underachieving in science, it is most likely due to ineffective science teaching.					
8. I can use a scientific way of thinking.					

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9.	The inadequacy of a student's science background can be overcome by good teaching.			
10.	The low science achievement of some students cannot generally be blamed on their teachers.			
11.	When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher.			
12.	I understand science concepts well enough to be effective in teaching elementary science.			
13.	Increased effort in science teaching produces little change in some students' science achievement.			
14.	The teacher is generally responsible for the achievement of students in science.			
15.	Students' achievement in science is directly related to their teacher's effectiveness in science teaching.			
16.	If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.			
17.	I find it difficult to explain to students why science experiments work.			
18.	I am typically able to answer students' science questions.			
19.	I wonder if I have the necessary scientific skills.			
20.	Given a choice, I will not invite the principal to evaluate my science teaching.			
21.	When a student has difficulty understanding a science concept, I will usually be at a loss as to how to help the student understand it better.			
22.	I do not know what to do to turn students on to science.			

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23. When teaching in science, I usually welcome students' questions.	
24. When teaching science, I can craft good questions for my students.	
25. I know what to do to get through the most difficult students.	
26. I can help foster student's creativity in science class.	
27. I can control disruptive behaviour in the classroom and science laboratory.	
28. I can motivate students who show low interest in science school work.	
29. I can use a variety of assessment strategies.	
30. I can provide an alternative explanation or example when students are confused.	
31. I have sufficient knowledge about science.	
32. I generally teach science effectively.	
33. I know the steps necessary to teach science concepts effectively.	
34. I know how to assess student performance in a classroom.	
35. I can adapt my teaching based upon what students currently understand or do not understand.	
36. I can adapt my teaching style to different learners.	
37. I can use wide range of teaching approaches in a classroom setting.	
38. I am familiar with common student understandings and misconceptions.	
39. I can select effective teaching approaches to guide student thinking and learning in science.	

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APPENDIX B

List of Malay Schools

No.	Schools' Code	Schools' Name
1.	ABA0001	SK Toh Tandewa Sakti
2.	ABA0003	SK Banir
3.	ABA0004	SK Temoh
4.	ABA0006	SK Bidor
5.	ABA0009	SK Batu Melintang
6.	ABA0012	SK Kampong Pahang
7.	ABA0016	SK Ayer Kuning
8.	ABA0018	SK Sungkai
9.	ABA0019	SK Perlok
10.	ABA0021	SK Aminuddin Baki
11.	ABA0024	SK Changkat Sulaiman
12.	ABA0129	SK Tapah
13.	ABA0130	SK Bidor 2
14.	ABB0045	SK Satu
15.	ABB0046	SK Datuk Kelana
16.	ABB0047	SK Seri Bidor
17.	ABB0048	SK Slim River
18.	ABA0129	SK Tapah
19.	ABA0130	SK Bidor 2
20.	ABA0005	SK Chenderiang
21.	ABA0030	SK Dato Kamariddin
22.	ABA0016	SK Ayer Kuning
23.	ABA0029	SK Slim Village
24.	ABB0049	SK Methodist
25.	ABA0031	SK Felda Sungai Kelah
26.	ABA0033	SK Trolak Timur
27.	ABA0110	SK Trolak Utara
28.	ABA0017	SK Batu Masjid
29.	ABA0032	SK Sungai Behrang

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List of Chinese Schools

No.	Schools' Code	Schools' Name
1.	ABC0054	SJK(C) Kheung Wa
2.	ABC0055	SJK(C) Bukit Pagar
3.	ABC0056	SJK(C) Pekan Getah
4.	ABC0057	SJK(C) Phui Chen
5.	ABC0059	SJK(C) Hwa Lian
6.	ABC0060	SJK(C) Choong Hua 1
7.	ABC0061	SJK(C) Choong Hua 2
8.	ABC0062	SJK(C) Pin Min
9.	ABC0063	SJK(C) Kg Coldstream
10.	ABC0064	SJK(C) Tanah Mas
11.	ABC0066	SJK(C) Kuala Bikam
12.	ABC0071	SJK(C) Behrang Ulu
13.	ABC0072	SJK(C) Chung Sin
14.	ABC0050	SJK(C) Pheng Lok
15.	ABC0053	SJK(C) Chenderiang
16.	ABC0058	SJK(C) Kampong Pahang
17.	ABC0050	SJK(C) Pheng Lok

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List of Indian Schools

No.	**Schools' Code**	**Schools' Name**
1.	ABD0073	SJK(T) Tapah
2.	ABD0082	SJK(T) Ladang Bidor Tahan
3.	ABD0090	SJK(T) Ladang Cluny
4.	ABD0081	SJK(T) Ladang Tong Wah
5.	ABD0077	SJK(T) Sungkai
6.	ABD0078	SJK(T) Slim River
7.	ABD0089	SJK(T) Ladang Kelapa Bali

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APPENDIX C

Dear Principal,

Good Day!!

I am a Master Student in Primary Science Education at Universiti Pendidikan Sultan Idris. I am conducting a research entitled "Measuring Primary Science Teachers' Self-Efficay Beliefs by using Primary Science Teachers Self-Efficacy Beliefs Scale" as a course requirement in the Master course. The purpose of the research is to examine the self-efficacy beliefs of science teachers in Batang Padang, Perak. Therefore, I would like to get your cooperation by encouraging the **Science teachers,** either science major or non-science major (as long as they are teaching subject Science) in your school to participate in the research. The questionnaire is available online at https://www.allcounted.com/s?did=s14brop07buzp. The responses of teachers will be kept anonymous. The summary of the results will be provided so that the school authorities can examine the level of science teachers' self-efficacy compared to the other schools.

I would appreciate the teachers' completion of the questionnaire by June, 30. A follow-up email will be sent to remind the teachers regarding the completion of the questionnaire.

I realise that the schedules of school teachers are busy and their time is valuable. However, I hope that the 15 minutes to complete the questionnaire will lead us to have a better understanding of the Science teachers' self-efficacy in Batang Padang, Perak.

Thank you in advance for the teachers' participation, if there are questions about the study, kindly contact the researcher at 016-4228531.

Yours truly,

Lau Shi Hong

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