Project Approach as an Alternative to Regular Laboratory Practical Work in the Teaching and learning of Biology in Rural Secondary Schools in Zimbabwe.

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Abstract

This article examines the possibility of using the Project Approach as an alternative to Laboratory Practical work in the teaching and learning of Biology at ordinary level in Rural Secondary schools in Zimbabwe. The study was carried out in six rural secondary schools in the Manicaland province of Zimbabwe and three ‘Teachers’ Colleges in the same province. The sample was composed of twelve biology teachers from six schools and three lecturers from the three teachers' colleges. Data were collected through focus group discussion, lesson observations and questionnaires. To determine if it is possible to implement this method, the study examined teachers’ knowledge of the project approach in theory, teacher confidence in using the method, and whether prevailing circumstances, such as time-tabling, assessment process and nature of curriculum permit the implementation of this approach. The findings of this research suggest that it is possible to implement the Project Approach in developing problem solving skills in ordinary level Biology students. However, this should not be a substitute to regular laboratory methods, but rather would be used in conjunction with those other methods.

Background

There is growing concern in Zimbabwe that the secondary school Ordinary Level and Advanced Level Biology results are poor according to the Zimbabwe Schools Examinations Council (ZIMSEC) reports for 2000, 2001 and 2002. In the year 2012, biology Ordinary Level had 38.38% pass, its lowest pass rate in the past five years. Examination reports from ZIMSEC indicate that ‘O’ Level Biology candidates continue to lack an understanding of biological concepts particularly problem solving.
skills. In Science Education, development of such skills is enhanced by laboratory activities, therefore, lack of these skills has contributed to the poor performance of these candidates in the 'O' level Biology final examination, as displayed by the poor trend in the pass rate.

Investigations into the methods employed in the teaching and learning of Biology show inconsistencies in presentation of learning materials which are practically oriented. These irregularities have failed to break boundaries between formal scientific knowledge and traditional knowledge systems, the philosophic assumptions of science and cultures of learners. The acquisition of scientific knowledge, skills and attitudes in schools is heavily compromised by the unavailability of resources and teacher unpreparedness. As a result, learners struggle to translate what they learn in school in to life skills.

The majority of secondary schools in rural areas do not have laboratories. Where these laboratories exist, they are poorly equipped. The learners, therefore, have to memorise practical work theoretically in order to pass the examination when they write the alternative to practical biology paper. The fact that there are alternatives to practical papers in Biology means that learners can sit for examinations without being exposed to practical work. Meanwhile, Biology is a practical subject. Theory work in the subject means that the learners are not able to put their learnt knowledge into practice to solve actual life problems.

The Purpose of the Study.
The purpose of this study was to explore possibilities of implementing the Project Approach as an alternative to Regular Laboratory Practical Work in Ordinary Level Biology Teaching in Rural Secondary schools where science equipment is limited or where there are no laboratories. The project approach method offers the required experience for the development of a functional biology and scientific literacy. Its use enables students to explore learning opportunities that focus on interacting with learning materials and hence improves students’ understanding of biology concepts as well as development of problem solving skills. The project approach enables learners to appreciate their physical environment as well as build on students’ creativeness and innovativeness. The research should expose learners to the fact that traditional laboratory work can be restrictive and may limit students’ investigative potential.

Literature Review
Practical work is an inquiry and hands on activity which makes it possible to transfer knowledge on higher order cognitive levels and create curiosity in students. Practical work develops problem solving skills and a deeper understanding of the concepts and principles in Biology for students. When students do biology, hands on, they will understand it and will enjoy the learning process since it will be relating what they will have learnt to real life situations. The challenges of the modern world require individuals who can apply their theoretical knowledge to solve practical real life problems such as environmental and economic challenges. Hence, practical work
prepares students for adult life since it fosters the theory they will have learned. Students, through doing practical work, would be doing what real scientists do and they would appreciate that theories are generated from research. Doing practical work forms the basis for good research skills in students. The project approach, therefore, enhances the development of many practical work skills.

Katz and Chard, (1989), correctly stated that “The Project Approach, involves children selecting a topic of interest, researching and studying it, and solving problems and dilemmas as they arise.” The Buck Institute of Education describes it as, “Project Based Learning (PBL), where students go through an extended process of inquiry in response to a complex question, problem, or challenge” (http://www.bie.org/about/what_is_pbl). The extended interactions with learning materials enable students to learn new material and transfer understanding to other new situations. The importance of time spent with learning material is emphasised further by Bigala, (1996:74), who defines project work as a scheme of work in which the pupils work singly or in groups, over a period of time varying from a few days to several weeks.

Khan and Zafar, (2011), carried out an experiment in which they sought to compare the effectiveness of the traditional laboratory and the inquiry (project) methods in developing scientific process skills in grade nine pupils using selected topics in the biology syllabus. They determined that, using a science process skill scale device, pupils taught using the inquiry method developed better science process skills than those taught the traditional way.

In addition, Shoemaker, (1989), explains how science is best taught in a holistic way which reflects the instructiveness of the real world. This complements Benson (2004), who argues that the implication is, therefore, that teaching strategies should be based on the premise that learning is a series of connections and goes on to suggest that the project method and theme teaching fit this description. Abimbola, (1994), makes the case that in Nigeria; teachers usually give the excuse of lack of materials and equipment for not carrying out practical work even when an activity can be done without conventional equipment. Abimbola’s article cites that while there are essential laboratory skills like manipulation of various forms of equipment, equally important inquiry skills can be developed through methods like projects done outside the laboratory.

Bigala, (1996), finds it feasible to use the project approach in schools in Malawi and goes on to give examples of such projects in different subjects including Biology. Bigala, (1996), also suggests ways of structuring the projects, organizing, and timetabling them.

**Methodology**

Data were collected from practising teachers at six schools and lecturers from three teachers’ colleges. The study mainly used the qualitative approach. A questionnaire for teachers and college lecturers to assess their understanding of the project approach was administered. Lessons were observed to determine the methods used by the teachers during the teaching and learning of Biology. A focus group
discussion was then held for teachers to determine the implications of the findings from the lesson observations.

**Results**

**Table 1.** Methods Used by Teachers during the Teaching and Learning of Biology

<table>
<thead>
<tr>
<th>METHOD</th>
<th>Practical Lessons</th>
<th>Theory Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Lecture</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Demonstration</td>
<td>10</td>
<td>41.6</td>
</tr>
<tr>
<td>Child centered</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Discovery</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Project Approach</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total number of lessons observed</td>
<td>24</td>
<td>100</td>
</tr>
</tbody>
</table>

**Figure 1.** Methods used during Practical lessons
Figure 2. Methods used during Theory lessons

Table 2. Teachers’ and College Lecturers' Knowledge about the Project Approach method

<table>
<thead>
<tr>
<th>RESPONSE</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give acceptable description of approach</td>
<td>10</td>
<td>42</td>
</tr>
<tr>
<td>Have used approach in practical lesson</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Perceive it as useful in achieving syllabus objectives</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Perceive it as a waste of time</td>
<td>9</td>
<td>38</td>
</tr>
<tr>
<td>Can use it in their practical lessons</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>
Findings and Discussion
The teaching method mainly used by the teachers is the lecture method even during the practical lessons. Most teachers cited lack of time and resources in order for them to use the other methods, especially the project approach. Only 41.6% of the teachers employed the teacher demonstration approach during the practical lessons because they perceived it as a faster and less expensive way of doing the practicals. Lack of resources was also cited as a factor contributing towards the use of the teacher demonstration approach. This is where the teacher performs the experiment while pupils watch. The students do not develop the manipulative skills they must acquire during the practical lessons. 91.6% of the teachers used the lecture method during their teaching in theory lessons. Only 12% of the teachers perceived the project approach as a useful method to achieve the syllabus objectives.

Generally, teachers indicated that they considered availability of resources when selecting methods for use in theory and practical lessons. Learning objectives, the topic and content were stated by 100% of the teachers as some of the considerations they usually make in selecting both practical and theory mediation approaches. The length of the syllabus was also cited as one of the major factors. Learners’ educational level, activities stated in the syllabus and stimulating the learner interest were least considered when choosing the method of teaching. What about information or data from the lecturers?

Despite the fact that most of the teachers are knowledgeable about the project approach, none used this approach during the teaching and learning of biology at the time this research was being conducted. This suggests that most students complete their studies without the necessary practical skills and knowledge stated in the syllabus. Without the practical experience, it is very difficult for the students to understand the biological concepts and principles, hence, the high failure rate. It follows the Chinese saying which says
"I hear and I forget; I see and I remember; I do and I understand" (http://en.wikiquote.org/wiki/Chinese_proverbs).

The conditions for possible implementation suggested by the teachers and lecturers indicate that the project approach cannot substitute the regular approach but rather, that the two can be implemented in conjunction with each other.

**Conclusion**

It is possible to implement the project approach, not as a substitute to conventional methods, but under the following conditions.

- To be implemented together with the conventional laboratory approach.
- Not every practical activity is to be conducted as a project.
- Not to be treated as a substitute to teaching.
- Not to conduct projects for their own sake, but these should always be premised on topics, content and concepts given in the syllabus.
- The number of projects should be limited to avoid overloading children with activities.

**Recommendations**

The study recommends to the Ministry of Education, Sports, Arts and Culture of Zimbabwe that:

- The teachers should have staff development workshops to build their confidence in using the method in the classroom.
- Teacher education should focus on building competences in the use of methods that are hands on and investigative and not just mention or discuss them in theory.
- A review of the current final assessment process that gives more weight to theory than practical skills is encouraged in order to ensure that the competences of critical thinking and problem solving that society expects learners to develop are assessed.
- A more encompassing research be undertaken on the general awareness of policies that guide methods of teaching and their implementation.

**References**


[16] Zimbabwe Curriculum Policy for Primary and Secondary schools. Ministry of Education Sport and Culture Secretary’s Circular No.3 of 2002