Educational Research and Review Vol. 4 (7), pp. 340-344, July, 2009
Available online at http://www.academicjournals.org/ERR
ISSN 1990-3839 © 2007 Academic Journals

Full Length Research Paper

Preservice; Nigerian science teachers' conceptions of integrated science

Oludipe Bimbola[1] and Oludipe Daniel I.[2*]

[1]Department of Curriculum Studies and Instructional Technnology, Olabisi Onabanjo University, Ago-Iwoye, Nigeria.
[2]Biological Sciences Department, College of Science and Information Technology, Tai Solarin University of Education, Ijebu-Ode, Nigeria.

Accepted 14 July, 2009

The main purpose of this study was to critically examine the conceptions students in the integrated science major and non-integrated science major have about integrated science. Participants were 187 student-teachers enrolled in a University of Education in South-West Nigeria. They all did integrated science at the Junior Secondary School (JSS) level and offered physics, chemistry and biology at the 100 and 200 levels in the University. Finding of this study revealed that, contrary to generally held opinion about non-integrated science students, majority of the participants held cohesive conceptions of integrated science, while gender was also found not to affect integrated science conceptions.

Key words: Conception, preservice teacher, integrated science, science.

INTRODUCTION

There has been growing concern throughout the country over the years about the discouraging state of the teaching and learning of Integrated Science. This arising mainly as a result of a failure within teaching-learning contexts to illustrate connections between classroom Integrated Science and the environment learners come from. It has been argued that Junior Secondary School (J.S.S.) Students must be well grounded in integrated science at the J.S.S. level for them to be able to study the core Science subjects (biology, chemistry, physics, etc) at the Senior Secondary School level (Olarewaju, 1994). This has resulted in call by West African Examination Council (WAEC) for setting up of committees to look into integrated science as a subject (Olarewaju, 1994). The committees recommended the following specific methods for teaching integrated science:

a. Use of discovery teaching tactics.
b. The inclusion of problem-solving activities.
c. The involvement of students in open ended field or laboratory exercise (Olarewaju, 1994).

The efforts of the committee were expected to bring about change in focus in the teaching and learning of the subject. For changes to be effectively implemented in integrated science education, it is necessary that base line information should be available on a number of important aspects. Such include, for example, how teachers view the subject, issues relating to attitudes toward the subject, integrated science anxiety and others. In Nigeria, while research has focused on a number of aspects related to integrated science education, there has been no research focusing on preservice teachers' conceptions of integrated science. Hence, this study was embarked upon in order to know the opinions and comments of preservice science teachers on Integrated Science.

The conception scale used by the researchers to tease out students' conceptions of integrated science was adapted from the one used by Arigbabu (2005), developed by Crawford et al. (1998b). The scale is divided into two categories: fragmented and cohesive. In fragmented conceptions, integrated was seen to be about principles, formulae and scientific calculations, while in cohesive conceptions it was seen as a complex, logical system that helped in providing insights for understanding our environment. Of significance here was the facts that fragmented conceptions were associated with surface while cohesive were associated with deep approaches to learning (Arigbabu, 2005). These categorizations have a bearing on higher order learning skills and outcomes, hence very important for integrated science students.

To encourage higher order learning skills and to improve

*Corresponding author. E-mail: daniel.oludipe@gmail.com.

the teaching and learning of integrated science, it is essential that students are discouraged from resorting to unnecessary retention of facts, where the sole aim is to consciously commit information to memory so as to recall it later (Cooper, Frommer, Gordon, and Nicholas, 2002). The aim, therefore, should be to ensure that learning environments that encourage higher order learning skills are created. It has also been argued that teachers should organize the teaching and learning context in such a way that students are more likely to follow higher order learning processes (Biggs, 1999).

If teachers are to be entrusted with the role of ensuring that appropriate environments are created for enhancing students' higher order learning skills, it is expedient that empirical research finds out the conceptions which science teachers hold about Integrated Science. This is paramount because educators have to find ways of injecting new knowledge into the system of improvement and to share that knowledge with future generations of teachers (Hiebert, Gallimore and Stigler, 2002).

Such knowledge and information should help provide guidance on necessary changes that could be effected in order to address issues including teaching for higher order learning skills among preservice teachers. Furthermore, to improve the quality of learning, an important facet is to adopt deeper approaches to study through the creation of a context involving good teaching, clear goals and some independence rather than to focus on discouraging surface approaches (Trigwell and Posser, 1991; Trigwell and Posser, 1997).

Moreover, teachers' conceptions of integrated science together with the teaching context play an influential role and impact on instructional decisions. Psychologically, teachers' behaviours in the classroom are shaped by internal principles based upon conceptions of integrated science teaching. Inexperienced teachers are more likely to pass their past integrated science learning experiences to learners, irrespective of the conceptions they hold. In view of this, the purpose of this study was to determine preservice teachers' conceptions of Integrated Science.

Research Questions

i) What conceptions of Integrated Science do the Integrated Science preservice teachers possess?
ii) What conceptions of Integrated Science do the preservice teachers in other science subjects possess?
iii) Is there any difference in Integrated Science conceptions between preservice integrated teachers and preservice teachers in other science subjects?
iv) Is there any difference in Integrated Science conceptions between male and female preservice science teachers?

Research Hypothesis

i) There is no significant difference between preservice integrated science teachers and preservice teachers in other science subjects in their conceptions of integrated science.
ii) There is no significant difference between male and female preservice science teachers in their conceptions of Integrated Science.

METHOD

Participants

One hundred and fifty integrated science and other sciences (biology, chemistry and physics) preservice teachers in a University of Education in South-west Nigeria participated in the study. There were 114 female (76%) and 36 male (24%). They were all second year students and they all took Biology, Chemistry and Physics as compulsory courses in their first year. It should be noted that the participants offered Integrated Science at their Junior Secondary School level and they are aware of its nature as a unified science subject. Out of the 150 participants, 20% of them are integrated science majors while the remaining 80% are core sciences majors (non-integrated science majors). The 150 preservice science students were randomly selected from the 350 second year preservice science teachers. Intact class was used for the Integrated Science majors because they are not many, while the remaining 80% of the core science majors were randomly selected from each of the core science subjects (Biology, Chemistry and Physics).

Instrument and procedure

The 20-item conception of Integrated Science was adapted from Crawford's et al. (1998) used by Arigbabu (2005) and was found to be valid and reliable. The instrument was also face-validated by two professional colleagues whose comments led to the modifications and reduction of the items to 14. The questionnaire consists of two subscales – fragmented and cohesive conceptions. To ascertain the reliability of the questionnaire, the questionnaire was administered to a set of 40 students randomly selected from 120 second year preservice science teachers of another University in Southwest Nigeria different from the set of students under study. Cronbach Alpha statistical method was used to analyze the data collected and the reliability levels were .82 (fragmented) and .71 (cohesive) respectively. Similarly, findings relating to the internal consistency reliability of the questionnaire from other context (such as mathematics) have been reported (Arigbabu, 2005; Alkhateeb, 2001; Mji, 1999). The questionnaire was administered during school hours at the end of the first semester.

Data analysis

The data gathered was analyzed using descriptive statistics and one-way Analysis of Variance (ANOVA) using SPSS 13.00 package.

RESULTS

The order of presentation of the results is as follows:

Means and standard deviations for each scale item with respect to gender and courses are presented in Tables 1. From Table 1, fragmented scores for scale item 1 were M = 3.97, SD = .912 (male) and M = 4.32, SD = .733 (female), statistically significant ($F_{1, 185} = .005$). The frag-

Table 1. Means, standard deviation, and ANOVA for the conception of integrated science subscales by gender and courses.

	N	Scale Items	Gender						Course					
			Male		Female				ISC		Non-ISC			
			M	SD	M	SD	F	Sig.	M	SD	M	SD	F	Sig.
Conception	1	ISC is the study of universe.	3.97	.912	4.32	.733	8.042	.005	4.37	.633	4.13	.859	2.474	.117
	2	ISC is about equations and rules.	3.03	.971	3.20	1.032	1.329	.250	3.63	1.051	3.01	.962	12.299	.001
	3	ISC is simply in over complication of mathematical operations.	2.75	.863	2.94	.834	2.136	.146	3.37	.819	2.74	.809	18.288	.000
	4	ISC is about finding out solutions to problems involving physic, chemistry and biology.	2.81	.923	3.00	.987	1.768	. 185	3.66	.938	2.74	32.152	.881	.000
Fragmented	5	ISC is about collections.	4.27	.886	4.45	.705	2.196	.140	4.39	.755	4.38	.793	.018	.895
	6	ISC deals with equations, formulae and diagrams.	3.86	.887	3.75	1.029	.644	.423	3.79	.963	3.79	.981	.000	.989
	7	In ISC you manipulate numbers and equations to solve problems.	3.25	1.051	3.39	.927	.906	.342	4.00	.113	3.16	.966	25.249	.000
Conception	8	We can use ISC to generate new knowledge.	4.55	.554	4.44	.729	1.198	. 275	4.50	7.62	4.48	.643	.037	.847
	9	ISC is a composite systematic approach developed to explain the composite knowledge of the world and relationships in it.	4.32	.724	4.33	.760	.027	.871	4.32	.775	4.33	.739	.009	.923
	10	ISC provides an insight into the complexities of aim reality.	4.27	.692	4.16	.805	1.030	.311	4.05	.928	4.24	.713	1.866	.174
	11	ISC describes reality in the aim of helping us to understand the world.	4.16	.800	4.31	.766	1.492	.224	4.53	.506	4.16	.822	6.088	.015
Fragmented	12	ISC is a universal language while allows people to communicate and understand the universe.	3.60	.996	3.77	.969	1.327	.251	3.68	1.016	3.71	.975	.023	.879
	13	ISC is a logical system which helps in explaining. The rudimentary and general knowledge of science.	4.37	.730	4.37	.720	.000	.989	4.26	.978	4.40	.645	1.019	.314
	14	ISC helps to explaining answer, and investigation matters in the world.	4.42	.665	4.33	.795	.666	.416	4.50	.558	4.34	.785	1.479	.226

M: Mean, SD: Standard Deviation, ISC: Integrated Science, NON-ISC: non-integrated science, Sig.: level of significance.

mented scores for scale items 2, 3, 4, 5, 6 and 7 respectively were M = 3.03, 2.75, 2.81, 4.27, 3.86, 3.25, SD = .971, .863, .923, .886, .887, 1.051 (male) and M = 3.20, 2.94, 3.00, 4.45, 3.75, 3.39, SD = 1.032, .834, .987, .705, 1.029, .927 (female), not statistically significant ($F_{1,185}$ = .250, $F_{1,185}$ = .146, $F_{1,185}$ = .185, $F_{1,185}$ = .140, $F_{1,185}$ = .423, $F_{1,185}$ = .342, all ns). On the other hand, cohesive scores for scale items 8, 9, 10, 11, 12, 13

and 14 respectively were M = 4.55, 4.32, 4.27,4.16, 3.60, 4.37, 4.42, SD = .554, .724, .692, .800, .996, .73 , .665 (male) and M = 4.44, 4.33, 4.16, 4.31, 3.77, 4.37, 4.33, SD = .729, .760, 805, .766, .969, .720, .795 (female), not statistically signifi-cant ($F_{1, 185}$ = .275, $F_{1,185}$ = .871, $F_{1,185}$ = .311, $F_{1,185}$ = .224, $F_{1,185}$ = .251, $F_{1,185}$ = .989, $F_{1,185}$ = .416, all ns).

From Table 1, fragmented scores for scale items 2, 3, 4 and 7 respectively were M = 3.63, 3.37, 3.66, 4.00, SD = 1.051, .819, .938, .113 (ISC major) and M = 3.01, 2.74, 2.74, 3.16, SD = .962, .809, .881, .966 (NON-ISC major), statistically significant ($F_{1,185}$ = .001, $F_{1,185}$ = .000, $F_{1,185}$ = .000, $F_{1,185}$ = .000, sgt). The fragmented scores for scale items 1, 5 and 6 were M = 4.37, 4.39, 3.79, SD = .633, .755, .963 (ISC major) and M = 4.13, 4.38, 3.79, SD = .859, .793, .981 (NON-ISC major), not statistically significant ($F_{1,185}$ = .117, $F_{1,185}$ = .895, $F_{1,185}$ = .989, ns). The cohesive scores for scale items 8,9,10,11,12,13 and 14 respectively were M = 4.50, 4.32, 4.05, 4.53, 3.68, 4.26, 4.50, SD = 7.62, .775, .928, .506, 1.016, .978, .558 (ISC major) and M = 4.48, 4.33, 4.24, 4.16, 3.71, 4.40, 4.34, SD = .643, .739, .713, .822, .975, .645, .785 (NON-ISC major), not statistically significant ($F_{1,185}$ = .847, $F_{1,185}$ = .923, $F_{1,185}$ = .174, $F_{1,185}$ = .015, $F_{1,185}$ = .879, $F_{1,185}$ = 314, $F_{1,185}$ = .226, ns).

DISCUSSION

Fragmentally, there was statistical significant difference in scores of the 1st subscale between male (M = 3.97, SD = .912) and female (M = 4.32, SD = .733) suggesting that this factor affected preservice science teachers' conceptions of Integrated Science. On the other hand, there were no statisti-cally significant difference between male and female students in the scores of the scale items 2, 3, 4, 5, 6 and 7 suggesting that these factors did not affect preservice science teachers' conceptions of integrated science.

With respect to science courses, fragmentally there were significant difference between Integrated Science (ISC) major and non – Integrated Science (ISC) major in scores for scale items 2, 3, 4 and 7 suggesting that these factors affected preservice science teachers' conceptions of Integrated Science. The mean scores for ISC major were higher than that of the mean scores for the non-ISC major. On the other hand, there were no statistical difference in scores for scale items 1, 5 and 6 respectively suggesting that these factors did not affect preservice science teachers' conceptions of Integrated Science.

Cohesively, with respect to difference in sex, there were no statistically significant differences in the scores for scale items suggesting that these factors did not affect preservice science teachers' conceptions of integrated science. In the same vein, there were no statistically significant difference, with respect to courses, between the ISC major and non-ISC major in scores for the cohesive scale items suggesting that these factors did not affect preservice science teachers' con-ceptions of integrated science.

Consequently, it is interesting that the finding of this study indicates that the ISC major students had both fragmented and cohesive conceptions of Integrated Science, while majority of the non-ISC major had cohesive conceptions of integrated science. This is interesting because ideally preservice teachers should hold cohesive conceptions otherwise there would be no hope for teaching for higher learning skills in teachers' future careers (Arigbabu, 2005). Since both ISC major and non-ISC major preservice science tea-chers had cohesive conceptions of Integrated Science, both sets of teachers would be able to handle Integrated Science effectively, and where there are insufficient qualified Integrated Science teachers – as it is in Nigeria – the non-ISC major teachers would be able to teach the subject effectively.

Conclusion

The findings of this research work showed that majority of the student-teachers in the ISC major and non-ISC major had cohesive conceptions of Integrated Science more than fragmented conceptions. There was no gender influence on conceptions held by the preservice science teachers in this study; this is in line with earlier studies (Arigbabu, 2005). The result of this study implies that Integrated Science students' conceptions of integrated science is not far better than that of the non-ISC major, though it is true to some extent but not to a larger extent. This is contrary to the general belief that Integrated Science students' conceptions of Integrated Science are far better than that of the non-ISC students. However, students' understanding of key concepts of the subject matter must be systematically related to the conceptions of learning. It is hoped that the result of this study would be useful for planners in the field of education in an attempt to enhance students' Integrated Science learning.

Recommendations

Since non-ISC major preservice science teachers also had cohesive conceptions of integrated science like their integrated science major colleagues, they would be able to handle integrated science effectively. However, for them to be able to handle Integrated Science effectively, they need to be well trained in Integrated Science concepts like their integrated science major colleagues who went through pedagogical training in integrated science education. The training can only come through the integrated science education programme. the training can be grouped into two ways: These are

(i) Inservice.
(ii) Preservice programmes respectively.

Since this study centers on preservice teachers, the study focused on the preservice training programme. The preservice training programme is meant for science education students (integrated science students and non-integrated science students). All science education students at both Colleges of Education and University levels should offer Integrated Science as a minor teaching subject at their first and second years respectively. Those who offer integrated science as a major course should continue the course in their subsequent years.

The integrated science education programme should include the following major points:

a. Lecture on the content of integrated science course.
b. Lecture on appropriate use of language of instruction.
c. Lecture on application of methods of teaching integrated science.
d. Lecture on improvisation techniques.
e. Lecture on integrated science concepts evaluation techniques.

During the above-mentioned training programme, care should be taken to group the preservice science teachers (non-integrated science major) according to their areas of specialization in order for them to be well drilled on the integrated topics outside their areas of specialization.

REFERENCES

Alkhateeb HM (2001) University Students' Conceptions of First – Year Mathematics. Psychol. Rep. 89: 41-47.
Arigbabu AA (2005). Conceptions of Mathematics: The Case of Social and Management Sciences Preservice Teachers. J. Sci. Teach. Assoc. Niger. 42(1/2): 11-15.
Biggs J (1999). What the Student Does: Teaching for Enhanced Learning. Higher Educ. Res. Dev. 21: 305-321.
Cooper I, Frommer M, Gordon S, Nicholas J (2002). University Teachers' Conceptions of Memorising in Science. Higher Educ. Res. Dev. 21: 305-321.
Crawford K, Gordon S, Nicholas J, Prosser M (1998a). University Mathematics Students' Conceptions of Mathematics. Stud. Higher Educ. 23: 87-94.
Crawford K, Gordon S, Nicholas J, Prosser M (1998b). University Mathematics Students' Conceptions of Mathematics. Stud. Higher Educ. 23: 87-94.
Hiebert J, Gallimore R, Stigler JW (2002). A Knowledge Base for the Teaching Profession. Educ. Res. 31(5): 3-15.
Mji A (1999). Reliability and Validity of the Conceptions of Mathematics Questionnaire. Psychol. Rep. 85: 579-582.
Olarewaju AO (1994). New Approaches to the Teaching of Integrated Science. Ibadan: Alafas Publishers.
Trigwell K, Prosser M (1991). Improving the Quality of student Learning: The Influence of Learning Context and Student Approaches to Learning on Learning Outcomes. Higher Educ. 22: 251-266.
Trigwell K, Prosser M (1997). Relations between Perceptions of the teaching Environment and Approaches to Teaching. Br. J. Educ. Psychol. 67: 25-35.