High School Students’ Attitude to Use of Technology in Science Teaching, Interest in Science and Study Habits as Determinants of Science Achievement in Barbados

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Abstract

This study was designed to determine if there were statistically significant differences in the selected students’ performance linked to their attitude towards use of technology in science teaching, interest in science and study habit as well as to determine the effects of the three selected variables on students’ achievement in science. A sample of 300 4th Form students participated in the study. Four instruments were used for data collection. Data analysis involved t-test and regression analysis. The results showed that there were significant differences in students’ science achievement based on their attitude to use of technology in science teaching (t = -14.444, P< 0.05), interest in science (t = -10.027, P< 0.05), and study habit (t = -4.80, P < 0.05). Moreover, the combination of the three variables significantly contributed to science achievement accounting for 47.6% (R Square=0.476, P<0.05) of the total variance. Also, all the variables except study habit individually contributed significantly to science achievement with attitude to use of technology in science teaching contributing the most and study habit, the least. Therefore, students should be motivated to cultivate positive attitude to use of technology in science teaching, be more interested in science and employ better study habits in order to improve in science achievement in schools.

Keywords: Science achievement, interest in science, study habit, attitude, technology, science teaching, determinants, high school, Barbados

Background

The major challenge facing science educators and researchers in the Caribbean is the underachievement in science subjects among the secondary school students. For instance Sweeny (2003:8) declared that ‘of particular concern in the Caribbean is the relatively low extent of science education, as suggested by the number of students who successfully pass secondary level science examinations. He further stated that a cursory review of Caribbean Examination Council-CSEC results in biology, chemistry, physics and integrated science for the past ten years indicates that pass rates have, for the most part, fallen below 50% in these science subjects’. Also, CXC Statistical Bulletin (2008) revealed that in the CSEC May-June 2008, only 38.31%, 51.39%, 29.25% and 31.70% of the students that sat for the examinations in Barbados obtained Grades I and II in Chemistry, Physics, Biology and Integrated Science respectively. The underachievement was even more pronounced in
CSEC January 2008 with 15.38%, 25%, 0.00% of the students in Barbados obtaining Grades I and II in Biology, Chemistry and Physics respectively. Therefore, there is need for researches that seek to search for variables that have impact on students’ science achievement with a view to understanding their interactions and suggesting how they can be applied to arrest the underachievement in science subjects.

Interestingly, it has been suggested that technology be utilized in science classrooms as a means of increasing the levels of achievement of students in science classes (AAAS, 1989; Bennet & King, 1991). Now, the integration of technology in teaching is no longer a “new” idea. Particularly the use of computer technology has moved beyond computer assisted instruction in the form of tutorials or drill or practice. According to Rodgers (2010), today’s technology can provide teachers and students with the opportunities for teaching and le

Educators use technology in the classroom because its wide range of uses and forms has potential to reach students of all learning styles, as well as make the teaching to be more efficient.

The interest and motivation that technology induces in students makes its use in schools important.

Educators better prepare students for the future when using technology aimed at addressing each learning style. So, using several types of technology in one lesson can help students understand initially, alleviating many of the questions that students will have later, as well as lessening the times a teacher must repeat concepts to those who did not comprehend them at the first time.

Extensive studies and model schools, according to Rodgers, have shown that educational technology enhances student learning in many cases. In the report on Effectiveness of Technology in Schools 1990 – 1994, “the researchers found that technology can lead to improvement in performance most notably in mathematics, science, social studies and language arts. When using technology in the classroom, at “risk” students demonstrated:

- Improved attitude
- Improved confidence
- Improved writing skills when using technology in classrooms

Generally, as an instructional tool, technology helps all students-including poor students and students with disabilities-master basic and advanced skills required for the world of work. As an assessment tool, technology yields meaningful information, on demand, about students’ progress and accomplishments and provides a medium for its storage. As a motivational tool, technology positively impacts student attitudes toward learning, self-confidence, and self esteem. Therefore, the impact of technology on the current and future lives of society’s youth makes it important to understand technology and professional practice of using it to teach from the students’ perspective (Frantom, Green & Hoffman, 2002). An investigation of students’ conceptions has been a major feature of educational research to inform curriculum change and developments in science, technology and technology education (Osborne, Simmons & Collins, 2003). However, Jones (1996) noted that the interaction between the use of technology and learning may be complex and depends on a number of factors.

One of such factors is students’ interest in science. According to Bulunuz and Jarret (2009), there is a connection between interest and effort. In other words, the more a person is interested in a subject, the more effort he will put into it. He further described an interested person as being engaged, engrossed or entirely taken up by an activity because of its recognized worth. Therefore interest can be regarded as a tool through which the distance between the person and the material is annihilated facilitating an ‘organic union’ between the two. Dewey (1933) cited by Bulunuz and Jarret (2009)
concluded that in many learning tasks in school, the process and outcome are separated which results in ‘divided interest’ and the student cannot connect the process of executing a task with its outcome. Linking interest with learning, Tobias (1994) alluded that working on interesting, compared to neutral, material may engage deeper cognitive processing, arouse a wider, more emotional, and more personal associative network. Another variable which has been found to significantly contribute to students’ science achievement is study habits. Studies like Okpala and Onocha (1988) and Olatoye and Ogunkola (2008) indicated that study habits make a significant contribution to the prediction of physics achievement. This implies that if a physics student exhibits negative study habits (e.g. lacks concentration, feels bored, tired and sleepy while studying physics, spends little time on physics and does not map out immediate goals to attain), it is likely that the student may lack the impetus to engage adequately in productive physics learning during allocated school time and during his personal study time. Nouhi, Shakoori and Nakhei (2008) added that mastering skills by students makes study more enjoyable and effective which in turn strengthen the students’ interest so that he or she spends more time studying. Moreover, some other studies (e.g. Josemon, 2006) revealed that in order to maximize students’ academic achievement, approaches to study and study habit of the students are as important as classroom environment and that inability of a school system to develop useful study habits in its learners leads to wastage and stagnation.

The background provided so far emphasized how each of the variables of attitude to use of technology in science teaching, interest in science and study habit have been found by various researchers to individually predict academic achievement However, there is need for further research which investigates again, in another setting like Barbados where there is urgent need to arrest the prevalent students’ underachievement in science, the individual effects as well as composite or combined effects of the variables on their science achievement. It is against this backdrop that the present study is posited.

Statement of the Problem
This study was designed to determine if the level of science achievement of the selected 4th Form students in Barbados was satisfactory or not, if there were statistically significant differences in the students’ performance linked to their attitude to use of technology in science teaching (positive or negative), interest in science (high or low) and study habit (good or poor) as well as to determine the combined and relative effects of the four selected variables (attitude to use of technology in science teaching, interest in science and study habit) on students’ achievement in science with a view to offering suggestions towards improving science achievement in schools.

Research Questions
1. Is the level of science achievement of the selected 4th Form students satisfactory?
2. Are there any significant differences in the students’ science achievement based on attitude to use of technology in science teaching , interest in science and study habit?
3. To what extent does the combination of students’ attitude to use of technology in science teaching , interest in science and study habit contribute to science achievement?
4. To what extent does each of the students’ variables (attitude to use of technology in science teaching, interest in science and study habit relatively affect science achievement?
5. What are the interrelationships among students’ science achievement, attitude to use of technology in science teaching, interest in science and study habit ?
Methodology

Design

This study employed expost – facto research design in which the existing status of the independent variables were only determined during data collection without any manipulation of the variables by the researcher.

Sample

A sample of 300 4th Form students participated in this study. The sample consisted of 143 boys and 157 girls between the ages of 13 and 15 with the mean age of 14.02 and standard deviation of 0.49. 150 of the students were randomly selected from three urban secondary schools at the rate of 50 students per school and the remaining 150 were from three rural schools, also at the rate of 50 students per school. Moreover, 88 and 212 of the students had low and high interest in science respectively. 107 and 193 students had good and poor study habits respectively while 58 and 248 students had negative and positive attitude to use of technology in science teaching respectively.

Instrumentation

Four validated instruments were used for collection of data for the study. They are:

i. Science Achievement Test (SAT)
ii. Interest in Science Scale (ISS)
iii. Study Habit Scale (SAS).
iv. Attitude to Use of Technology in Education (ATUTE)

SAT is a 50-item multiple choice test items with four options (A – D) for an item. The items covered all the topics expected to have been covered in the Integrated science from 1st Form to 3rd Form.

ISS and SAS and ATUTE are four-point Likert-Scale type. Students were asked to indicate their opinions by ticking any of ‘Strongly Agree’, ‘Agree’, ‘Disagree’, and ‘Strongly Disagree’ in front of each statement. The ISS, SAS and ATUTE have 15, 14 and 15 items respectively. Students were not asked to indicate their names on the questionnaires so as to make the responses anonymous.

The initial versions of the instruments were given to experts for suggestions and comments before coming up with the final versions. The Crombach alpha reliability coefficients of 0.712, 0.723, 0.755 and 0.722 were obtained for SAT, ISS, SHS and ATUTE respectively.

Procedure

The researcher sought the consent of the Principals of the schools to take part in the study, by explaining to them the purpose of the study and they all consented. Having constructed the instruments and established their psychometric properties which confirmed that the instruments were valid and reliable, the researcher with five other Research Assistants that have been adequately trained administered the four instruments on the students who voluntarily took part in the study. The instruments were collected back immediately because of the achievement test involved. The researcher ensured that the students responded to the items at the same time in all the schools with the help of the principals and the research assistants.

Data Analysis

Data were analyzed using mean and standard deviation for research question 1, t – test for research question 2, regression analysis for research questions 3 and 4 and Pearson product moment correlation for question 5. All research questions were answered at 0.05 level of confidence using a two-tailed test.
Results

Research Question 1

Is the level of science achievement of the selected 4th Form students satisfactory?

Table 1: Level of Science Achievement

<table>
<thead>
<tr>
<th>Science achievement</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300</td>
<td>12.00</td>
<td>38.00</td>
<td>29.09</td>
<td>5.1676</td>
</tr>
</tbody>
</table>

Table 1 suggests that the students’ mean score on the science achievement test of 29.09 or 58.18 is not really satisfactory. This is because although it is more than 50%, it is lower than 60%. The minimum score of 12 which is 24% is obviously too low.

Research Question 2

Are there significant differences in the students’ science achievement based on attitude to use of technology in science teaching, interest in science and study habit?

Table 2: Comparison of students’ science achievement based on attitude to use of technology in science teaching, interest in science and study habit

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Df</th>
<th>t</th>
<th>P</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attitude to Technology</td>
<td>Positive</td>
<td>242</td>
<td>22.32</td>
<td>3.8725</td>
<td>298</td>
<td>-14.444</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Technology</td>
<td>Negative</td>
<td>58</td>
<td>30.71</td>
<td>3.9926</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interest in Science</td>
<td>Low</td>
<td>88</td>
<td>25.0682</td>
<td>5.4220</td>
<td>298</td>
<td>-10.027</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>High</td>
<td>212</td>
<td>30.7584</td>
<td>4.0217</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Study Habit</td>
<td>Poor</td>
<td>107</td>
<td>27.2336</td>
<td>5.0086</td>
<td>298</td>
<td>-4.801</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Habit</td>
<td>Good</td>
<td>193</td>
<td>30.1192</td>
<td>4.9751</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant (p<0.05), NS = Not Significant (p>0.05)

Table 2 shows that there were statistically significant differences in students’ science achievement based on their attitude to use of technology in science teaching (-14.444, P< 0.05), interest in science (t = -10.027, P< 0.05), study habit (t = -4.801, P < 0.05)

Research Question 3

To what extent does the combination of students’ attitude to use of technology in science teaching, interest in science and study habit affect science achievement?

Table 3: Combined effect of students’ attitude towards use of technology in science teaching, interest in science and study habit on science achievement

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Square</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>3797.884</td>
<td>3</td>
<td>1265.961</td>
<td>89.504</td>
<td>.000*</td>
</tr>
<tr>
<td>Residual</td>
<td>4186.686</td>
<td>296</td>
<td>14.144</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7984.570</td>
<td>299</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant (p<0.05)

Interestingly, the combination of the three variables accounted for 47.6 % (R square = 0.476, P < 0.05) of the total variance in the students’ science achievement and this was found to be significant.
Research Question 4

To what extent does each of the students’ variables (attitude to use of technology in science teaching, interest in science and study habit) relatively affect science achievement?

Table 4: Relative contributions of the predictor variables to the prediction of science achievement

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficient</th>
<th>Standardized Coefficient</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>10.781</td>
<td>1.187</td>
<td>-</td>
<td>9.081</td>
</tr>
<tr>
<td>Attitude to Use of Technology in education</td>
<td>6.679</td>
<td>0.619</td>
<td>0.511</td>
<td>10.794</td>
</tr>
<tr>
<td>Interest in Science</td>
<td>2.870</td>
<td>0.544</td>
<td>0.253</td>
<td>5.274</td>
</tr>
<tr>
<td>Study Habit</td>
<td>0.818</td>
<td>0.477</td>
<td>0.076</td>
<td>1.716</td>
</tr>
</tbody>
</table>

* Significant (p<0.05), NS = Not Significant (p>0.05)

In terms of relative effects of the variables, Table 4 shows the decreasing order of contributions or effects of the variables and it is thus: Attitude to Use of Technology > Interest in science > Study Habit. Notably, it is only the relative effect of study habit that is not significant.

The findings imply that students’ science achievement is still relatively low and unacceptable in Barbados and that the factors of attitude to use of technology in science teaching and interest in science are crucial in arresting the students’ underachievement.

Research Question 5

What are the interrelationships among students’ attitude to use of technology in science teaching, interest in science, study habit and science achievement?

Table 5: Correlation matrix of science achievement, Interest in science and Study habit of the students

<table>
<thead>
<tr>
<th></th>
<th>Science Achievement</th>
<th>Attitude to Use of Technology</th>
<th>Interest in Science</th>
<th>Study habit category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Achievement</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude to Use of Technology in education</td>
<td>.642**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest in Science</td>
<td>.502**</td>
<td>.445**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Study habit</td>
<td>.268**</td>
<td>.235**</td>
<td>.284**</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

There are significant positive relationships between attitude to use of technology and science achievement, attitude to use of technology and interest in science, study habit and interest in science, science achievement and interest in science, science achievement and study habit. In other words a student with high interest in science is likely to have positive study habit to study science and also likely to have high achievement in science particularly when he or she has positive attitude to use of technology in science teaching.

Discussion

The major findings of this study are:

- The mean science achievement score of 29.09 (58.18%) by the students is not really satisfactory. Although it is above 50% but it is below 60% and the least score is 24% which is unacceptable for a nation who wants to be technologically advanced.
- There are statistically significant differences in students’ science achievement based on attitude to use of technology in science teaching (t = -14.444, P< 0.05) in favour of students who have
positive attitude to use of technology in science teaching, interest in science (t = -10.03, P < 0.05) in favour of students with high interest in science and study habit (t = -4.80, P < 0.05) in favour of students with good study habits

- The combination of the three variables accounted for 47.6% (R square = 0.476, P < 0.05) of the total variance in the students’ science achievement and this was found to be significant.
- In terms of relative effects or contributions, attitude to use of technology in science teaching and interest in science individually contributed significantly to science achievement with attitude to use of technology contributing more than interest in science while and study habit did not contribute significantly as an individual factor.
- There are significant positive relationships between attitude to use of technology and science achievement, attitude to use of technology and interest in science, study habit and interest in science, science achievement and interest in science, science achievement and study habit. In other words a student with high interest in science is likely to have positive study habit to study science and also likely to have high achievement in science particularly when he or she has positive attitude to use of technology in science teaching.

That science achievement of secondary school students in Barbados is not yet satisfactory is consistent with the revelations in the CXC Statistical Bulletin (2008) which showed that in CSEC January 2008, only 15.38%, 25%, 0.00% of the students in Barbados obtained Grades I and II in Biology, Chemistry and Physics respectively. However, the combination of attitude to use of technology in science teaching, interest in science and study habit, were found to be significant in influencing science achievement and that each of the variables, except study habit individually influenced significantly the students’ science achievement in this study. Corroborating this finding is the “The Aspen Institute of Communication and Society program cited by Rodgers(2010) which noted that “the creative use of technology has the potential to engage young people and instill an excitement about learning in ways that few traditional teaching aids and techniques seem capable of doing. All these also lend credence to Bulunuz and Jarret (2009) who asserted that there is a connection between interest and effort. In other words, the more a person is interested in a subject, the more effort he will put into it. He further described an interested person as being engaged, engrossed or entirely taken up by an activity because of its recognized worth. Therefore interest can be regarded as a tool through which the distance between the person and the material is annihilated facilitating an ‘organic union’ between the two. Also, the fact that study habits, either in combination with other variables was able to significantly predict science achievement does not come as a surprise. This is because Okpala and Onocha (1988) had earlier found the same result among Nigerian physics students. They therefore inferred that if a physics student exhibits negative study habits (e.g. lacks concentration, feels bored, tired and sleepy while studying physics, spends little time on physics and does not map out immediate goals to attain), it is likely that the student may lack the impetus to engage adequately in productive physics learning during allocated school time and during his personal study time. On the other hand, if the student exhibits positive or good study habit, it is likely that the student will engage adequately in productive science learning during the school time and his or her personal time. This view is corroborated by Josemon (2006) who submitted that in order to maximize students’ academic achievement, approaches to study and study habit of the students are as important as classroom environment and that inability of a school system to develop useful study habits in its learners leads to wastage and stagnation.

**Conclusion**

The results reported in this study underscored the need for science educators to use the three student related factors (attitude to use of technology in science teaching, interest in science and study habit) as a predictor set in studying cognitive outcomes in science subjects. Secondary school principals and practicing science teachers who are interested in solving the problem of underachievement in the
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sciences should encourage the development of the following qualities in their male and female students: positive attitude to use of technology in science teaching, high interest in science and good study habit.

References
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