EFFECT OF SCIENCE – TECHNOLOGY – SOCIETY CURRICULUM MODEL ON SECONDARY SCHOOLS' DECISION MAKING ABILITY IN COPING WITH SOCIO-SCIENTIFIC ISSUES

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The aim of this study was to investigate the effect of Science-Technology-Society (STS) curriculum on decision making. Four hundred and eighty (480) Senior Secondary two students were randomly selected from intact classes in six secondary schools in Calabar Municipality of Cross River State. The experimental and control groups each comprised 120 students randomly assigned to them. The experimental group was exposed to a researcher-designed and validated Curriculum in Science-Technology-Society (COSTS) for 12 weeks for 2 hours per week. The control group followed the normal existing science curriculum. A quasi experimental factorial designed was used to identify the effect of COSTS if any on decision making ability in coping with socio-scientific issues. The Decision Making Ability Test was administered to both experimental and control group. The data obtained were subjected to statistical analysis using Analysis of Covariance and the results that emerged showed that the experimental group performed significantly better in decision making than the control group. This study highlights the need for an alternative science curriculum that will make students become rational decision makers in a society riddled with science and technological problems.

INTRODUCTION

Decision-making refers to the process which an individual selects from two or more alternative. It involves the identification of the social institution involve in any social issue, the processing of all information and the relevance of each knowledge system in arriving at a decision (Juniper 1976; Janis and Mann, 1977; Aikenhead, 1980, 1985).

Life is in essence a continuous process of decision making or selecting from available or created options. Furthermore, the capability for decision making is a vital human quality that can be improved through instruction (Hurd, 1972; Kuhn, 1977; Zoller, 1978). Some form of decision making is practiced by everybody each day of his life. But despite its pervasiveness, and its importance to people and society, decision making at present has no systematic formed place in any educational programme. It is for this reason that Watson (1980) argued that decision making must play a part in any science curriculum. The wise use of knowledge, which is scientific technological or otherwise, enables students to assume social responsibility of attentive citizens or key decision makers.

The cornerstone of any democratic society is the active participation of intelligent and capable decision making citizens in its social and political life. It therefore follows that secondary school students are expected to become competent decision makers, capable of piloting the affairs of the nation. In essence, the development of better decision makers enable the ordinary to become

actively involved in social, technological, economical and political problems and their possible solutions.

The present science curriculum is devoid of training in decision making; rather basic knowledge for academic preparation receives significant emphasis. Goals related to personal use of science in every day life, to scientific literacy for social decision making and to career planning and decision making are largely ignored. Hence, this study is undertaken to contribute towards effort directed to remedy this missing component of science education.

OBJECTIVE

The purpose of this study was to investigate the effect of Science-Technology–Society (STS) curriculum on decision making. The study sought to determine if there is any significant difference in the post-test performance of experimental and control group in their decision making ability in the resolution of socio-scientific issues.

SIGNIFICANCE

The educating of competent decision makers is significant in terms of:

- promoting rational and thoughtful decision in a modern world of science and technology.
- making society function productively at all levels.
- assisting the individual to appreciate, understand and evaluate the decisions of others.

METHODOLOGY

Research Design

The design used for this study was a quasi-experimental design. The design was a modified pretest-posttest control group design, simply diagrammatized below:

$$O_1 \qquad X \qquad O_2 \qquad (E)$$

$$O_3 \qquad \sim \qquad O_4 \qquad (C)$$
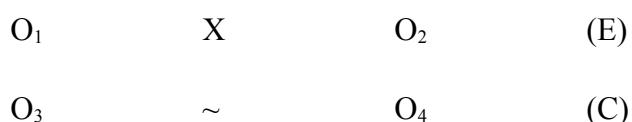
Where E represents experimental group, C – control group O_1 O_3 pretest performance, O_2, O_4 post test performance.

Population and Sample

The population of this study consisted of all Senior Secondary Two (SSII) students in all the Secondary Schools in Calabar Municipality. A sample of six schools was selected through stratified random sampling from fifteen existing Secondary Schools in Calabar Municipal. A sample of 480 Senior Secondary Two students was randomly selected from the six schools to form subjects of the study. A breakdown of the figure 480 gave 240 subjects in the experimental group and 240 subjects in the control group.

Instrumentation

The two instruments used for this study were:

- The Curriculum on Science – Technology – Society (COSTS) and

- Decision Making Ability Test (DMAT).

The ultimate goal of COSTS was to significantly improve the scientific and technological literacy of students. Closely aligned with the goal of literacy was the goal of achievement critical thinking and decision making.

The content of COSTS was built around five major themes namely:

- epistemology and social content of science
- nature of technology and society – the ethics and values of each; and the interaction between science, technology and society.
- characteristics of a scientist/technological knowledge.
- social construction of scientific and technological knowledge
- decision making on socio-scientific issues

The development of COSTS followed a multi-stage sequence, which took advantage of classroom realism. First the researcher developed and taught the content of COSTS package using a pilot school. Based on this classroom experience the COSTS package was modified. The face and content validity of COSTS were ascertained by a panel of experts to be about 90% agreement. The final curriculum package was obtained after a critical appraisal, revisions and modification based on expert advice.

Decision Making Ability Test

DMAT is an instrument that required students to gather information, process such information and be able to choose between alternatives after evaluating the advantages and disadvantages of each choice. This instrument allowed subjects to work through simulation, case models, controversies/dilemmas that required different kinds of decision making viz scientific, technological, ethical, moral and public policy. Guidelines for decision making were also provided for resolving the various Nigerian based science and technology related social issues.

Treatment

The experimental group was taught the content of the curriculum on Science–Technology–Society designated by the researcher using the mode of instruction suggested for STS (Aikenhead, 1988).

The experimental group was taught by the researcher. The decision making component of the COSTS package was taught to the experimental group using the ten-point guide provided by Aikenhead (1985). He recommended the following procedural ways:

- Itemize the domain of society, which appear to be relevant to the issue.
- Identify which domain and/or agency is given the social authority or the political power, to make the culture decision.
- Generate plausible choices.
- Predict the short-term or long logical consequences of each psychological consequence.
- Scrutinize the reasoning relied upon in making those predictions.

- Clarify the values that seem to support or negate, the various alternatives and recognize the values inherent in the prediction of consequences.

- Priorities the values in the context of the issues under decision.

- Weigh the evidence, the probability of the various consequences, and the values underlying the alternatives.

- Choose one alternative stating thoughtful justification

- Clarify the way in which science and technology contributed to this choice.

The subjects in the control group were not taught the content of the COSTS package but were allowed to experience their existing traditional science curriculum.

To assume the equivalence and comparability of subjects in the experimental and control groups, pretest measures represented by O_1 and O_3 were used to compare the groups. The comparison indicated that the groups were not equal with respect to decision making ability (F_3, 4756-57p<.01).

The result of the pre-entry behaviour with respect to selected variable has clearly shown that the groups were not equivalent at the start of the experimental treatment. The analysis of covariance was used to remove bias attributable to the experimental groups not being matched on some importance characteristics and to increase the precision of the experiment by minimizing the error variance.

Procedure

The study was carried out during the second term of 2004/2005 academic session. This covered a period of 12 weeks for the experimental and control groups. Each week comprised a 2hour of STS instruction. Prior to treatment the subjects were given a pretest to obtain a base for measuring gain during instruction. The test score on the pretest provided a description of the cognitive entry knowledge and skills possessed by the students with respect to the decision making variable at the beginning of the unit of instruction. The experimental group were treated with the COSTS materials while the control group were not given treatment but experienced their existing science curriculum using the conventional methods.

The post-test was administered after the experimental treatment. The instrument (DMAT) served both as the pretest and the post-test.

FINDINGS

Analysis of covariance was conducted on the subjects post –test score in decision making ability test using their pre-test scores as covariates. The result of the analysis is presented in table1.

Source of variation	Sum of squares	Degree of freedom	Mean Square	F	Sign. of p
Comariates	18947.742	1	18947.742	1162.622	0.000*
Main effects	26511.376	1	26511.376	1626.721	0.000*
Explained	45459.118	2	22729.559	1394.672	0.000*
Residual	7773.873	477	16.297		
Total	53232.992	479	111.134		

Table 1: Analysis of Covariance of the Experimental and Control Groups' Post-test Performance Scores on Decision Making Ability Test.

An examination of table 1 reveals that the F-ratio obtained is highly significant [F = 1626.72; p<.01). An F-ratio of 1626.72 was observed to be greater than the critical F-ratio of 6.70 given 1 and 478 degrees of freedom, and with .01 level of significance. The null hypothesis was thus rejected. This finding implies that there is a significant difference between the experimental and control groups with respect to decision making in the resolution of socio-scientific issues.

The result of the Multiple classification Analysis (MCA) presented in Table 2 reveals that the amount of variance accounted for by the treatment effect is 85.4% $(0.924)^2$ of the total variance.

Therefore, it could be concluded that experimental subjects have a superior decision making capacity in coping with science and technology related social problem than those of the control group.

		Unadjusted for independents			
Grand Mean = 30.079					
Variable+	Unadjusted			+ Covariates	
Category	N	Dev'n	Eta	Dev'n	Beta
EXPGP					
1	240	9.73		9.44	
2	240	-9.73		-9.44	
			0.92		0.90
R^2					0.854
R					0.924

Table 2: Multiple Classification Analysis.

DISCUSSION

The superiority of the STS group (experimental) over the non STS group (control) in decision making may not be unrelated with the nature of the task the subjects were engage in during treatment. The STS subjects were actively involved in tacking real life problems and decision making situations and experiences. "Doing" perhaps, is the real test of "Knowing" and so far there appears to be no substitute for first-hand experience (Zoller, 1982).

The poor performance of the control group in decision making task may not be unrelated to the educational inadequacies of the present science curricula. In other words, the traditional curricula do not seem to equip students with sufficient experiences, necessary to make them capable decision makers.

This is so because:

- Students are not exposed to open-ended, socially oriented problems, the solution of which calls for discrimination in applying value judgment.

- The conflict of values in the real world is ignored for the most part; since it occurs outside the confines of the school.

- No deliberate attempt is made within most schools to develop decision making skills to be applied within our contemporary modern socio-technological context.

- Science Curricula generally do not recognize the natural desire of youths to participate in the making of decision in the socio-technical domain (Zoller, 1982).

Consequently, many students are overwhelmed by the information, inputs conveyed to them and of which they are ill equipped to search out plausible solutions, originate new ones, assess the result or implement any decision.

According to Aikenhead (1980) decision making techniques and wisdom do not develop unless they constitute an explicit content of science and examination. Science curricula in Nigeria currently lack these explicit objectives hence the poor performance by the control group on this variable. The implication of this is that students do not have the skills or wisdom in resolving science and technology related, social issues as at when such issues arise…. They cannot offer what they do not have. This contributed to the poor performance of the control group. This tends to show that students who will become key decision makers in the future are not being adequately prepared for such a task.

CONCLUSION

In conclusion STS is not just another "harmless", intellectual exercise. It is a deliberate attempt to change students from being recipients of decisions made for them by someone else to one which make them active participants in the decision making process in the real world situation. Many of the problems of life that beset individuals and our country require an understanding of science and technology for their resolution. Because these problems are likely to persist, young people will be called upon to solve problems and attempt decision of that influence human being and the quality of life. The worthiness of the decision reached on these subjects will depend to a great extent on the decision maker himself having a valid understanding of the nature of science and technology.

RECOMMENDATIONS

Based on the findings of this result the following recommendations are made.

That science curriculum should be redesigned to:

Integrate science-technology – society themes, problems and issues in the overall curriculum.

Include decision making component that is they should provide the students with both the opportunity to apply their judgment in choosing among alternatives.

Train teachers adequate for the role they will be called upon to play in implementing desirable science curricula aimed at preparing they youth for the life of tomorrow.

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