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Inquiry-based instruction, students’ attitudes and teachers’ support towards science achievement in rural primary schools

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Abstract

The purpose of this study is to seek the relationship between inquiry-based instruction, students’ attitudes toward science and teachers’ support towards science achievement. It also looks at the gender differences in science achievement. This study was conducted among 149 students in a national primary school in a rural area of Kedah, Malaysia. Questionnaires were distributed among the students for feedback. The results indicated that female students perform better in science than male students. In addition, the regression results revealed that all three independent variables, namely inquiry-based instruction, students’ attitudes toward science and teachers’ support significantly influence science achievement among year five students. It was clear that the findings of this study have important implications for primary school students, specifically in evaluating science achievement. It is still unclear whether these findings could be generalized to other non-western countries.

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Keywords: inquiry-based instruction, students' attitudes, teachers' support, science achievement;

1. Introduction

Malaysia is progressing towards a developed nation status, and needs to create a society that is scientifically oriented, forward-looking, knowledgeable, progressive, having a high capacity for change, innovative, be a competitive player and a contributor to scientific and technological developments in the future global arena. Hence, the Malaysian education system greatly emphasizes the success of science education. Student success in science achievement is often used to measure teachers’ effectiveness in the teaching and learning process, as well as students’ acquiring of science knowledge and attitudes engaged in such learning processes. The accomplishment of improving student success in science in Malaysia is necessary in order to increase overall science literacy among Malaysians. This ensures the preparedness for the growing science and technology demands of the 21\textsuperscript{st} century.

Previous research stated that science achievement is able to increase due to inquiry-based instruction, students’ attitudes toward science, teachers’ support and others. This was also confirmed by Amaral, Garrison and Klentschy (2002) who stated that an inquiry-based approach has a positive impact on students’ academic achievements. Johnson and Lawson (1998) claimed that nothing seemed to be lost when switching to inquiry-based instruction, students’ attitudes toward science, teachers’ support and others.
Based instruction. Moreover, he added that much was gained. Tepe (1999) and Aknipar et al. (2009) found that students’ attitudes toward science lessons increased as their grade increased. Teachers’ teaching methods influence students’ behavior towards learning (Raffini, 1993).

The statistic taken from a national primary school in one of the rural areas in Kedah showed that there have been ups and downs in the UPSR science examination results. The results are 79.90% (2007), 78.00% (2008), 68.50% (2009) and 68.10% (2010). The results demonstrate a decrease in performance starting from 2007. The results show that the students are underachieving in science due to certain factors.

2. Literature review

Gender is also considered an essential component related to science performance research (Baker, 2002; Kahle & Meece, 1994; Krockover & Shepardson, 1995). This is very much in line with the investigation carried out by Lynch (2000), Rodriguez (1998), and Stevens (1993). Scantlebury (1994) claimed that most cultures led females and males into different experiences; hence, they start school with different knowledge, expectations and self-confidence in learning. In Malaysian primary schools, the composition of males and females enrolled in public primary school is about the same. This places Malaysia in a unique situation among developing countries.

The relationship between inquiry-based instruction and science achievement is unclear. According to Alouf and Bently (2003), Amaral et al. (2002), Jorgenson and Vanosdall (2002), and Von Secker (2002), there are some studies that found a positive relationship between inquiry-based instruction and science achievement. However, there are also studies that showed no significant relationship between inquiry-based instruction and science achievement (Booth, 2001). Inquiry-based instruction has a positive impact on students’ learning that is reflected in their academic achievements and their ability to solve problems (Geier et al., 2008; Hmelo-Silver, Duncan, & Chinn, 2007). Inquiry helps students to comprehend scientific knowledge and also the way in which students are expected to learn during the process of constructing knowledge (Abd-El-Khalick et al., 2004).

According to George (2006), one of the issues regarding science education research is attitudes toward science and science teaching. Tan (2007) in his study showed a significant positive correlation, indicating that students with more positive attitudes tend to be more achievement oriented. Students’ attitudes toward studying science have been a substantive feature of work for the science education research community for the past 30 to 40 years. Science education research stated that there is a series of studies determining attitudes of primary school students. Girod (2001), Tepe (1999), Turhan (2003) and Aknipar et al. (2009) claimed that there were some studies that examined the relation between students’ attitudes toward science and their academic achievement as well as learning strategy. Attitudes toward science are positively related to science achievement and there are studies that found such positive correlations (House, 1996; Lee & Burkam, 1996). Alkan (2006), Ilgaz (2006) and Aknipar et al. (2009) found that students’ attitudes toward science lessons increased as their grade increased. George (2006), Kulce (2005) and Aknipar et al. (2009) stated that there are results that showed students’ attitudes toward science lessons increased as their grade decreased.

Teachers with high efficacy showed a great commitment to students’ achievement. Hancock, Bray and Nason (1995) stated that student-centered instruction has a potential for enhancing intrinsic motivation among students. Inquiry-based instruction aligns very much with student-centered instruction. The alignment of both methods of instruction helps shift students’ way of learning from being passive to being a more active and dynamic learning experience. An appropriate and supportive teaching style increases students’ interest, enjoyment, engagement and academic performance. Teachers who smile, have eye contact and relaxed body language, call students by name, use humor and encourage students’ input and discussion are positively related to students’ state of motivation (Christophel & Gorham, 1995).

The exact relationship between inquiry-based instruction, students’ attitudes towards science and teachers’ support towards science achievement still needs to be studied, specifically regarding science in Malaysian primary schools. The gender differences also seem to play a role in students’ science achievement. As such, there was a need to study these relationships, as all three factors are prerequisite to sustain students’ science achievement.
2.1. Research objectives

i. To determine the gender differences among year five students in science achievement.

ii. To identify which is the best predictor of inquiry-based instruction, students’ attitudes in science and teachers’ support towards science achievement.

2. Methodology

The subject of the study is year five students in a national primary school in a rural area of Kedah. The total number of students is 150 (70 males & 80 females). The three instruments used in this study followed a survey format, with typical scoring on a three-point numeric Likert scale as follows: 3 (always), 2 (sometimes) and 1 (never). Inquiry-based instruction was adapted from the Fundamental Abilities of Inquiry listed in the NSES (NRC, 1996). The original questionnaire consisted of 16 items, but 6 items were excluded after the pilot study, therefore 10 items remained. The survey asks students to identify the inquiry elements they experienced during lessons. The attitudes toward science inventory instruments have been used effectively in several evaluation studies of elementary science learning (Girod, 2001). The inventory measures four factors: affect, interest, efficacy and identity. The original questionnaire consisted of 16 items, but after the pilot study, only 9 questions remained. Wubble and Levy (1991) created a Questionnaire of Teacher Interaction (QTI) comprising of 48 items. It is made available for students to review their own science teachers and their classroom instructions. Students’ science achievement is the average score taken from the mid-term and final-term examination from year four consisting of objective and subjective questions. Data for this study was obtained from year five students in a national primary school in a rural area of Kedah. For real data collection, the researcher distributed the questionnaires to the students personally. The researcher then explained the questionnaires. Students were given adequate time to fill in the questionnaires. Data collected was analyzed using independent t-test and regression.

4. Research findings

Independent sample t-test was used to determine whether students’ science achievement differed significantly according to their gender. Results showed a significant difference between the science achievement of males and females ($t$(138) = -2.47, $p < .05$). More specifically, female students scored significantly higher ($M$ = 40.72, $SD$ = 14.61) than males ($M$ = 34.15, $SD$ = 16.91) in science achievement (Table 1).

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>mean</th>
<th>$SD$</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>65</td>
<td>34.15</td>
<td>16.91</td>
<td>138</td>
<td>-2.47</td>
<td>.00*</td>
</tr>
<tr>
<td>Female</td>
<td>75</td>
<td>40.72</td>
<td>14.61</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05(2-tailed)*

Results also shows the results of the multiple regression analysis with science achievement as the dependent variable. The regression model has a coefficient determinator $R^2$ with an average value of 0.14. This indicates that 14% of variance in science achievement can be explained jointly by the three variables; inquiry-based, students’ attitudes and teachers’ support. F statistics, which test $H_0: R^2 = 0$ are significant ($p < .05$) for the regression model, that is science achievement ($R^2 = 0.14; p < .05$). This means that at least one regression coefficient in each regression model differs significantly from zero. The $t$ value for inquiry-based, students’ attitudes and teachers’ support are significant contributors to science achievement. The findings of this study indicate that students’ attitude is the best predictor (7.80%) for science achievement followed by inquiry-based (3.80%) and teachers’ support (2.40%) (Table 2).
Table 2: Multiple regression analysis between inquiry-based, students’ attitude and teacher support toward science achievement

<table>
<thead>
<tr>
<th>Variables</th>
<th>Science achievement</th>
<th>Students’ Science Achievement Score</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unstandardized Beta</td>
<td>Standard Error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>76.74</td>
<td>18.09</td>
<td>4.24</td>
<td>.00</td>
</tr>
<tr>
<td>Inquiry</td>
<td>18.85</td>
<td>5.98</td>
<td>0.36</td>
<td>3.15</td>
</tr>
<tr>
<td>Attitude</td>
<td>14.99</td>
<td>4.10</td>
<td>0.42</td>
<td>3.66</td>
</tr>
<tr>
<td>Teacher Support</td>
<td>11.13</td>
<td>5.51</td>
<td>0.16</td>
<td>2.02</td>
</tr>
</tbody>
</table>

*p < .05

5. Discussion and implications

The results showed that female students performed better than male students in science achievement. This finding is consistent with a study by Andre, Whigham, Hendrickson and Chambers (1999), which showed that females outperformed males in science. This indicates that female students put more effort into their studies and are more consistent and serious than male students. This may be due to some indications which show that male students are becoming the disadvantaged gender in schools, and that fewer male students are interested in science.

There is a significant overall total effect of inquiry-based instruction on science achievement. A positive relationship shows that the higher the inquiry-based instruction, the higher the science achievement of students. The findings are consistent with those of Alouf and Bently (2003), Amaral et al. (2002), Jorgenson and Vanosdall (2002) and Von Secker (2002), who found a positive relationship between inquiry-based instruction and science achievement. Nuangchalerm and Thammasena (2009) added that students should be provided with opportunities to appreciate and understand various forms of scientific inquiry. Inquiry can be embraced by different approaches, ranging from structured inquiry to guided inquiry or open inquiry (Banchi & Bell, 2008). Another finding of this study is the significant relationship between students’ attitudes towards science and science achievement. The more positive the attitude is among students, the more the grade level increases. The results of this study are also consistent with other studies. George(2006), Tan(2007), Aknipar et al.(2009) and Alkan (2006) claimed that there is positive relation between students’ attitudes toward science and their academic achievement. Students of this school have positive attitudes toward science that encourages them to be more interested and ready to engage in science.

The results show a significant relationship between teachers’ support and science achievement. Teachers in rural schools are very supportive. They listen, give encouragements and show empathy for students. They use the pedagogical approach that is quite similar to the methods usually used in urban schools. Teacher rarely look at students as a disadvantaged group and describe their teaching styles as equally demanding as the ones in urban schools. Teachers who are well trained, have eye contact and relaxed body language, call students by name, use humor and encourage students’ input and discussion are positively related to students’ state of motivation. The results are also consistent with previous studies that show that teachers support will increase science achievement among students (Christophel & Gorham, 1995; Meerah et al., 2010; Saat & Ismail, 2003).

In summary, the current study found inquiry-based instruction, students’ attitudes toward science and teachers’ support to be associated with science achievement. As such, the present findings have some contribution towards the teaching profession, such as recruitment and training. In addition, the present findings also have an implication on the students’ learning orientation.

References


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