



VIEWS AND PERCEIVED UNDERSTANDING OF THE PROCESS APPROACH IN TEACHING SCIENCE IN PRIMARY SCHOOLS

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Abstract:

The study was carried out to find out the views and perceived understanding of the process approach in science teaching by primary school teachers. A survey was carried out in Seke urban primary schools. Convenience sampling of 140 teachers participated in this research study. Questionnaires and interviews were used to collect data. The SPSS data analysis package was used to analyse the data. The study found out that most teachers did not have knowledge of the process approach and they used the content and the concept approach in science teaching. The study recommends a capacity building programme for primary school teachers focusing on use of the process approach in science teaching.

Keywords: process approach, teaching science, primary schools

1. Introduction

Primary school Science is the basis for further study at secondary and tertiary levels. Thus, pupils are provided with a sound foundation for future learning of science is likely to excel. Teachers in primary school should be equipped with appropriate teaching methods to lay the base for successful learning of science. In Zimbabwe, the Environmental Science Syllabus (1994) stresses the need to employ the hands-on process approach in science teaching. The process of approaches encourages active involvement of pupils in the learning process. The teacher's role is to facilitate learning by providing the necessary guidance and motivation. According to Harlen (1980), children will achieve more permanent learning as they find out for themselves and are allowed to experiment and master concepts.

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2. Review of Related Literature

2.1 Teaching of science in primary school

Effective teaching of science demands more than just content mastery. The teaching of science requires that pupils are actively involved in the learning process (Harlen, 1987). Teaching students about science includes three dimensions of science and these are content of science, basic concepts and scientific knowledge. Other important dimensions of science are processes of doing science and scientific attitudes. The process skills form the foundation of the process approach. The six basic science processes skills are observation, communication, classification measurements, inference and prediction. Observation is a fundamental science process skill. We observe objects and events using our five senses. It is important that pupils make observation, gather the data and look for relationships. Observations are usually for purposes of looking for similarities and differences, classifying objects or ordering events. The development of observation is guided by the teacher at primary school level Gega (1994).

Communication, involves children using all the five senses as well. In science, communication means putting the information obtained from observation and investigation into some form, for other people to understand. According to Harlen (1993), communication is an outward extension of thought and helps in the process of rearranging thought. Children can communicate through pictures, diagrams, maps charts, graphs models and language. The teachers are involved in organising group discussions through various activities Young (1989).

Classifying is another important process skill. Classifying involves sorting and arranging objects Classifying also involves organizing; ideas or events so that patterns and relationships can be detected. Children should be given opportunities to observe objects. The teacher should organize activities that allow children to construct simple classification schemes Young (1990). Measuring is encouraged to make observations more precise. Measuring involves determining magnitude degree of quantity, quality or length; teachers need to provide a variety of concrete objects for measuring. There is need to compare things in terms of size, weight, area, temperature and value. Another skill is inferring. Inferring involves interpreting or drawing conclusion from what is observed. To be able to infer children must use existing observation or measurements to derive an explanations. The teacher's role is to allow children observe, discuss and finally infer (Gega 1977, Young, 1990).

A prediction is a forecast of what a future observation or event would be. It is the teachers' job of design tasks which encourages making predictions based o observations measurements and inferences. According to Abruscat (1994), prediction promotes

positive attitudes towards science activities. Another skill is experimenting. Experimenting is an integrated process skill since it requires use of such skills as observing, classifying, measuring, commenting and inferring children should be provided with opportunities to test their own ideas through experimenting, Young (1990). Children after experimenting in a trial and error way, the teacher needs to give the necessary guidance. The process approach encourages children to experiment with a wide range of materials Gega (1977). The process approach allows pupils to have opportunities to actively seek evidence for themselves through their own senses. There should be plenty of handling and investigating materials and objects. There should be discussions in the classroom between pupils and between the teacher and pupils. The teacher should ensure children having real things to handle, Harlen (1993). The teacher should have knowledge of the process skills and how to develop them in children.

2.2 Statement of the problem

Science teaching in primary school in Zimbabwe is dominated by teacher talk with little student participation Lewin and Bajah (1991). The environmental science syllabus (1994) advocates for use of the process approach for successful science teaching. This study sought to find out the views and perceived understanding of the process approach by primary school teachers.

2.3 Research Questions

- What are views of teachers towards the use of the process approach in science teaching?
- Do teachers understand the tenets of the process approach in teaching science?
- What are the teachers' preferred teaching approaches in science teaching?

2.4 Methodology

The descriptive survey was used in this study and it was preferred because it is the best method of collecting data for the purpose of describing a population large enough to be observed. The descriptive survey is used to describe characteristic of a population or phenomenon being studied. It does not answer how when and why characteristic occur rather it addresses 'what' question. In this study, the sample was made up of 140 teachers who were randomly selected from the primary school teachers in Chitungwiza Urban.

2.5 Data Collection

Primary school teachers responded to questionnaires. Only 10 teachers and 10 school heads were interviewed. Questionnaires had open-ended and close-ended questions. The interviews allowed the researchers to explain purpose of the research and what he or she wants from the interviewees, provided opportunities for follow up on misinterpretations of questions by participants, and clarify them. Eight teachers were observed teaching science.

2.6 Data Analysis

Data was analyzed using SPSS. Frequencies and percentages were computed basing on the data, trends and patterns emerged from the data and open-ended responses and observation notes were qualitatively analysed.

3. Results and Discussion

Table 1: Area Covered During Teacher Preparation

Area Studied	Yes	No
	No %	No %
a) I studied Environmental and Agricultural Science as a main subject at college	17 12.7	90 67.2
b) I studied Environmental and Agricultural Science as a curriculum depth study (CDS) at college	26 19.4	78 58.2
c) I studied science as main subject at college	17 12.7	77 57.4
d) I studied science as an applied subject at college	60 44.8	54 40.4
e) I did not study any form of science	19 14.2	78 58.2

Table 1 shows the nature of teacher preparation during teacher preparation. Only 12.7% of the teachers indicated that they had studied environmental and agricultural science (EAS) as main subject at college while (67%) did not. Those who studied (EAS) as a curriculum depth study (CDS) at college was (19.4%) while the majority of teachers (58%) did not. Only (12%) of the students studied science as main subject while (57%) did not. Teachers who studied science as an applied subject were (44%) while the rest had not. At least (14%) did not study any form of science at all while the majority of teachers studied some form of science. The responses indicated that some teachers were not trained to teach science although they had gone through a teachers' college.

Table 2: Approaches to teaching Primary School Environmental Science

	Very Often %	Often %	Some Times %	Rarely %	Never %	Mean	Standard Deviation
Content Approach	33.6	31.3	17.9	9.0	3.7	3.86	1.12
Project Approach	12.7	18.7	44.8	14.9	3.7	3.23	1.00
Process Approach	20.1	44.8	19.4	12.9	1.5	3.77	0.94
Concept Approach	43.3	32.8	15.7	5.3	1.5	4.16	0.94

When asked to indicate the preference of science teaching approaches most teachers indicated that they mostly used the content approach. As for the project approach, (44%) indicated that they sometimes used this approach including the process approach when teaching science. The concept approach was preferred by the teachers since it was also considered as useful in preparing pupils for examinations. The concept approach was believed to be more effective than other approaches, in science teaching. The project approach was preferred by the teachers as it enabled pupils interact and learn from each other. It was also said to promote children’s research and discovery skills when learning science. The process approach was preferred by a few teachers. The process approach promotes discovering things around by pupils on their own.

Table 3: Views on the Role of Process Approach in Science Teaching

Statements	Sa	A	Ud	Da	Sda	Mean	Standard Deviation
a) I prepare materials for use in science lessons during my own spare time.	82 (61.2)	46 (34.3)	1 (0.7)	1 (0.7)	1 (0.7)	4.58	0.63
b) I consider the process approach as the most important approach in teaching primary school science.	39 (29.1)	72 (53.7)	11 (8.2)	5 (3.7)	1 (0.7)	4.12	0.78
c) Experiments are difficult to organise at primary school level	15 (11.2)	44 (32.8)	3 (2.2)	51 (38.1)	18 (13.4)	2.90	1.32
d) Developing children’s skill of observation will enable them use all their senses together information.	3 (2.2)	79 (59.0)	46 (34.3)	2 (1.5)	4 (3.0)	4.53	0.63
e) All science process skills are part of investigation.	43 (32.1)	61 (45.5)	14 (10.4)	9 (6.7)	1 (0.7)	4.06	0.89
f) Hypothesizing will enable	28	74	20	5	1	3.96	0.78

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children realise that scientific knowledge is tentative and is subject to change.	(20.9)	(55.2)	(14.9)	(3.7)	(0.7)		
g) Predictions are the same as guesses in science.	13 (9.7)	49 (36.6)	18 (13.4)	32 (23.9)	17 (12.7)	3.07	1.25
h) Opportunities for using and developing process skills have to be considered in secondary content.	42 (31.3)	74 (55.2)	10 (7.5)	2 (1.5)	1 (0.7)	4.19	0.71
i) The teacher can assess children's understanding of process skills such as observation, inferring and investigation very easily.	26 (19.4)	66 (49.3)	17 (12.7)	20 (14.9)	0 0	3.76	0.95
j) Mathematics in important when using the process approach in science teaching.	28 (20.9)	72 (53.7)	15 (1.2)	13 (9.7)	2 (1.5)	3.49	1.40
k) Teachers can only teach science if they have adequate content at primary school level	37 (27.6)	44 (32.8)	4 (3.0)	28 (20.9)	14 (10.4)	3.79	0.98
l) Teachers should provide adequate content to children when using the process approach.	37 (27.6)	4 (32.8)	4 (20.9)	28 (20.9)	14 (10.4)	3.97	0.96

Table 3 gives responses by teachers to statements in relation to the process approach in science teaching. The teachers agreed that they prepared materials for use in the science lessons during their own spare time. They considered the process approach was the most important approach in teaching primary school science. Teachers were able to develop observation skills to enable the children use all their senses to gather information. Developing process skills had to be considered when selecting content and teachers needed to develop children's understanding of process skills such as observation, inferring and investigating. Teachers agreed that mathematics was important when using the process approach in science teaching and those teachers could only teach science if they had adequate content in science and mathematics. Asked whether lack of equipment hampered the teachers' use of the process approach. Teachers indicated that materials were not available in the immediate environment and it was difficult to use the process approach. Some teachers highlighted that the process approach required setting up of apparatus for experiments and investigation. One actually wrote *``A soldier without a gun is useless so is a teacher without equipment``*. Asked

whether the teacher needed any further training in the use of the process approach some teachers felt that they did not need any further training. This was because of the availability of school based staff development. For those who wanted to be staff developed on the use of the process approach identified the following areas as needing emphasis during staff development, these were experimenting, interpreting data, investigating, hypothesizing, predicting, communicating, controlling variables, organising activities, using numbers, and use of available resources and classifying.

When asked to indicate whether the environmental science syllabus promoted carrying out of experiments by children, most teachers considered that the suggested activities and practical work in the syllabus promoted carrying out of experiments, by children. Some felt that the syllabus required pupils to find out for themselves and then prove facts through experimenting. However, some teachers complained that there were no kits to enable the children carrying out experiments. Some considered the syllabus to be as content oriented and did not promote experimenting. Others felt experiments needed higher order skills and equipment which were not available in primary schools. Asked to identify materials the teacher prepared at home for science lessons the following items were indicated, charts, work cards. Collection included cardboard boxes, tins, bottles, food stuffs, insects, candles, paper, relevant pictures and stones.

Teachers indicated that they sometimes took children outside classroom to view the environment, and also collect and investigate things from the environment. Children were also taken out to handle materials or carry out experiments. Teachers considered that process skills as the basic to the teaching and learning of primary sciences. Through the process approach children understand their environment and develop skills of analysing and the general scientific skills usable after completing primary education, they will be actively involved in the learning process.

4. Discussion

In view of the findings stated above it seems most teachers preferred the content approach to science teaching and concept approach. Most of these teachers studied science as an applied subject at college. Teachers have a negative attitude towards the process approach preferring the content and concept approaches to science teaching. School heads interviewed confirmed that teachers preferred the content approach since it was easier to use. The science lessons observed were content-oriented and teacher dominated. Teachers preferred the content approach since as it adequately prepared students for examinations. This confirms Lewis and Bajah's (1991) findings in

Zimbabwe were most of the lessons in science were content oriented and teacher dominated with little input from pupils.

Teachers considered some process skills to be very important such as controlling variables and interpreting data and experimenting as well. This showed lack of understanding of the process approach in that all process skills are important and interrelated as Young (1979) puts it, you cannot teach one process skill without teaching others. Hence, all process skills are very important when using the process approach. Again, the teacher should be knowledgeable of process skills to develop in children rather than a lot of content. Harlen (1980) confirms the above assertion by highlighting that the process approach requires a teacher to be knowledgeable of appropriate scientific skills to develop in children than content.

Teachers considered providing content as very important and making and testing children's predictions as more important. Materials teachers prepared for science lessons were mainly charts, work cards and maps. All these did not reflect much use of the environment. When interviewed teachers considered grounds outside the classroom as the environment. Although they considered the environment as very important in the teaching of science, it seems they did not extensively use it. According to Harlen (1993), the teachers' roles include planning; organising and setting up conditions for various activities to take place and for help to be given when needed. This means the teacher should be a facilitator for learning. Yet teachers tended to consider providing content as very important in children's learning of science and hardly used the environment in their teaching of science.

Teachers viewed lack of equipment as hampering the use of the process approach. Curin (1980) considers that at primary school level the environment is an important resources for learning. This means teachers obtain their materials and equipment from the environment when teaching science. The findings reveal that teachers do not extensively use the environment as a resource when teaching science. Harlen (1993) believes learning of science should encourage productive use of the resources in the local environment. This was not evident in the lessons observed.

Most teachers studied environmental science as an applied subject. However, most teachers did not want to be staff developed on the use of the process approach yet they considered experiments as difficult to organise. They identified process skills that were complex for both the teacher and children as interpreting data, inferring, communicating hypothesizing, controlling variables, predicting experimenting, investigating using numbers and classifying. Although teachers considered process skills as easy to assess, they tended to consider simple process skills as complicated for

the children for example using numbers. This lack of distinction between simple and complex processes reflected the teacher's lack of knowledge of process skills.

It is not clear therefore why teachers did not want to be staff developed on the use of the process approach. Observed lessons did not bear evidence of the use of process skills as well as in planning lesson presentation. School heads did not find the use of the process approach common in the lessons observed. It would be possible to attribute the response of the teachers to a negative attitude towards the process approach as well as lack of understanding of the process approach. A prerequisite to understanding of a concept is mastering it. This means teachers can only teach using the process approach if they clearly understand this approach. Teachers would not be expected to teach what they do not understand very well. If at all this would happen, it would only be accidental. Observed lessons confirmed the above assertion as teachers accidentally exposed children to observing, communicating, classifying and experimenting, although these process skills were not planned for. Curin (1980) stresses the hands-on process approach in the learning of science in all grades. Unless teachers are familiar with the process approach Harlen (1987) believes they will not consider it as a methodology in science teaching.

5. Conclusion

Teachers in the primary schools do not understand the process approach in science teaching and need to be capacitated to use it in the classroom to promote development of a solid base for future successful study of science as a subject.

5.1 Recommendations

- Teachers need to be capacitated on the use of the process approach in science teaching.
- Teachers colleges need to put in the process approach as a component in their syllabus during teacher preparation.
- Schools should be equipped with resources and materials to effectively use the process approach in science teaching.

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