Using Visual Aids to Enhance Third Year Undergraduate Teacher Trainee Students’ Academic Performance in Reproduction and Growth in Flowering Plants

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There is a plethora of teaching strategies that are espoused by the science teacher to attain his/her lesson objectives. Researchers have over the years found most of these methods, the tactics used by teachers in teaching, to be effective in teaching science concepts to learners. However, research has not ascertained which one teaching strategy is most effective in imparting knowledge to learners. This study seeks to find an appropriate teaching strategy that will arouse the interest and participation of students in the teaching and learning process. Visual aids were employed as the main intervention strategy. A total of one hundred third year undergraduate teacher trainees from the University of Education, Winneba, Ghana constitute the research sample. The participants were put into experimental and control groups. Tests and questionnaires were the main instruments used to collect data for analysis. Data collected were analyzed quantitatively using the Statistical Package for the Social Sciences, SPSS. The study found that the academic achievement of the students in the experimental group improved tremendously after the intervention, as opposed to that of their counterparts in the control group. The study concludes with the recommendation that visual aids should be used to teach concepts of science that are abstract in nature in order to make the lesson real to the learners.

Keywords: Visual aids, animation, pollination, fertilization, student perceptions, intervention.

INTRODUCTION

The teaching and learning of science in Ghana have over the years been given a lot of attention in order to develop science inclined graduates and personnel to make Ghana an industrialized country (Anderson, 2006). This is seen in terms of policy making, scholarships awarded to brilliant but needy students and teachers alike to pursue courses in the subject and an increase in the enrolment both at the second cycle and tertiary level.

Science as a subject present to the learner skills such as creativity, critical thinking, good observation, logical reasoning and teamwork. In fact, it sharpens the mind. An understanding of science enables citizens to better understand and interpret daily occurrences such as the outbreak of diseases and the transitional growth of humans, thereby producing well informed and responsible citizens (Reiss et. al., 2015).

Simpson (1987) as cited in Duckworth (1990) defines science as ‘the exploration of the material universe in order to seek orderly explanations to the objects and events encountered. These explanations must be tested. Biology, a branch of science that deals with the study of living things also includes how organisms interact with their physical environment and with each other.

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The study of Biology in schools help students to develop multidimensional expertise and grasp the important role that interrelationships can play in the real world. Research shows that students retain information better when they are given multiple facets since different students have different learning approaches or learning style in the classroom (Kolb & Kolb, 2005). Studies over the years show that teachers depend greatly on the use of words to express, convey ideas or facts in the teaching-learning process. This process is termed the ‘chalk-talk’ method. Today advances in technology have made it possible to produce materials and devices that could be used to minimize the teachers’ talking and at the same time, make the message clearer, more interesting and easier for the learner to assimilate (Onasanya et al., 2008). Graphics communicate facts and ideas clearly through a combination of drawings, words and pictures. The use of graphics in teaching creates definitiveness to the materials being studied. They help to visualize the whole concepts learned and their relationships with one another. One of the topics in Biology that requires the use of teaching aids is reproduction and growth in flowering plants. Teaching and learning combined with visual aids (e.g., animations, pictures, chart, real objects, etc.) improve learning and facilitates understanding (Jolly, 2003). The use of visual aid may help students to construct knowledge for themselves without being ‘spoon-fed.’ Visual aids create a mental picture in the mind of students. The manipulation of flower, seeds and fruits aids students to work with some senses of the body like touch, sight which make students discover things on their own and learn better. Also, from the constructivism view, students learn best by constructing or creating their own knowledge and that new information is linked to prior knowledge. To achieve this, visual aids can be used. The use of visual aid to teaching abstract concepts helps to make the lesson more real and concrete, and engage students in learning. This strategy employed in teaching Biology makes the subject very attractive, enjoyable and more dynamic. In addition, it helps students to grasp concepts in the more effectively. Visual aids are those materials that make the teaching and learning of Biology more interesting and productive for both teachers and students (Jolly, 2003).

CONCEPTUAL FRAMEWORK

Teaching and learning play a crucial role in education. Teachers use different approaches to teach their students to engage them in active learning. With the passage of time, altered methods and techniques are entered in the field of education and the teacher uses different kinds of aids to make learning effective. Most of the problems related to science literacy can be tackled by making science learning interesting. With the help of teaching aids, science learning and teaching becomes more interesting and motivating. Visual aids arouse the interest of learners and help teachers to explain concepts of science easily. Visual aids are those instructional aids which are used in the classroom to encourage students learning the process. According to Burton as cited in Shabiralyani et al. (2015), “Visual aids are those sensory objects or images which initiate or stimulate and support learning.” Chaney and Teel (1967) described visual aids as “any devices which can be used to make the learning experience more real, more accurate and more active.” There is a famous Chinese proverb “one sighted is worth, a hundred words” it is factual that we take the knowledge through our intellects. Kishore (2003) said, “visual aids stimulate thinking and awareness”. It has been proven that an activity that motivates children also leads to successful learning and that motivation is strongly linked to the child’s involvement in the learning process.

Visual aid does not only arouse the interest of students but also motivate students and get them involved in the learning process. Findings from many researchers support the use of visual aids, for instance, Rieber’s (1990; 1991) research findings support the use of animated graphics. More so, Kieras (1992) investigated the effects of animation and static graphics on students’ ability to understand the operation of an energy system. Students studied conceptual information about the system in the form of text or in the form of static or animated diagrams. Students who learned from the animated graphic performed significantly better than those who learned from a static graphic which also performed better than those who learned from the text. Gautam (1999) utilized the computer as an effective tool for teaching science. Form his study, Gautam concludes that “Computer offers a strong medium for teaching and learning science.” The visual image of an abstract phenomenon on the monitor gives a clear understanding of the different scientific concepts to the students. In the use of computer-assisted instruction (CAI), the students understand better and apply different scientific phenomena clearly and correctly. In the normal classroom situation (without the computer), the concepts are not often clearly explained.

A similar study comparing the effectiveness of computer-aided instruction (in terms of the achievement of students) to the traditional method was conducted by Dubey and Adhikari (1999). Their study was focused more on the teaching of biology. Sawrey (1990) studied the importance of computer animations in chemistry. In his work, he elaborated on the need for computer animations in the teaching of chemistry. He reviewed the research on the use of computer animations in chemistry instruction and found out that several researchers have documented that students have considerable difficulties answering conceptual questions based on the particulate nature of matter. There are three theories proposed for computer animation and learning. Piaget’s theory of intellectual development focuses on the process by which learners develop logical and proportional reasoning abilities. Herron (1978) provided an excellent discussion of the difference between learners who have not fully developed these abilities (concrete operational thinkers) and those
who have (formal operational thinkers). Secondly, the instructional effectiveness of computer animations can be explained using Paivio’s (1991) dual coding theory. The theory assumes that learners store information received in working memory as either verbal or visual (pictorial) mental representations in long term storage. The instructional superiority of pictures over words lies in the assumption that while words are coded verbally, pictures are more likely to be coded visually and verbally. As a result, better recall of pictures can be expected because they are dually coded. The third theory, a derivation of the dual coding theory proposed by Mayer is referred to as contiguity theory. The contiguity principle suggests that pictures and words presented simultaneously are more effective than when presented separately. Also, Athanassios Jimoyiannis and Vassilis Komis deliberated on the effect of Computer simulations on student in Physics. In their research, students were studied to determine the role of computer simulations in the development of a functional understanding of the concept of velocity and acceleration in projectile motion in physics. Their findings strongly support that computer simulation may be used as an alternative instructional tool, in order to help students, confront their cognitive constraints and develop a functional understanding of physics.

In spite of the numerous research that has been done on the value of visual aids as tools for teaching and learning, no study has yet addressed the issue of retention of learned information in any area of biology. This study seeks to determine how effective the use of visual aids could be to students in understanding the concept of reproduction and growth in plants.

MATERIALS AND METHODS

The researchers adopted a quantitative research design for this study. The populations consist of the third year (level 300) students in the Science Faculty, University of Education, Winneba, Ghana. A total of one hundred (100) students were sampled for the study.

These students were aged between 20 and 35 years. The participants were put into experimental (50 students) and control (50 students) groups. There was no significant difference between the performances of both groups at the start of the study. The study was carried out from September 17th 2018 to November 30th 2018. The simple random sampling technique was used in selecting students to avoid prejudice and give room for effective students- materials interaction and adequate classroom management. In order to ensure effective and efficient implementation of the intervention, the mentioned target group was selected because these students have studied biology for almost two years and therefore could make a meaningful contribution to the study. The purposive sampling technique which is a non-probability sampling technique was employed in this study. Studying an entire population of the school can be cumbersome hence the need to sample a portion of the population.

Tests were the main tool used to collect information on students’ achievement. Results from the test were analyzed.

The researchers conducted a pre-intervention test on the concept of reproduction and growth in plants. The pre-intervention test conducted had thirty multiple choice questions. The total score for each student was collated. This was the same for the post-test conducted after the implementation of the interventional activities.

The pre-test was followed immediately by teaching the two groups of students the same concept; “Reproduction and growth in flowering plants.” The experimental was taught using instructional materials (visual aids) and the control group without instructional materials (visual aids).

The scores of students in both pre-test and post-test were transformed into group data and the frequency of students’ performance computed.

Planning of the Lesson

Each student was required to come to the lecture room with a complete flower. A labelled diagram of a flower together with an explicated animation on pollination, fertilization in flowering plants and pictures of the various vegetative parts of plants was prepared by the teacher for the purpose of the lesson delivery. This was done so that the interest of the students would be aroused and students could see things for themselves and understand the topic better.

Lesson Presentation

The relevant previous knowledge of the students on the structure of a flower was reviewed. Pictures of a flower were displayed on the screen followed by an explanation of the structures of the flower and their functions. Students were then given a hibiscus flower to observe and study its parts. Through guidance, students were able to identify the parts of the flower by tearing the part they had identified and showed it to the class.

![Fig. 1.1: Parts of flower (Bell & Bryan, 2008)](image-url)
Students were asked to mention the parts of the flower that aid in pollination and also state the features that enable them to do so. The male and female parts of the flower were projected on a screen to help give a vivid explanation to the features that comprise these parts. Animation on pollination was projected on a screen for students to observe. The animation was displayed for the second time, accompanied by an explanation of the processes involved. In order for the students to know what pollen grains are, students were given matured stamen containing pollen grains.

Vegetative parts of different plants such as bulb of onion, a rhizome of ginger, a corm of cocoyam and sucker of plantain were exhibited on a table together with projected images on the screen to help students observe the parts. Students were then instructed to carefully examine the external features of the specimen of plants displayed on the table and compare the features of each of them. Chance was given to students to asked questions on what has been learnt so far.
Fig. 1.4: Some vegetative parts of plants (Bell & Bryan, 2008).

RESULTS

The quantitative data generated in the study were analyzed and presented using basic descriptive statistics such as tables (1, 2 and 3) and bar graph.

ANALYSES OF RESULTS FROM PRE-INTERVENTION TEST

Table 1: Analysis of results from Pre-intervention test

<table>
<thead>
<tr>
<th>Marks</th>
<th>Class-mid point(x)</th>
<th>Number of students (Frequency, f)</th>
<th>f(x)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>3</td>
<td>16</td>
<td>48</td>
<td>16</td>
</tr>
<tr>
<td>6-10</td>
<td>8</td>
<td>52</td>
<td>416</td>
<td>52</td>
</tr>
<tr>
<td>11-15</td>
<td>13</td>
<td>16</td>
<td>208</td>
<td>16</td>
</tr>
<tr>
<td>16-20</td>
<td>18</td>
<td>8</td>
<td>144</td>
<td>8</td>
</tr>
<tr>
<td>21-25</td>
<td>23</td>
<td>5</td>
<td>115</td>
<td>5</td>
</tr>
<tr>
<td>26-30</td>
<td>28</td>
<td>3</td>
<td>84</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100</td>
<td>1015</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean for pre-test = \( \frac{\Sigma f(x)}{\Sigma f} = \frac{1015}{100} = 10.15 \)

From the table, the number of students who took part in the pre-test was 100. The mean mark for the pre-test was 10.15. Out of the total number of the students, 68 students representing 68% scored below the mean mark. Only 32 students representing 32% had marks above the mean mark. The general performance of the class was below average. The information in the table is represented in the bar graph in figure 1.5 below.

Fig. 1.5: bar graph showing the pre-test results before the implementation of the intervention
After the implementation of the intervention, the researcher conducted another test with the view to finding out the effectiveness of the intervention strategy that was rolled out. The performance of students in the post-test is presented below in table 2.

**Table 2: results of the post-intervention test for the experimental group.**

<table>
<thead>
<tr>
<th>Marks midpoint (x)</th>
<th>Number of students (Frequency)</th>
<th>fx</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6-10</td>
<td>8</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>11-15</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16-20</td>
<td>18</td>
<td>9</td>
<td>162</td>
</tr>
<tr>
<td>21-25</td>
<td>23</td>
<td>21</td>
<td>482</td>
</tr>
<tr>
<td>26-30</td>
<td>28</td>
<td>19</td>
<td>532</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>1184</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean for post-test = \( \frac{\sum fx}{\sum f} = \frac{1184}{50} = 23.68 \)

Table 2 presented above shows the outcome of the post-test of the experimental group after the implementation of the intervention.

The mean mark for the post-test was 23.68. From the table, it can be observed that 10 students representing 20% of the total number of students scored below the mean mark. 40 students representing 80% scored around and above the mean mark. The general performance of the class was good.

The results in Table 2 are represented in the graph in figure 1.2 below.

**Figure 1.6: a bar chart showing the post-test result after the implementation of the intervention**

**Table 3: Post – intervention results in the control group**

<table>
<thead>
<tr>
<th>Marks midpoint (x)</th>
<th>Number of students (Frequency)</th>
<th>fx</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>3</td>
<td>17</td>
<td>51</td>
</tr>
<tr>
<td>6-10</td>
<td>8</td>
<td>21</td>
<td>168</td>
</tr>
<tr>
<td>11-15</td>
<td>13</td>
<td>8</td>
<td>104</td>
</tr>
<tr>
<td>16-20</td>
<td>18</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>21-25</td>
<td>23</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>26-30</td>
<td>28</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>415</td>
<td>100</td>
</tr>
</tbody>
</table>

Mean for post-test = \( \frac{\sum fx}{\sum f} = \frac{415}{50} = 8.3 \)

From the table, out of the 50-member group, 38 students making 76% scored below the mean mark whiles 12 students making 24% scored above the mean mark narrowly.

The table is presented in the graph below.

**Figure 1.7: a bar chart showing the post-test result after intervention for the control group**

**DISCUSSION**

Learning can happen as an outcome of attaining a skill, principle, perception, knowledge, fact, and new information (Adeyanju, 1997). Learning can be reinforced with different teaching/learning resources because they stimulate, motivate as well as focus learners’ attention on the desired behaviour during the instructional process. Visual aids arouse the interest of learners and help teachers to explain the concepts easily.

Data collected from post-test results showed a tremendous improvement of experimental over the control group. The total of 80% of the students in the experimental group scored above the mean mark after the intervention. The performance of the control group remained relatively the same.

Findings from this study agree with the findings of Inyang (1997) that teaching is effective when the teacher makes use of instructional materials. Todd and Kukllthau (2005) found a simple correlation between the students’ inputs and better academic achievement. The analysis shows that visual aids have a positive impact on the academic performance of science students especially.

**Figure 1.8: a graph showing the comparison between the experimental group and control group after the intervention**
Observations made after the intervention suggest a good improvement in the academic achievement of the experimental group, as opposed to the control group. It is inferred from this, therefore, that the use of visual aids and appropriate teaching and learning materials can help enhance the academic achievement of students.

CONCLUSION

A number of problems may be encountered in teaching any science (biology) topic. Though some of the problems may be solved by those in authority, problems that occur in the classroom may be solved best by the teacher when he or she engages in continuous research. With this, the students can apply their knowledge gained to solve everyday problems they encounter in society.

Using visual aid as a teaching method stimulates thinking and improves learning. Students develop an increase in understanding when visual aids are used to teach them. Students find visual aid sessions interesting as it links content to reality.

RECOMMENDATION

Science teachers should use visual aids to teach topics in science especially reproduction and growth in flowering plants

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