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Students' Motivation towards Science Learning and Students' Science Achievement

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Abstract

The aim of this study is to identify the level of students' motivation towards science learning and students' science achievement. This study also identifies gender differences and examine how the students' motivation towards science learning relates with parental education level and students' science achievement. There are 165 respondents involved who have been selected randomly from ten secondary schools in Pahang, Malaysia. A survey questionnaire was utilized in this study and the instrument employed was *Students' Motivation towards Science Learning (SMTSL)*. The result revealed that the students were moderately motivated towards science learning and achieved mid-low achievement in their science subjects. There was a significant difference in the mean of student's motivation towards science learning scores for male students (*M*= 3.5418, *SD*= .44206) and female students [*M*= 3.7133, *SD*= .44106; *t* (163) = 2.361, p= .019]. The female students were significantly more motivated than male students in learning science. The result of the study indicated that students' motivation towards science learning has a significant correlation with students' science achievement (*r* =.354*, r^2=.125, *p*=.000). Finally, recommendations are given to parents, teachers, policymakers and educational administrators, and serve as a means to improve students' science achievement.

Keywords: Students' Motivation, Science Learning, Students' Science Achievement, Gender Differences and Parental Education Level.

Introduction

As a nation which is progressing towards a developed nation status, Malaysia needs to create a society that is scientifically oriented, progressive, knowledgeable, having a high capacity for change, forward-looking, innovative and a contributor to scientific and technological developments in the future. In line with this, there is a need to produce citizens who are creative, critical, inquisitive, open minded and competent in science and technology.

On top of that, science education plays an important role to ensure Malaysians are ready to face challenges of globalization. Through science education, students have the capability to understand scientific knowledge, identify important scientific questions, draw evidence-based conclusions and make decisions about how human activity affects the natural

world (Organization for Economic Cooperation and Development [OECD], 2007). In addition, students who are scientifically literate can easily grasp essential science concept, understand the nature of science, realize the relevance of science and technology in their lives and willing to continue their science study in school, or beyond school (National Research Council [NRC], 2000). It is important for all students to become scientifically literate (Feinstein, 2011; Roberts, 2007). Hence, learning science by the students is an inevitable need in today's world.

The Malaysian science curriculum is formulated based on the needs of the nation as well as global scientific requirements. The Malaysian science curriculum comprises of three core science subjects and four elective science subjects (MOE, 2003). The core subjects are science at primary school level, science at lower secondary level and science at upper secondary level. Elective science subjects are offered at the upper secondary level and consist of biology, chemistry, physics, and additional science. The elective science subject at the upper level is offered to science stream students. The purpose of offering elective science subjects is to prepare students who are more scientifically inclined to pursue the study of science at the post-secondary level. This group of students would take up careers in the field of science and technology and play a leading role in the field of national development.

Science learning includes many factors that are the determinants of science learning quality and process. These can be classified as cognitive factors and affective factors. The cognitive factors include information processing, reasoning ability and academic achievement (Lawson, 2004; Lawson et al., 2006; Schunk, 2000; Yumasak et al., 2007). While for the affective factors that are emphasized in the science education literature are attitude, self-efficacy, anxiety and motivation (Baldwin et al., 1999; Ekici, 2005; Glynn, & Koballa, 2006; Mallow, 2006; Osborne et al., 2003; Uzuntiryaki & Aydin, 2008; Yumasak et al., 2007). In science learning, motivation is the affective factor that is given more concern than the others (Osborne, Simon & Collins, 2003).

Motivation has been recognized as an important construct (Koballa & Glynn, 2007) in the field of science education. Most of the literature also shows us that motivation is a very important factor in science learning. Student's motivation towards science learning makes science learning effective (Sarıbıyık et al., 2004). According to Cavas (2011), student motivation plays a crucial role in science learning, which targeting in promoting student's construction of his/her conceptual understanding of science. There are some factors that will influence students' motivation towards science learning. According to Tuan et al (2005), students' motivation towards science learning may be influenced by six factors, namely: self-efficacy, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation.

Students' motivation towards science learning has contributed a considerable impact on students' science achievement (Pintrich & Schunk, 2002). The academic achievement, success of the students is important because it is strongly linked to the positive outcomes we value the most students. Researches show that academically successful students will have more employment opportunities than those with less education (Rentner & Kober, 2001). Besides, academically successful students are more stable in their employment; more likely to have health insurance; less dependent on public assistance; less likely to engage in criminal activity; more active as citizens and charitable volunteers and healthy (Janelle, 2011).

Moreover, academically successful students may also able to ensure the country's human capital growth which is in line with the national vision and mission.

Problem of Statement

Science and technology are often perceived as fundamental forces behind economic development in industrialized. Malaysia as a developing country should be prepared to join the ranks of developed nations. So, it is important for students to excel in science.

Motivation in science learning is believed to be the vital parts of developing and supporting a lifelong interest in science (National Research Council [NRC], 2000) and develop students' scientific literacy level. In addition, motivation has been identified to have impacts on students' learning (Pintrich & Schunk, 2002) and influence the science students' performance in science (Othman et al., 2009). Researchers (Kamisah et al., 2007) found that motivation in science required further attention because motivation is a predictor to students' involvement in science.

Unfortunately, many studies revealed that student's attitudes, interest, and motivation towards science learning decline throughout their years at school, especially during secondary school years (Galton, 2009; Osborne et al., 2003). From the reports of performance in science learning in Malaysia, it is found that students' lack of interest and declining ability to do science (Kong, 1993; Lee, 1989; MOE, 1998). Furthermore, some of the studies have shown that the students had negative attitude towards science learning (Aziz & Hui Ling, 2010) and students' scientific attitude between gender, ethnicity and across educational levels is found to be low (Kamisah et al., 2007).

The students' motivation towards science learning was found that it has considerable impact on students' scientific attitude and achievement (Cavas, 2011). It is found that there are numerous factors affecting students' motivation towards science learning. Many researchers have investigated different factors that will influence students' motivation towards science learning such as gender (Akbaş & Kan, 2007; Azizoğlu & Çetin, 2009; Bolat, 2007; Debacker & Nelson, 2001; Yilmaz & Cavas, 2007), parental education level (Bolat, 2007; Davis-Kean, 2005; Dubow, Boxer & Huesmann, 2009) and academic success (Akbaş & Kan, 2007; Patrick et al., 2007). In Malaysia context, there are some researchers (Ahmad, Rohandi, Azman, 2010; Aziz & Ling, 2010; Kamisah et al., 2007; Paniandi, 2009; Zanaton, Lilia & Kamisah, 2006) who carried out research on students' attitude towards science learning in Malaysia. However, the situation seems to be less clear regarding what concerns the students' motivation towards science learning in Malaysia and the factors - gender, parental education level and academic success that will influence the students' motivation towards science learning.

In the recently released 2011 Trends in International Mathematics and Science Study (TIMSS), Malaysia's ranking in Science fell by an ever greater margin, from 21st in 2007 to 32nd in 2011. In terms of marks scored, Malaysia was the poorest performing nation of the 59 country survey by showing the biggest decline since the study was first conducted in 1999. Malaysia's average score for science dropped 66 points from 492 in 1999 and then another decline to 426 in 2011. Besides, it was found that low students' science achievement in biology, chemistry and physics in government examination, SPM amongst the pure science

stream students in Pahang. In this sense, the present study is carried out to examine the relationship between students' motivation towards science learning and students' science achievement.

Research Objectives

The main purpose of the present study is to determine the relationship between students' motivation towards science learning and students' science achievement.

Literature Review

In the early 1960's, many learning and instructional theories were being developed. Albert Bandura and his researchers recognized that many overlooked an important aspect of learning, the observation of others. From this, began the Social Cognitive Theory. The Social Cognitive Theory started as the Social Learning Theory in the 1960s. With the publication of Social Foundations of Thought and Action: A Social Cognitive Theory, Bandura (1986) advanced a view of human functioning that accords a central role to cognitive, vicarious, self-regulatory, and self-reflective processes in human adaptation and change. Thus, the Social Learning Theory was developed by Bandura into the Social Cognitive Theory in 1986 and later extended by the other researchers (Pajares & Shunk, 2001; Pintrich, 2003). The Social Cognitive Theory defines learning as an internal mental process that may not be reflected in the immediate behavioural change (Bandura, 1986).

Bandura (1986) view human functioning as the product of a dynamic interplay of personal, behavioural, and environmental influences. For example, how people interpret the results of their own behaviour informs and alters their environment and the personal factors they possess which, in turn and alter subsequently. This is the foundation of Bandura's (1986) conception of reciprocal determinism, the view that a) personal factors in the form of cognition, affect, and biological events, b) behaviours, and c) environment influences creates interactions that results in a triadic reciprocal.

In classroom, the three factors (behavioural factor, cognitive, affective, and biological event - personal factor and environment factor) typically interact. For example, a teacher presents a lesson to the class, students reflect on what the teacher is saying (environment influences cognition). Students who face problems and do not understand a point of the lesson, they raise their hands to ask questions to the teacher (cognition influences behaviour). The teacher reviews the point (behaviour influences). At the end of the lesson, the teacher gives student exercises to accomplish (environment influences cognition which influences behaviour). As students work on the task, they believe they are performing it well (behaviour influences cognition).

Motivation

In science learning, motivation has been recognized as an important construct (Koballa & Glynn, 2007) and as an important key to make learning effective (Sarıbıyık, Altunçekiç & Yaman, 2004). As Gardner (2000) mentioned that, *"If one is motivated to learn, one is likely to work hard, to be continual, to be stimulated rather than discouraged by obstacles, and to continue to learn even when not pressed to do so, for the sheer pleasure of quenching curiosity or stretching one's faculties in unfamiliar directions*" (p. 76).

Motivation is a complex, multidimensional construct that interacts with cognition to influence learning (Taasoobshirazi & Sinatra, 2011). Since motivation is an important key to a successful learning (Sarıbıyık, et al., 2004), thus, what is the motivation and how is motivation related to learning? In particular, motivation to learn refers to the deposition of students to find academic activities relevant and worthwhile and to try to derive the intended academic benefits from them (Brophy, 2004; Glynn et al., 2009). Students who are motivated to learn will maintain themselves in being interested and paying attention, thus they are willing to make an effort and taking the necessary time to learn, focusing and devoting on the subjects, not giving up doing demanded behaviour in difficult circumstances, insisting on bringing it to the end and resolution are then observed. It is considered that bearing all these difficulties would influence the students' achievement.

Motivation to learn science is defined as an internal state that arouses, directs, and sustains science-learning behaviour, motivation to learn science promotes student construction of their conceptual understanding of science (Cavas, 2011). In studying the motivation to learn science, science education researchers attempt to explain why the students strive to learn science, how intense they strive, how long they strive and what beliefs, feeling, and emotions characterize them in this process (Robert et al., 2011).

Students' Motivation towards Science Learning

Motivation towards science learning may be defined as a desire of science learning (Bolat, 2007). According to Patrick, Mantzicopoulos and Samarapungavan (2009), students start forming their motivation towards science learning during their first year of school. The student's motivation towards science learning was found to have a considerable impact on their science attitude and achievement (Cavas, Factor affecting the motivation of Turkish primary students for science learning, 2011).

Student's motivation towards science learning may be affected by various factors. Lee and Brophy (1996) investigated students' motivation patterns in science learning by classifying it, which range from students who were intrinsically motivated students who had disruptive behaviour through a qualitative method. Similarly to them, Barlia and Beeth (1999) also investigated motivation patterns, but their research was on college physic science learner. Researcher, Erb (1996) found out high school students' lack of motivation in learning science which are caused by: the students' lack of responsibility, low self-esteem, and students family destruction. However, other researchers (Barlia & Beeth, 1999; Hynd et al., 2000) identified the factors that influence students' motivation in learning science included students' own interests towards the subjects and the grades they received in class; students' interpretations of the nature of the task; students' success or failure to make progress in scientific understanding; and students' general goal and affective orientations in science class and achievement of scientific understanding. The present study examines the relationship between students' motivation towards science learning and students' science achievement

Methodology

The research design of this study is a quantitative survey study. The descriptive statistics are used to analyse data of the students' motivation towards science learning and students' science achievement. This study is done in ten secondary schools in Pahang, Malaysia. All of the schools are government based secondary schools that involved applied KBSM and using

the same syllabus. To determine the population of the present study, the researcher contacted the respective science (biology, chemistry or physic) teachers of ten secondary schools in one district in Pahang. The researcher obtained the form four pure science stream students name list from the respective science teachers of the ten secondary schools. From the name list received, the population of the present study was determined. It was found that there are 282 form four pure science stream students from ten secondary schools in one district in Pahang. To determine the sample size, according to Krejcie and Morgan (1970), when the population for the research is 282, then the sample size is 165. Thus, a total of 165 students from form four pure science stream in the year of 2013 participated in the present study. The sampling technique that used in the present study is simple random sampling, in which all the form four pure science stream students of the population has an equal and independent chance of being selected as a member of the sample.

The questionnaires consist of students' background that includes gender, mother's and father's education level and average score for science subjects (biology, chemistry, and physics) midterm examination of the year 2013. The result of average score for science subjects of the midterm examination is taken as an indicator of students' science achievement. Low achievement means that the students are doing poorly and getting low scores below 39 marks for their science subjects (Biology, Chemistry and Physics) in midterm examination. Mid-low achievement means the students are getting the scores within the range of 40 to 49 marks. Middle achievement means the students are getting the score within the range of 50 to 64 marks. Mid-high achievement means the students' scores are within the range of 65 to 74 marks and high achievement means the student is doing well in the midterm examination, especially with a score of 75 marks and above in science subjects in the midterm examination. A pilot study is carried out on 30 respondents and Alpha Cronbach's for the adapted questionnaire on *Students' Motivation towards Science Learning (SMTSL) was* $\alpha = .84$.

Results and Discussion

The finding of this study found that most of the students were moderately motivated towards science learning, with 69.1% (n = 114) of them fell into this range. 24.8% (n = 41) of them were low motivated towards science learning. While only 6.1% (n = 10) have high motivation towards science learning. This finding may give an inducement to the students to be more motivated in science learning. Moreover, this finding may help educators to understand that the students were moderately motivated in learning science and educators may be persuaded to think of solutions to raise students' motivation. In addition, educators may be more sensitive and conscious about preparing a conducive environment which provides high motivation level to them.

The findings of this study found that most students, 37.0% (n= 61) achieved mid-low achievement in their midterm examination of the year 2013. 24.2% (n = 40) of the students achieved middle achievement, 18.8% (n = 31) of the students had achieved mid-high achievement, and 10.9% (n = 18) of the students achieved low achievement. Least of the students, 9.1% (n = 15) are able to achieve high achievement in science. This finding may help us to understand better about science achievement among the students.

As mentioned in the literature review, there have been conflicting findings about gender differences in students' motivation towards science learning. Some studies show that

no gender differences on students' motivation towards science learning (Organization for Economic Co-operation and Development [OECD], 2007; Akbaş & Kan, 2007; Albert, 2010; Zeyer & Wolf, 2010; Karaarslan & Sungur, 2011; Mustafa, 2012; Sarwat, Safia & Col (R), 2013).

However, some studies show that there were differences in students' motivation towards science learning based on gender. For example, Simpson and Oliver (1985) determined that the female students have higher motivation in learning science than their male counterparts. Similarly, Zamrud (2008), Ikhwan et al. (2009), Güvercin et al. (2010), and Cavas (2011) also found *that female students have high motivation towards learning science than male students.*

The findings of the present study are consistent with those of Simpson and Oliver's (1985); Zamrud (2008); Ikhwan et al (2009); Güvercin et al (2010); Cavas (2011) which found that there was a significant difference between male and female students in students' motivation towards science learning. The female students have high motivation towards science learning compared to male students. Moreover, female students also obtained higher mean scores on the students' motivation towards science learning scale. This finding is in agreement with Cavas (2011) findings, which showed that female students obtain a higher mean score if compare to male students.

However, there were also some studies which showed that male students are, on average, more motivated to learn science than female students (Zeyer et al., 2011; Cavallo et al., 2004). Therefore, concerning gender differences in students' motivation towards science learning, related literature revealed mixed results and needs further investigation.

This study set out with the aim of assessing the relationship between students' motivation towards science learning and students' science achievement. On the question of: - "Is there any significant relation between students' motivation towards science learning and students' science achievement?" This study found that the students' motivation towards science learning has a significant correlation with students' science achievement. This study produced results which corroborate the findings of a great deal of the previous work in this field such as Alexande, Natriello, and Pallas (1985); Athman and Monroe (2004) found that there is a link between motivation and achievement, Patrick et al (2007); Sevinc et al (2011) found that students' motivation influenced the students' achievement in science. This finding also consistent with Robert et al (2011), she found that there was a significant relationship between level of motivation and science achievement.

In reviewing the literature, students who have high motivation to learn science are having a higher level of achievement in science than those that are less motivated to learn the content (Glynn et al., 2009; Patrick et al., 2007). This is because a highly motivated person as one who is also developing high levels of internal achievement and excellence and more likely to be "engaged in learning in a deeper, more self-regulating fashion" (Athman & Monroe, 2004). The current study found that the students are moderately motivated in learning science. Therefore, the students achieved mid-low achievement in science. One of the issues emerging from this finding is – in order to improve students" science achievement it is crucial to increase students" motivation towards science learning. Further studies need to focus on how to motivate science stream students towards science learning.

In addition, the findings of the current study corroborate the ideas of Tuan, et al (2005) and Betul Sevinc, et. al (2011), who found that all of the scales have a correlation with students' science achievement. Among the scales, active learning strategies have the highest correlation with students' science achievement. This finding slightly differs from the previous studies (Tuan et al., 2005; Schunk, 1991) which showed that self – efficacy has the highest correlation with the students' achievement. The performance goal has the least correlation with the students' science achievement which is consistent with (Sevinc et. al., 2011). The findings of the current study have important implications for educators to promote active learning strategies during the teaching and learning process such as hands-on activities.

Implications of the Study

The findings of the current study helps to provide a comprehensive understanding of students' motivation towards science learning. Through this study, the students' motivation level towards science learning and students' science achievement were identified. The findings of this study may lead students to understand better about their motivation level towards science learning and how students' motivation towards science learning relates to their science achievement. Students' motivation influences their achievement in science. Oliver and Simpson (1988) concluded that science motivation predict academic success. Patrick et al (2007) suggested that motivation has a strong influence on students' achievement in science. The findings showed that there was a significant relation between students' motivation towards science learning and students' science achievement. The students were moderately motivated towards science learning. Therefore, they achieved mid-low achievement in science. This finding revealed that there is a link between motivation and achievement in agreement with studies carried out by (Alexande et al., 1985; Athman and Monroe, 2004). This finding has implication for the students that help them to realize that there is a link between their motivation towards science learning and their achievement in science. Students should be given an inducement to be more motivated in science learning especially for those who have low motivation in science learning in order to achieve higher achievement.

Students' motivation is a tool used by researchers to clarify the degree in which students show effort and interest in their pursuits, regardless of whether the tasks are desired by the teacher or not (Brophy, 2004). The findings of this study showed that students were moderately motivated in learning science. This finding showed that the students show effort and interest moderately in their pursuits and the tasks that are desired by teachers. Therefore, a definite need for educators to understand what motivates the students in class. Educators can make a difference to motivate students in learning science, such as give suitable rewards or advices to students and make them feel they are being cared and loved in class. Furthermore, educators should be more sensitive and conscious about preparing a conducive environment which provides the high motivation level to students.

The finding of the study showed a significant difference in students' motivation towards science learning in male and female students. The female students have higher motivation in learning science compared to the male students. This is another important practical implication for educators. Educators need to consider the expectations that they have on students of both sexes and make a distinction in the approach needed to handle different gender. Based on the report of OECD (Artelt et al., 2003) shown that male students need to

be helped towards a more positive approach to reading, which requires them to see it as a useful, profitable and enjoyable activity. Therefore, educators may conduct their teaching which would enhance motivation by establishing relevance. Educators may establish the relevance of what is taught through real-life examples and relating materials to everyday application, drawing cases from current newsworthy issues, giving local examples (establish relevance to local cases) and relating theory to practice (how theory can be applied in practice) (Kember & McNaught, 2007).

The findings showed that no significant relationship between students' motivation towards science learning and parental education level. Specifically, the students' motivation towards science learning is not influenced by parental education level. However, there is one of the factors that may influence students' motivation towards science learning, which is learning environment (stimulation). Accordingly, programmes can be developed to increase parents' awareness about the important of creating home environment that stimulates their children's thinking. As well as, schools can help parents to create such support home environments, provide learning materials and fun experience for their children (Pintrich & Schunk, 2002). This may increase children motivation and interest towards science learning.

It is found that students' motivation towards science learning have a significant relation to students' science achievement. The finding of this study showed that students who have moderate motivation to learn science have mid-low achievement in science. The finding reported in this study justify the importance of students' motivation towards science learning to students' science achievement. This evidence describes the prediction of students' science achievement by students' motivation towards science learning in the consensus of the literature. This finding revealed that the students' motivation towards science learning is a significant predictor of students' science achievement in agreement with studies carried out by (Oliver and Simpson, 1988; Akbaş and Kan, 2007). Therefore, it could be suggested that students' motivation towards science learning have an important effect on students' achievement, and also an important component of educational and instructional processes. Moreover, it is also found that all of the scales have a correlation with the students' science achievement. Among the scales, active learning strategies have the highest correlation with students' science achievement. Thus, these findings have implication for the educators that they should try as much as they could to motivate their students towards science learning, especially they are encouraged to promote active learning strategies such as hands–on activities in order to improve students' science achievement. Besides, the parents as well as the government should engage in programmes that can motivate the students to improve students' science achievement.

Contribution of this study will lead students to understand better about their level of motivation towards science learning. Students will be given an inducement to be more motivated in science learning especially for those who have low motivation in science learning. Moreover, the findings of the present study will help educators to understand students' motivation level towards science learning. Research in students' motivation level towards science learning is crucial because it helps explain achievement differences among students and serve as a means to improve students' science achievement. The educators may be even more sensitive and conscious about preparing a conducive environment which provides high motivation level to their students. Central to understanding students'

academic success and social adjustment in academic settings is motivation. Current views of learning underline that not only cognition but also students' motivation and volition are crucial factors for successful learning and achievement (Wolters, 2003). Both skill and will are needed in learning along with environmental and social support (Zusho et al., 2003). Students' motivation is manifested in their active engagement in the learning process, eager approach of challenging learning tasks, intense effort spent through the use of active learning strategies, and persistence in achieving learning and problem solving in the face of difficulties (Zimmerman & Schunk, 2008).

Besides, this study may also help educators to have better understanding on how students' motivation towards science learning differ accordingly to their gender, and students' science achievement have a significant correlation with students' motivation towards science learning. The educators must make a distinction in the approach needed to handle students from different gender and different level of academic achievement. This could significantly contribute to differentiating educational material and practices appropriately as well as implementing more effective teaching methods on the different types of students. Finally, it is hoped that these findings may serve as resource materials for science educators, scientist, school authorities, psychologists, counselors, government, parents and significant others who are concerned with the academic progress of the students.

Conclusion

In order to understand better about students' motivation towards science learning, the future research should be conducting future qualitative research.

Qualitative methods should be considered when the research aim to assess the interaction of different environmental and social factors among the students. If the students with low motivation, to what extent can instructional methods foster their motivation? What are the ways to increase students' motivation towards science learning? In addition, it is recommended that for future research it may involve more respondents in other areas.

Still another direction for future research is to measure the students' science achievement; the future researchers should be incorporating multiple measures of science achievement. The inclusion of only one measure, science achievement (average score for science subjects) of the pure science stream students in the midterm examination of was a limitation of this study, and it would be desirable in future research to include additionally, more specific measures such as the government examination, namely SPM.

It is essential that students' motivation towards science learning among the students be assessed. Students' motivation towards science learning can lead students to scientific literacy - understand scientific knowledge, identify important scientific questions, draw evidence- based conclusions, and make decisions about how human activity affects the natural world. Indirectly, students' motivation towards science learning play an important role to prepare the students who were scientifically literate that would take up careers in the field of science and technology and play a leading role in the field of national development. Students' motivation towards science learning can also lead students to become more successful. It is found that students' motivation towards science learning have contributed a considerable impact on students' science achievement (Pintrich & Schunk, 2002) and influence the science students' performance in science (Othman et. al., 2009). Successful

academic achievement amongst the students is important because it is strongly linked to the positive outcomes that we value of the most students.

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