STUDENTS’ PERCEPTION OF THE INFLUENCE OF PRIOR KNOWLEDGE OF MATHEMATICS ON ACADEMIC ACHIEVEMENT AND INTEREST IN PHYSICS

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Abstract

The study investigated students’ perception of the influence of prior knowledge of mathematics on academic achievement and interest in physics in Onitsha North Local Government Area of Anambra State. Ex-post facto research design was used for the study. Four (4) public secondary school were randomly selected out of sixteen (16) schools. A total of six hundred (600) S.S II mathematics and physics students were used out of five thousand, three hundred and fifty-three (5,353) students.

Two research questions and one hypothesis guided the study. Data collected were analyzed using mean and standard deviation were used to answer the research questions. T-test was used to test the H_0 at .05 level of significance. The result showed that there is no significant difference between the mean rating of male and female students perception of elements of mathematics knowledge. Based on the findings, the researchers recommend that students should understand the basic concepts in mathematics which is a gateway to physics and also encourage them to take the learning of mathematics serious.

The world today believed that for any learning to be useful, it must lead to skilled knowledge, and skilled knowledge has to be acquired through mathematical reasoning. Mathematics is the fundamental part of human thought and logic, and
integral to attempts at understanding the world and ourselves. Mathematics has gained status as a discipline; perhaps, it is the most basic discipline to any person who will be truly educated in any science and in many other areas. The nature of mathematics can be viewed in two folds, on one side, it deals with quantitative relationship between material objects and thus becomes a tool in science, business and economics. On the other side, it reduces theorem from arbitrary chosen postulates and seeks to carry out these theorem to their logical conclusion, showing its application in the world of practical affairs. It had its origin in counting, weighing and measuring needed in the primitive trade, but today, applied mathematics is the main spring of our civilization which we are conscious that “to measure is to know”.

Mathematics in its broad sense can be used in the development of all types of forms and necessary deductive reasoning. An extract from Plato’s dialogue says “the metaphysical philosophers from his point of view recognizes mathematics as an instrument of deduction which strengthens the power of attention, develop the sense of order and construction and enable the mind to assimilate systematically the qualitative differences of physical phenomena”. Mathematics applications can be traced to everyday life both for enlightened masses. This everyday activity involves mathematics, and application of mathematics can be found in physics, economic, computer science, engineering, etc. Students’ interest is one of the factors affecting study achievement to the material taught. For example, if a teacher teaches the students with textbooks that are not standard or too simple or difficult for student to comprehend, it will lead to failure on the side of the students. Wanhar (2008) believed that there is a linear relation between the comprehension of mathematics concept and the ability to solve physics problems, while Prasetyo (2011) as of the opinion that students having high mathematics ability has effects to students’ achievement of physics study. Physics is that branch of science which treats laws, properties and interactions of matter, motion and energy. It is concerned with all scientific investigations of natural phenomena which lead to the mathematical formulations of equations to represent different physics phenomena or event. This study of physics involves investigating the laws of motion, the structure of space and time, the nature and types of forces that hold different materials together, the interaction of electromagnetic radiation such as light, X-Rays, gamma rays etc, with matter Argan (1979).

Furthermore, physics is believed to be inevitably instrumental to social growth. The knowledge of physics contributes to the discovery of hydro-electric powers which has made life comfortable. Mathematics deals systematically in treatment of the basic theory of the functions and also gives application to the specific problems of physics, Engineering, Medicine and Pharmacy. With the mathematical methods in physics, it is possible to study the simplest classes function without becoming involved with more general function. There are different fields of mathematics that are involved in physics and this include matrices and determinants linear equations, the calculation of variation, differential equations and integral equation. There are other principles of physics that
Students’ perception of the …

cconnects mathematics such as arithmetic principles method of measuring small density and the formula gotten is evaluated numerically. Oguniyi (1982) cited in Yara (2009) found out that students positive attitude towards science could be enhanced by the teacher related factors such as teachers enthusiasm, resourcefulness and helpful behavior. The way teacher present his subject in the classroom will affect his subjects in the students either positively or negatively.

Moreover, mathematics leaves its imprints upon the foundation of many school subjects in one way or the other. One cannot realistically understand science without considering the important role played by mathematicians just as science itself could not develop to its present stage without mathematics. Students’ performances are very poor especially in WAEC, SSCE and NECO. Yusa’u (2014) stated that the November/December 2011/2012 NECO exam, only 15, 669 or 14.15 per cent of the 104,187 candidates that sat for English language passed, while 75,355 or 68.06 per cent failed.

A total of 101,792 candidates sat for Mathematics but only 45,547 or 41.19 per cent got credit and above, while 10,328 representing 9.34 per cent ended with ordinary pass.

In Physics, 43,504 representing 90.05 per cent failed, while 24 candidates or 0.05per cent obtained credit and above. Mathematics as a basic subject starting from playground to all levels in education requires good background and understanding, which will encourage the learner in the calculation and graphical aspect of it which leads to interest in physics.

Conclusively, it is believed that a good background in mathematics is required for the study of science and other science related subjects.

Statement of the Problem

Inspite of government efforts and policy on curriculum planning and development in school time table especially allotting more time on science subjects, yet students perceive mathematics as a difficult subject due to the calculation involved in it. Poor performance in science subjects especially in mathematics and physics have become concern to the principal, teachers’ educationists and stakeholders. It is obvious that some teachers employed in some schools lack classroom skills and some of them are not competent in handling the subjects thereby having negative effect on the students on the perception of the subjects.

However, sequel to the above problems, the research is geared towards unveiling students’ perceptions of the influence of prior knowledge of mathematics on academic achievement and interest in physics.
Purpose of the Study
The study was carried out to find out the students’ perception of the influence of prior knowledge of mathematics on academic achievement and interest in physics. Specifically, the study sought to find out;
1. If the students prior knowledge in mathematics affect their achievement in physics.
2. The perception of students about mathematics and physics.
3. How students’ prior knowledge in mathematics affect their interest in physics.

Research Questions
The following research questions guided the study;
1. To what extent does the students’ prior knowledge in mathematics affect their achievement in physics?
2. To what extent does males and females differ in their mean perception of elements of mathematics knowledge?

Hypothesis
The study was tested at null hypothesis at .05 level of significance
1. There is no significant difference between the mean between the male and female differences in their mean perception of elements of mathematics knowledge.

Methodology
Ex-post facto research design was adopted for the study. This study was carried out in Onitsha North Local Government Area of Anambra State. Four (4) public secondary school were randomly selected out of sixteen (16) schools. A total of six hundred (600) S.S II mathematics and physics students were used out of five thousand, three hundred and fifty-three (5,353) students. A questionnaire titled the students perception of math and their interest in physics was used to collect data. The questionnaire contains two clusters, A and B clusters. Cluster A sought information on the students’ perception of math and physics while cluster B sought on the influence of prior knowledge of mathematics on academic achievement and interest in physics. The instrument was validated by two experts in mathematics education and one expert in measurement and evaluation and was considered to be valid in terms of face and content validation. Mean scores and standard deviations were used to answer the research questions and mean scores of 2.50and above were rated positive (agree) while the mean scores below 2.50 were rated negative (disagree). Hypothesis was tested at .05 level of significance.
Results

Research Question 1

What elements of prior knowledge of mathematics affect achievement in physics?

**Table 1:** Response on what elements of prior knowledge of mathematics affect achievement in physics.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>x</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The knowledge of menstruation helps improve my achievement in Archimedes principles.</td>
<td>3.67</td>
<td>0.86</td>
<td>Agreed</td>
</tr>
<tr>
<td>2</td>
<td>Calculus helps me to understand dynamics.</td>
<td>3.64</td>
<td>0.70</td>
<td>Agreed</td>
</tr>
<tr>
<td>3</td>
<td>The knowledge of statistics and probability helps me in understanding magnetism.</td>
<td>1.62</td>
<td>0.85</td>
<td>Disagree</td>
</tr>
<tr>
<td>4</td>
<td>Applying knowledge of geometry helps me in solving mechanics.</td>
<td>3.48</td>
<td>0.64</td>
<td>Agreed</td>
</tr>
<tr>
<td>5</td>
<td>The knowledge of algebra helps me in solving questions in vectors.</td>
<td>3.44</td>
<td>0.77</td>
<td>Agreed</td>
</tr>
<tr>
<td>6</td>
<td>The understanding of subscripts variables helps me in calculation of force of friction.</td>
<td>3.18</td>
<td>0.86</td>
<td>Agreed</td>
</tr>
<tr>
<td>7</td>
<td>The knowledge of calculus helps me in understanding thermodynamics and electricity.</td>
<td>3.29</td>
<td>0.73</td>
<td>Agreed</td>
</tr>
<tr>
<td>8</td>
<td>Applying differential equations helps me in understanding the force of gravity.</td>
<td>3.53</td>
<td>0.91</td>
<td>Agreed</td>
</tr>
<tr>
<td>9</td>
<td>Application of knowledge of squares and square roots helps to increase my understanding of quantum physics and motion.</td>
<td>2.90</td>
<td>0.79</td>
<td>Agreed</td>
</tr>
<tr>
<td>10</td>
<td>The knowledge of algebraic graphs helps me in plotting graphs in physics.</td>
<td>3.29</td>
<td>0.82</td>
<td>Agreed</td>
</tr>
</tbody>
</table>

**Grand Mean**

|      |                          | 3.15 | 0.74 |

The result presented in table 1 shows that the students agreed on items 1, 2, 4, 5, 6, 7, 8, 9 and 10. The mean score were 2.50 and above while item 3 which has a mean score below 2.50 was disagreed. The grand mean was 3.15.

The result shows that the respondents believed that many elements of prior knowledge of mathematics affect their achievement in physics. The most influencing factor has a mean score of 3.67 which states that the knowledge of menstruation helps improve their achievement in learning Archimedes principle. From item 3 above with mean score of 1.62, the respondents believed that the knowledge of statistics and probability does not help in understanding magnetism. The table shows that students’ prior knowledge of mathematics was perceived as affecting achievement in physics.
Research Question 2

To what extent does males and females differ in their mean perception of elements of mathematics knowledge?

Table 2: Response on what extent does males and females differ in their mean perception of elements of mathematics knowledge.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Items</th>
<th>Male</th>
<th>SD</th>
<th>Female</th>
<th>SD</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Lack of examples to support theoretical knowledge affects my interest.</td>
<td>3.69</td>
<td>0.48</td>
<td>2.60</td>
<td>0.54</td>
<td>Very Great extent</td>
</tr>
<tr>
<td>12</td>
<td>Lack of illustrative pictures affects my interest.</td>
<td>2.90</td>
<td>1.00</td>
<td>3.21</td>
<td>0.88</td>
<td>Great extent</td>
</tr>
<tr>
<td>13</td>
<td>I found in difficulty in applying mathematical algebraic formula.</td>
<td>3.60</td>
<td>0.58</td>
<td>2.86</td>
<td>0.42</td>
<td>Very Great extent</td>
</tr>
<tr>
<td>14</td>
<td>Difficult concepts in mathematics, graphs affect my interest in physics.</td>
<td>3.11</td>
<td>0.88</td>
<td>3.61</td>
<td>0.73</td>
<td>Great extent</td>
</tr>
<tr>
<td>15</td>
<td>Lack of instructional materials in mathematics affects my interest in mathematics.</td>
<td>2.84</td>
<td>0.81</td>
<td>3.0</td>
<td>0.64</td>
<td>Great extent</td>
</tr>
<tr>
<td>16</td>
<td>Lack of laboratory equipment affects my interest in physics.</td>
<td>3.29</td>
<td>0.70</td>
<td>3.2</td>
<td>0.72</td>
<td>Great extent</td>
</tr>
<tr>
<td>17</td>
<td>Lack of mathematical textbooks affects my interest in physics.</td>
<td>2.86</td>
<td>0.81</td>
<td>2.5</td>
<td>0.79</td>
<td>Great extent</td>
</tr>
<tr>
<td>18</td>
<td>I perceive mathematics as a difficult concept because of statistics aspect of it.</td>
<td>2.56</td>
<td>1.05</td>
<td>2.70</td>
<td>0.99</td>
<td>Great extent</td>
</tr>
<tr>
<td>19</td>
<td>Teacher’s characters affect my attitudes towards.</td>
<td>2.93</td>
<td>0.72</td>
<td>2.64</td>
<td>0.86</td>
<td>Great extent</td>
</tr>
<tr>
<td>20</td>
<td>I find it difficult in solving fraction and inequalities</td>
<td>3.03</td>
<td>0.94</td>
<td>3.10</td>
<td>0.73</td>
<td>Great extent</td>
</tr>
</tbody>
</table>

|     | **Grand Mean**                                                        | 3.08 | 0.79| 2.94   | 0.73|                           |

The result presented in table 2 shows that the respondents believed that gender differences does not have influence on the mean perception of elements of mathematics knowledge. Items 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 were all accepted because their mean scores were between 2.50 and above.

The respondents believed that lack of factors like instructional materials, lack of laboratories and mathematics textbooks affect their perception of elements of mathematics knowledge. Items 11 has the highest mean score of 3.69 which the respondents believed that lack of examples to support the theoretical knowledge affect their interests. The result of table 2 shows that males and females do not differ in their mean perception of elements of mathematics knowledge.
Table 3: Summary of t-test analysis on the mean rating of male and female students’ perception of elements of mathematics

<table>
<thead>
<tr>
<th>Gender</th>
<th>No</th>
<th>Mean</th>
<th>S.D</th>
<th>df</th>
<th>t-cal</th>
<th>t-crit</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>360</td>
<td>3.08</td>
<td>0.79</td>
<td>118</td>
<td>2.226</td>
<td>1.96</td>
<td>Do not reject H₀₁</td>
</tr>
<tr>
<td>Female</td>
<td>240</td>
<td>2.94</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data analysis in table 3 above shows that t-calculated is 2.226 which shows that the mean rating of male and female perception of elements of mathematics is greater than t-critical which is 1.96 at .05 level of significance which shows that the null hypothesis was not rejected. Hence, there is no significant differences between the mean rating of male and female students perception of elements of mathematics.

Discussion of Results

The analysis of the data revealed in table 1 that the students’ agreed on items 1, 2, 4, 5, 6, 7, 8, 9 and 10 which have mean scores of 2.5 and above while item 3 had mean score below 2.5 and was rejected. Prasetyo (2011) as of the opinion that students having high mathematics ability has effects to students’ achievement of physics study. The result shows that the respondents believed that many elements of prior knowledge of mathematics affect their achievement in physics. The most influencing factor has a mean score of 3.67 which states that the knowledge of menstruation helps improve their achievement in learning Archimedes principle. Item 3 above have mean score of 1.62 which the respondents believed that the knowledge of statistics and probability does not help in understanding magnetism. It is in line with Eraikhinemen (2003), who believed that a sound background in mathematics is a necessary condition for the study of science and other related subjects. It is believed that the study of physics at any level requires good understanding of mathematics. Students need to have good background in mathematics which enables them to have interest in physics.

However, indications from table 2 reveals that items 11-20 agreed that males and females do not differ in their mean perception of elements of mathematics knowledge and their mean scores are 2.50 and above. The respondents believed that lack of factors like instructional materials, lack of laboratories and mathematics textbooks affect their perception of elements of mathematics knowledge. Items 11 has the highest mean score of 3.69 which the respondents believed that lack of examples to support the theoretical knowledge affect their interests. Prasetyo (2011) as of the opinion that students having high mathematics ability has effects to students’ achievement of physics study.

In table 3 above reveals that at 0.05 level of significance, the t-calculated is 2.226 while t-critical is 1.96 which shows that the hypothesis is not rejected that there is no significant differences between the mean rating of male and female students’ perception
of elements of mathematics. Ngyambuloh (2005) opines that what a teacher knows and can do, can make and cannot, can be irreparable loss not only to the child but also to the nation at large. The teachers need to be encouraged and be enthusiastic in teaching and helping the students to learn and have interest.

**Recommendations**

Based on the findings some recommendations were made;

1. Students should be made to understand the basic concepts in mathematics and also encourages taking the learning of mathematics and physics serious, since it is the key to other sciences.
2. Qualified and competent, mathematics teachers should be employed and should be made to teach only their area of specialization.
3. Curriculum planners and the school principal should allot enough time in some science subjects especially in mathematics whenever they are making school time tables.
4. Principals and teachers should be encouraged to create a forum or workshops whereby the students will have an interaction concerning their area of difficulties.
5. The student should be provided with a well-equipped mathematics laboratory and instructional materials in mathematics concept which will enhance their learning.

**References**


Prasetyo A.A. (2011). *Physics Teaching with Guidance Inquiry by Using Experiment and Demonstration Method in Virtual Laboratory Based on Pre-Performance and Ability of Student*. Case Study on Dinamye Static Electricity of x Grade students in TanjungSecor Senior High School, 2010/11), SebelasMaret University, Suralarta, Indonesia.


