

Attitude towards Physics and Additional Mathematics Achievement towards Physics Achievement

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Abstract

The purpose of this research is to identify the difference in students' attitude towards Physics and Additional Mathematics achievement based on gender and relationship between attitudinal variables towards Physics and Additional Mathematics achievement with achievement in Physics. This research focused on six variables, which is attitude towards Physics, career related to Physics, importance of Physics, difficulty of understanding Physics, Physics teachers and Physics equipment usage. The respondents consist of 203 Grade 10 students in science stream who are taking Physics as an elective subject. This research was done in secondary schools in the district of Kota Bharu, Kelantan. A questionnaire was used to gather the data regarding six aspects (24 items). The items from Prokop, Tuncer, and Chuda (2007) were translated and used to determine the students' attitude towards Physics. The findings showed a significant difference in students' interest towards Physics, career related to Physics, importance of Physics, difficulty of understanding Physics, Physics teachers and Physics equipment usage whereby the male students are higher compared to female students. Meanwhile there was no difference between students' attitude towards the importance of Physics and achievement in Additional Mathematics. There is a strong relationship between Additional Mathematics achievement and Physics achievement followed by interest towards Physics and difficulty of understanding Physics. Meanwhile the relationship between students' attitude towards career related to Physics, importance of Physics, Physics teacher and Physics equipment usage is not significant towards Physics achievement. Physics teachers should give more emphasis in not only the learning of Physics but more importantly on students' attitude towards the learning of Physics.

Keywords: attitude towards Physics, career related to Physics, importance of Physics, difficulty of understanding Physics, Physics teachers

1. Introduction

Ministry of Education (MOE) has targeted 60% of the form four and form five students to be streamed in the Science and Technology while 40% in the Social Sciences. This target has to be achieved in the year 2010 as posited by the Minister of Education in his 2001 New Year speech (Education Policy Plan & Research Division, 2003). Physics as one dynamic discipline of science is always developing and flourishing rapidly. The concepts and principles of Physics are applied in various daily activities such as in the technology of transportation, communication, power generation, and space discovery and exploration. Physics has contributed so much towards the development and concordance of our lives especially in this era of Science and Technology. In secondary schools, Physics is taught in two years starting from form four and ends when the students are in form five. Physics is taught to enable students to grasp its concept and principles in depth along with how this knowledge can be applied in their daily lives (Curriculum Development Center, 2002). The streaming of students in the secondary schools mainly depends on students' attitude towards Science during lower secondary level schooling. Learning and mastering Physics have become important since Malaysia started her space exploration in 2007.

1.1 Problem Statement

Physics is unpopular and known to be a boring subject among students in secondary schools especially in the rural areas. If this phenomenon is not addressed and is ignored, students who are neither interested nor motivated to learn this subject will increase and this will lead to negative attitude and perception towards Physics (Business Coalition for Education Reform (2002). Furthermore, according to Guzel (2004), the decrease in Physics academic achievement is alarming. The outstanding factor that caused this is the students' attitude towards

Physics (George, 2006).

In schools, teachers have always commented that failure in Physics achievement by some students is due to their negative attitude and lack of interest towards the subject. Attitude affects internal motivation which in turn affects the academic achievement and students' participation in school (Visser, 2007). Physics has always been perceived as a tough subject compared to its other two pure science counterparts, Biology and Chemistry. Physics is not only difficult to be grasped but students also consider finding the solutions to solve any problems related to Physics as complicated (Seth, Fatin, & Marlina, 2007). Kessels, Rau, and Hannover (2006) found that female students lack interest in Physics compared to male students. Female students claimed that Physics is difficult for them because the subject tends to favour the masculine nature.

The Malaysian Certificate of Education (MCE) result for Physics in the Kota Bharu district showed a decrease in students obtaining grade A where there were only 12.3% in 2005 and consecutively decreased to 10.6% and 7.4% in 2006 and 2007. The average number of students obtaining grade A in Physics for MCE in the special programme secondary schools for 2006 was 16.2% which declined to 14.9% in 2008. The Additional Mathematics MCE result also showed a decrease in students obtaining grade A that is 18.9% in 2006 and 17.8% in 2007. Meanwhile the overall Additional Mathematics result for the state declined from 96.4% in 2007 to 95.3% in 2008 (Kelantan State Department of Education, 2009). Lim (2011) claimed that the 1967 National Education Policy Act which planned to allocate students in science stream and social science stream in the ratio of 60:40 has never been achieved until now. This shows that students are still unequipped to be streamed in the Science discipline which require an excellent achievement in the Science and Mathematics subjects.

1.2 Theory of Attitude

Rosenberg and Hovland (1960) claimed that attitude is the intermediary for all types of reactions which can be categorized into three main components namely emotion, cognitive and behaviour. These three components explain students' attitude towards learning. According to Goleman (1995), a student's level of Emotional Quotient (EQ) is the main factor towards his/her success where 20% of a student's success depends on IQ while the other 80% depends on how a student manages his/her emotion effectively. Cognitive attitude refers to how information is processed, use of knowledge and change towards choices in the human mind. A cognitive process may exist in its natural form or may be consciously or unconsciously developed. Therefore, cognitive attitude is a reaction based on knowledge to clarify the concept which will be perceived and practiced.

1.3 Students' Attitude towards Physics Based on Gender

Narmadha and Chamundeswari (2013) investigated attitude towards learning Science and science achievement among secondary school students from different types of schools in the city of Chennai, India. The attitude towards Learning of Science Scale (Grewal, 1972) was used to assess the attitude towards learning Science and the marks scored in Science were taken from their half yearly performance. The girls were found to be better in their attitude towards learning of Science when compared to the boys in all categories of schools.

Fatoba and Aladejana (2014) in their study examined the gender on students' attitude in Physics in senior secondary schools in Oyo State, Nigeria. The participants for this study were 160 senior secondary school two (SSS2) students offering Physics in Ibadan, Oyo State. It was found that there was a slight difference in attitude among the students in favour of females in Physics.

Shaw (2003) in his study identified the relationship between students' attitude towards Physics with their achievements in Physics. The finding showed that there is a relationship between attitude and achievement for female students but not for male students. The result showed that there is no difference in attitude between male and female students towards Physics. A study by Lena (2005) showed that male and female students who achieved high grades in Mathematics do not differ in terms of their attitudes towards Mathematics. For Physics, female students who showed positive attitude obtained better results compared to male students.

A study by Visser (2007) found that students' attitude towards Science, especially the female students, decreased when they entered secondary schools. The female students' attitude towards Physics was found to be low and they commented that learning Biology was more enjoyable. A study by Nur Asyiqin (2004) showed that there is a difference in terms of attitude dimension between male and female students.

The findings in the study by Pell and Manganye (2007) showed that there is no difference between attitude and gender among African students. However, in a study by Pell and Jarvis (2001) found that male students recorded a much higher positive attitude compared to female students. Male students, consistently, have a more positive attitude towards Science compares to female students. This situation is prominent in Physics compared to in Biology (Visser, 2007). A study by Nur Asyiqin (2004) conducted at that Matriculation College showed that

there is no gender difference in attitude towards teaching and learning of Mathematics.

Kessels, Rau, and Hannover (2006) found that female students lack interest in Physics compared to male students. Female students have a higher negative attitude towards Physics compared to male students. Female students claimed that Physics is difficult for them because the subject tends to favour the masculine nature. According to Marsh and Tapis (2002), the difference in students' attitude in terms of gender will result in difference in achievement and readiness to achieve learning target. Based on the study done by Johnson (1987), Physics and Mathematics are said to be in contrast to the female natural being that are known to have feminine characteristics. Male students showed more positive attitude towards subjects that are considered as masculine compared to female students who are more positive towards subjects which are more feminine such as Biology.

Male students, as a whole, show a higher positive attitude towards Physics compared to female students. They also have the inclination to choose a Science and Technical related career (Krogh & Thomsen, 2005). A study by Sgoutas, Nagel, and Scott (2005) conducted on 148 science students in San Diego found that female students have a higher negative attitude compared to male students. Male students tend to use science equipment's more and participated in activities related to science (Guzzetti & Williams, 1996). The findings by Kahle and Lakes (1983) showed that a higher number of female students gave a negative view of science and careers related to science. Majority of female students opined that science classes are boring and they only need to memorize facts to secure good grades whereas careers related to science are perceived as having to do a lot of work.

1.5 The Relationships between Attitude towards Physics and Physics Achievement

A study by Ali and Awan (2013) to examine the relationships of attitude towards Science with the achievement in Physics, Chemistry, Biology and Mathematics. TOSRA was used to measure students' attitude towards Science among 10th grade students. The study indicated that attitude towards Science has a positive relationship with the science achievement among secondary school students. Narmadha and Chamundeswari (2013) determined a positive relationship between attitude towards learning Science and achievement among the secondary school students.

A study by Haniza (2003) conducted in one of the Technical Higher Institutions, which aimed to determine attitude and motivation towards the English language, found that there is a significant relationship between attitude and academic achievement. This finding concurred with a study conducted by Thompson, Lokan, Lamb, and Ainley (2001), which showed that students who have positive attitude towards Mathematics and Science obtained better results in Mathematics and Science. They also found that it is important to inculcate in the students positive attitude towards Mathematics and Science if they want their students to obtain good achievements. This opinion is supported by Magno (2003) in his study which showed that students who have positive attitude towards Physics achieved good grades in Physics. A study by Sharma, Rosemary and Wilson (2006) on 60 students found that there is difference in attitude towards Physics among students where positive attitude is higher than negative attitude. For positive attitude, students perceived Physics as important and useful whereas for negative attitude, students claimed that Physics is not important. Positive attitude towards Physics showed a positive relationship with good achievement in Physics.

A study done by Sharma et al. (2006), found that 42% of the respondents have no background knowledge to Physics but majority of them have good perception of Physics. The students' positive attitude towards Physics showed positive relationship with students' achievement. The students are able to understand and further explain the concept of Physics and thus make the teaching and learning environment of Physics more effective. This study found that the level of ability at problem solving in Physics is related to the students' interest towards the subject. Students who are interested in Physics scored high marks in their assessments. A study by Thompson et al. (2001) showed that good achievement is important for students who are interested in Mathematics and Science. They have the confidence to do the best whereas those who are uninspired and bored, generally, obtained lower grades.

The findings by Azizi, Jamaluddin, and Yusof (2000), showed that, in general, the relationship between attitude and achievement is weak although the study showed that there is positive relationship between attitude towards science and the achievement in science. The study by Mior, (2002) on the other hand, proved that attitude towards science differ in terms of school streaming and school category but there is no difference in terms of gender. Visser (2007) in his study claimed that the decision to choose Physics depends very much on the students' achievement in Science and Mathematics. The students perceived Physics as for those who are intelligent and that Physics is a very difficult subject. This study also found that attitude towards science has no relationship with achievement in science. The students were found to achieve good grades in science without having any positive attitude towards science.

1.6 Relationship between Achievement in Mathematics and Achievement in Physics

Guzel (2004) in his study identified the relationship between achievement in Physics and students' attitude towards Mathematics. The result of the study found that female students showed a higher positive attitude towards Mathematics compared to male students. A study by Seth et al. (2007) found a relationship between students' attitude towards Mathematics and their achievement in Physics. The higher positive attitude they have towards Mathematics, the better grades they obtain in Physics and the higher grades they obtain in Mathematics the better they are at solving problems in Physics.

1.7 Research Questions:

Is there any difference between attitudinal variables towards Physics and achievement in Additional Mathematics in terms of gender?

Is there any difference between attitudinal variables towards Physics and achievement in Additional Mathematics with the achievement in Physics?

2. Methodology

2.1 Respondents

The respondents of the study are form four students in two daily urban secondary schools of special program class. 203 students participated in this study which comprised of 93 (45%) male students and 110 (55%) female students. All the students studied Physics, which is an elective subject for grade 10 science stream students.

2.2 Instruments

The instrument to measure the relationship between Physics and achievement in Additional Mathematics with achievement in Physics was taken from a study done by Prokop, Tuncer, and Chude (2007). The instrument was adapted and translated to Bahasa Malaysia and re-translated to the English language following Brislin's (1970) method. It consists of six variables namely interest towards Physics (5 items), career related to Physics (5 items), importance of Physics (5 items), Physics teachers (3 items), difficulty in Physics (3 items) and Physics equipments usage (3 items).

Achievement in Additional Mathematics and Physics is measured based on the scores the participants obtained in their final year examination. Students' attitude is measured by using the 5-point Likert Scale which are; totally disagree (1), disagree (2), slightly agree (3), agree (4) and totally agree (5). This instrument contains items which relate to gender, and scores for Physics and Additional Mathematics obtained in the final examination.

2.3 Pilot Study

The pilot study involved 30 grade 10 secondary school students in stae of Kota Bharu, Malaysia. All the items showed a high item correlation value where the Cronbach Alpha value for the six variables that are interest towards Physics, attitude towards career related to Physics, attitude towards the importance of Physics, attitude towards Physics teachers, the difficulty of Physics and Physics equipment usage are 0.84, 0.69, 0.85, 0.84, 0.76 dan 0.82 respectively (Table 1). The alpha value for attitudinal variables towards Physics is more than 0.70 and the alpha value for reliability exceeds 0.69 which means it is suitable to be used in this study.

Table 1. Reliability value according to attitudinal variables towards Physics

Attitude	Item	Corrected Item Total Correlation	α
1. Interest	5	.58 .61 .66 .83 .59	0.84
2. Career	5	.19 .83 .35 .57 .37	0.69
3. Importance	5	.81 .55 .72 .78 .48	0.85
4. Teachers	3	.78 .76 .64	0.84
5. Difficulty	3	.64 .54 .62	0.76
6. Equipments	3	.58 .72 .75	0.82
Total	24		0.92

2.4 Data Collection and Analysis

A total of 214 questionnaires have been distributed to schools and 203 responses were gained. The procedure and

date for Physics teachers to distribute and collect the questionnaires were given by the researcher. The students were given 15 minutes to complete the questionnaire. Data related to students' achievements in Physics and Additional Mathematics were obtained from their final year examination with the permission of the State Education Department. The final examination questions were prepared by the Principal Council for Kota Bharu district. The data was analysed using the Statistical Packages For Social Sciences (SPSS) Version 16, t-test and Pearson Correlation. Besides these, d (size effect) is also used in this study. Cohen (1988) suggested size effect in three categories namely small size effect ($d = 0.20$), average size effect ($d = 0.50$) and large size effect ($d = 0.80$).

3. Findings of Study

Levene's test is not significant ($p > .05$). This showed that equal variances assume between male and female students. Independent sample t-test is a significant ($t(201) = 4.14, p < .05, d = .61$) with average size effect. This shows that there is significant difference in interest towards Physics between gender. The finding showed that the score of male students ($M = 3.91, SD = 0.56$) in interest towards Physics is higher than female students ($M = 3.57, SD = 0.59$). Students' attitude towards career related to Physics is a significant ($t(201) = 4.76, p < .05, d = .82$) with large size effect. This showed that the score of male students ($M = 3.76, SD = 0.77$) in career related to Physics is higher than female students ($M = 3.21, SD = 0.86$). Attitude towards Physics teachers is a significant ($t(201) = 2.63, p < .05, d = .57$) with average size effect. This shows that attitude towards Physics teachers for male students ($M = 4.05, SD = 0.57$) is higher than female students ($M = 3.80, SD = 0.73$). Students' attitude towards the difficulty in Physics based on gender is also significant ($t(201) = 4.56, p < .05, d = .64$) with average size effect. This shows that female students ($M = 2.91, SD = 0.66$) face difficulty in Physics more than male students ($M = 3.35, SD = 0.72$). Students' attitude towards usage of Physics equipments between genders is significant ($t(201) = 3.70, p < .05, d = .54$) with average size effect. This shows that male students' ($M = 3.85, SD = 0.66$) attitude towards usage of Physics equipments is higher than female students ($M = 3.46, SD = 0.77$). Students' attitude towards the importance of Physics based on gender is not significant ($t(201) = 1.59, p > .05, d = .23$). This shows that there is not significant difference between the importance of Physics in terms of gender. For achievement in Additional Mathematics, Independent sample t-test showed that it is not significant different based on gender ($t(201) = -0.51, p > .05, d = -.07$) with small size effect (Table 2).

Table 2. Result of difference in students' attitude towards Physics based on gender

Hypothesis	Physics attitude	Gender	Mean	SD	df	t	p
Ho (1)	Interest	Male	3.91	0.56	200	4.14	.00*
		Female	3.57	0.59			
Ho (2)	Career	Male	3.76	0.77	201	4.76	.00*
		Female	3.21	0.86			
Ho (3)	Importance	Male	3.94	0.54	200	1.59	.11
		Female	3.81	0.57			
Ho (4)	Teachers	Male	4.05	0.57	201	2.63	.01*
		Female	3.80	0.73			
Ho (5)	Difficulty	Male	3.35	0.72	201	4.56	.00*
		Female	2.91	0.66			
Ho (6)	Equipment's	Male	3.85	0.66	200	3.70	.00*
		Female	3.46	0.77			
Ho (7)	Additional Mathematics marks	Male	49.83	15.74	201	-0.51	.61
		Female	50.87	13.61			

* $p < .05, p > .05$.

The correlation result shows that here is positive significant relationship between students' interest towards Physics and their achievement in Physics ($r = .24, p < .05$). This finding shows that students who have high

interest in Physics obtain good grades in Physics and those who have low interest in Physics obtain low grades in Physics. The result finding showed positive significant relationship between students' attitude towards difficulty in Physics and Physics achievement ($r = .19, p < .05$). There is also positive significant relationship between achievement in Additional Mathematics and achievement in Physics ($r = .74, p < .05$). The correlation test result showed that there is no significant relationship between students' attitude towards career related to Physics ($r = .03, p > .05$), attitude towards the importance of Physics ($r = .06, p > .05$), attitude towards usage of Physics equipments ($r = .02, p > .05$) and achievement in Physics (Table 3).

Table 3. Determine the relationship between attitudinal variables with achievement in Physics and Additional Mathematics with achievement in Physics

Students' Attitude Towards Physics	Achievement in Physics
Interest towards Physics	.24**
Attitude towards career related to Physics	.03
Attitude towards the importance of Physics	.06
Attitude towards Physics teachers	.00
Attitude towards difficulty in Physics	.19**
Attitude towards usage of Physics equipments	.02
Marks for Additional Mathematics	.74**

** $p < .01, p > .05$.

4. Discussion and Implication

4.1 Students' Attitude towards Physics Based on Gender

The findings showed that there are five attitudinal variables towards Physics based on gender namely interest towards Physics, students' attitude towards career related to Physics, students' attitude towards Physics teachers, students' attitude towards difficulty in Physics and students' attitude towards usage of Physics equipments. There is difference in students' attitude towards Physics in terms of gender. Male students are more interested in Physics than female students. This result finding agrees to studies done by Visser (2007), Krogh and Thomsen (2005), Sgoutas et al. (2005) and Kessels et al. (2006). These results are contradictory to the early researches conducted by Narmadha and Chamundeswari (2013) who found that the girls are better than boys in both attitude towards learning of Science and science achievement. Whereas a study by Fatoba and Aladejana (2014) in their study gender found slight difference in students' attitude in favour of females in Physics. Finding by Mior (2002), Shaw (2003), Pell and Manganye (2007) and Nur Asyiqin (2004) who found that there are no difference in interest towards Physics based on gender. There is difference in students' attitudinal variables towards career related to physics based on gender. The result findings in this study conform to the findings by Kahle and Lakes (1983) that female students showed negative attitude towards career related to Physics.

There is also difference in students' attitudinal variables towards Physics teachers, difficulty in Physics and usage of Physics equipment's based on gender. These findings are similar to the findings by Guzzetti and Williams (1996) which found that male students are more positive towards using the Physics equipments compared to female students. However, the findings from studies by Lena (2005), Sgoutas et al. (2005) and Marsh and Tapia (2002) showed that female students have a higher positive attitude towards Physics and they obtained better achievement in Physics compared to male students.

4.2 The Relationship between Students' Attitude towards Physics and Their Achievement in Physics and Relationship between Achievement in Additional Mathematics and Achievement in Physics

The result showed that there is a relationship between students' attitude towards the difficulty in Physics and their achievement in Physics. This finding is similar to the finding by Nur Ashiqin (2004) which showed that attitude is an important factor to determine students' achievement. This claim is supported by Magno (2003) in his study which showed that students who have positive attitude towards Physics achieved good grades in Physics.

This result concurs with the result by Seth et al. (2007) in his study which found that students with positive attitude towards Physics have a better ability in Physics and also with the studies by Thompson et al. (2001) and

Ali and Awan (2013) where students who have positive attitude towards Science obtained good achievement in Science. Attitude is an important factor to determine success in physics and the finding of this study agrees with the findings by Nur Ashiqin (2004) and Narmadha and Chamundeswari (2013). This study also has shown that there is a relationship between Additional Mathematics and achievement in Physics which is similar to the study by Seth et al. (2007) which showed that the higher the score the students obtained for Additional Mathematics, the higher it is for Physics.

4.3 The Implication of the Result Findings

Physics activities that are interesting with the aid of multimedia and the internet might increase the students' interest towards learning Physics. The finding shows direct implication on teaching and learning of Physics in schools, the result finding also showed that the achievement in Additional Mathematics influences the achievement in Physics. The better the students at Additional Mathematics, they better they become in Physics. Therefore, the school and the MOE should use the finding from this study as a basis to create better approach or method in teaching Physics so as to produce students who are successful in their academic achievements with the help of their teachers who implement teaching based on students' attitude towards Physics. Teachers understanding of the importance of students' attitude towards their learning will contribute to a better and systematic teaching and learning and classroom activities. This will then determine the academic achievements of the students.

4.4 Conclusion

Learning attitude in Physics is an important element to study Physics which has been considered as being a difficult subject for most students. The finding of this study showed that students with positive attitude towards Physics are able to increase their achievements in Physics as well as in Additional Mathematics. To increase students' positive attitude towards teaching and learning of Physics, cooperation from everyone is needed so that teaching and learning can be done effectively. The students' success and failure in the academic achievements depends on many factors. Although there exist relationships in students' attitude towards Physics and the difficulty in Physics which also are related to achievement, other attitudinal variables are also important. Teachers should be more sensitive towards students' attitude in the subject taught, be it Physics or Additional Mathematics. Therefore, Physics teachers can use various approaches in making Physics fun and more likeable. Physics teachers also have to give more attention towards female students to master Physics so that gender bias can be minimized among students.

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