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Full Length Research Paper

The relation between teacher trainees' background in science and success in the end of first year first semester integrated science examination (a case study at St. Louis College of Education, Kumasi)

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There has been some concern regarding teacher trainees' low understanding of basic science concepts, though the topics that are treated have been covered at the Senior High School level. This study was conducted at St. Louis College of Education with the purpose of verifying the relationship between the teacher trainees' background in Integrated Science and their performance in the Diploma in Basic Education Examinations (DBE) at the End of First Semester Examinations. The study revealed that teacher trainees who possessed poor background in Integrated Science displayed poor observational skills, poor problem solving skills and fleeting attention during Integrated Science lessons and thus performed poorly in the Diploma in Basic Education examinations in Integrated Science. However, the teacher trainees who possessed good background in Integrated Science displayed good problem solving skills, increased interest in Integrated Science lessons and quality observational skill and thus performed creditably well in the Diploma in Basic Education examination in Integrated Science. It is argued that teacher trainees who enter College of Education with good grades in Integrated Science in WASSCE examinations are more likely to perform better in Integrated Science in the Diploma in Basic Education examinations. It can be recommended that the students who apply to enter the Diploma in Basic Education program must be rigidly examined to ensure that they possess sound knowledge in Integrated Science. This is due to the fact that the study has revealed that there is significant relationship between the background knowledge in Integrated Science and performance in Diploma in Basic Education examinations in Integrated Science.

Keywords: Integrated Science, Senior High School, West African Senior Secondary Certificate, Teacher Trainees, Examination, Diploma in Basic Education Examination, Basic School, College of Education, End of First Semester Examinations

INTRODUCTION

The very poor and deteriorating performance in integrated science among first year teacher trainees of St. Louis College of Education is of serious concern to the students themselves, College Administrators and Educators. This is because the integrated science course outline for Colleges of Education is designed to consolidate mainly teacher trainees' knowledge on the topics treated in Integrated Science at Senior High School level. Also the teacher trainees are expected to teach Integrated Science in basic schools and so they need to acquire the relevant knowledge and skills that will enable them to teach effectively at various levels in basic schools. It is therefore imperative to investigate the relationship between the backgrounds of teacher trainees

in Integrated Science and their performance in college with the view to identifying the appropriate methodologies to help the teacher trainees.

The Acting Director General of Ghana Education Service at the opening ceremony at a workshop for the orientation and training of District INSET committee at St. Louis College of Education, Kumasi on March 28, 2011 expressed concern about the poor performance of students in Science. He had this to say, "It is unfortunate that we are still battling with poor student performance in schools, especially in General Science and Mathematics. The results of the National Education Assessment (NEA) and the School Education Assessment (SEA) show a very abysmal performance of students. As the results indicate, less than 20% of students in Ghana's basic school reach the minimum proficiency in Mathematics and Science. Pupils in basic schools do not participate in Integrated Science lessons and have become passive learners with little involvement. The pupils resort to copying notes from the chalkboard and textbooks during Integrated Science lessons".

The concerns raised by the Acting Director –General were not isolated. For example, Sarfo and Nkopodi (2009) reported that majority of teacher trainees in Colleges of Education in Ghana have a poor background in Integrated Science which is traceable to their Junior High School days. It is against these backgrounds that this research was conducted to ascertain the relationship that exist between the teacher trainees' background in Integrated Science and their success in the end of first year first semester examinations in Integrated Science.

In another development, every educational program has a base line and a ceiling. This base line is a starting point which in most instances assumes that learners entering a program have already acquired basic knowledge and skills relevant to their understanding of the new content. It therefore stands to reason that if teacher trainees enter the Diploma in Basic Education program without solid foundation in Integrated Science from the Senior High School, then pressure will be mounted on them to be successful in Integrated Science Examination. In this state of affairs, such teacher trainees may resort to receptive and rote learning which not productive.

Purpose of the study

The study was aimed at the verification as to whether the background of teacher trainees in Integrated Science has any influence on their success in the end of first year first semester Integrated Science examinations.

Hypotheses

On the basis of the purpose of the study, the following theoretical hypothesis (H1) was formulated.

There is no significant relationship between teacher trainees' background in Integrated Science and their success in the end of first year first semester Integrated Science examination.

In contrast the following null hypothesis (Ho) was formulated.

There is a significant relationship between teacher trainees' background in Integrated Science and their success in the end of first year first semester Integrated Science examination.

The relation between the background of students and school success

According to Ayres (1995) the relation between the background of a student and learning can be seen as steps in the developmental process. He asserted that there is a certain sequence in which a student's development must take place. The first step in this sequence forms the foundation for the second step and so on. If the foundation was not laid properly, the steps that follow could also then not be developed. It stands to reason that the background of teacher trainees in Integrated Science which they acquired from the Senior High School level forms the foundation for the learning of Integrated Science at the College of Education. Moreover, the Integrated Science course at the College of Education level is designed to consolidate mainly the teacher trainees' knowledge on the topics treated in Integrated Science at the Senior High School level. Therefore the research attempted to investigate the relationship between the teacher trainees' background in Integrated Science and their success in the first semester examinations.

Zirbel (2001) contends that learning is a mental process that depends on perception and awareness, on how addition stimuli and new ideas get integrated into the old knowledge database (a process Piaget called 'assimilation'), and on how, through reasoning (a previously mental mechanism), the entire database gets re-organized in alternations of the mental structures and the creation of new ones (a process called 'accommodation'). Zirbel (2001) continues that adding new information is the first part of learning and so the whole learning process involves the integration, re-organization and creation of new mental structures. This implies that, whenever one refers to an object that is not present or an activity that is not going on; the impression of these must be created in the mind of the person.

Qualter (1996) reported that students do not enter the classroom as a "blank slates", but come to class with already formed ideas on many topics. Students have their own individual present knowledge, beliefs, and ways of thinking (Novak, 1987; Helm and Novak, 1983; Smith

Disessa and Rochelle, 1994). Sometimes these views may be rather strange, even elaborate, but regardless of their content, these views tend to be highly resistant to change. The views can change but what has to happen at the neural level is to establish new dendric connections, eliminate others and tweak the wrights of the signals that determine whether or not particular neurons will fire. While "learning of unfamiliar " and "conceptually understanding" the subject-matter already provides a large challenge and involves much neural activity, unlearning misconceptions is significantly more difficult.

LeDoux (1999) in his contribution emphasizes that whenever we experience something new, the brain searches for an existing network into which to fit that information, and if that network exists, we can process and evaluate the information relatively quickly and at ease. But if we are asked to learn new skills, additional connections among the neurons have to be made-which always takes some time and experience. Thus thinking in ways we have already learned to think will be much easier than being challenged to think in new ways. In view of this, it can be deduced that the teacher trainees who have good background in Integrated Science are more likely to comprehend the topics that they learn during their training at the Colleges of Education than those with poor background in Integrated Science. Hence the study was conducted to identify the relationship between the background of the teacher trainees and their performance in Integrated Science.

School readiness

Pretorius (1998) intimated that learners who are disadvantaged due to the fact that they come from an environment with poor learning materials and learning situations possess inadequate background knowledge in specific subject areas. Pretorius (1998) further stated that learners who have inadequate background knowledge are not ready for learning and are not able to realize the teaching aims and thus not passing the examination and eventually not becoming productive members of society. These learners who are not school ready because they have inadequate background knowledge are thus considered as high- risk learners in respect of school success. It is therefore imperative to find out how school readiness of the teacher trainees whose background in Integrated Science is inadequate affects their success in Integrated Science examinations. Van Zyl (1991) observed that learners who are not school ready do not accept challenges, do not tackle tasks to completion, do not have a sense of responsibility, do not have the ability to communicate and to share, as well as the ability to regulate themselves. Such learners do not make progress since they lack the skill necessary for understanding and organizing information and problem solving techniques which are skills that prepare learners for functioning within the formal school situations.

In order to be ready to learn in the formal school, the learner's cognitive development must already have developed to a high level. The learner must be able to notice what is happening around him or her. His or her powers of observation must also already be developed to a reasonably high level (Moletsane and Bouwer 2000). Attention span forms a very important part of school readiness, and the length of time the learner can pay attention is a determining factor for learning. Fleeting attention to a large extent retards learning. Even if the learner has a high intelligence, his or her attention span still remains the means whereby intelligence must be realized (Steenkamp 1997). The learner's powers of thought must be advanced to the extent that the learner is able to form abstract thoughts and ideas. He or She must no longer be totally bound by concrete thought. Visualizing and fantasizing are two important methods of learning which must be sufficiently developed together with memory, which also plays an important role (De Witt and Booysen 1994). From the above it stands to reason that the factors that determine the school readiness of learners, such as, attention span, ability to form abstract thoughts and ideas, ability to visualize and fantasize play very vital role in determining the success of learners. It was therefore imperative to investigate the relationship between the background of teacher trainees in science and their school readiness which is positively linked to their success in examinations.

The nature of students' learning

Kyiriacou (1996) defined student learning as changes in student's behavior which take place as a result of being engaged in an educational experience. It is worthy of note that for effective learning to take place, each student must be engaged in the activity of learning. And for this to happen, there should be effective teaching, which is the ability of the teacher to set up a learning experience which brings about the desired educational outcomes. Ausubel (1988) emphasized two important distinctions in student learning. He looked at the distinction between reception and discovery learning, and the distinction between rote and meaningful learning.

In reception learning the entire content of what is to be learned is presented to the learner in its final form; the learner is required to internalize or incorporate the material presented. By contrast, in discovery learning the content of what is to be learned has first to be discovered by the pupil through some learning activity. In meaningful learning, the essential characteristic of the learning is that it can be related in a meaningful, non-arbitrary way to what the learner already knows. In rote learning,

however, what is learned is characterized by arbitrary associations with the learner's previous knowledge. These two distinctions, reception versus discovery learning and meaningful versus rote learning, are seen by Ausubel to be independent of each other. Thus reception learning can be either meaningful or rote, and discovery learning may be either meaningful or rote. This is an important observation, since there is a tendency to assume that reception learning is also rote learning, and that discovery learning is also meaningful learning. Meaningful learning has important implications for the notion of teaching for understanding, since it places emphasis on the type of changes in the pupil's cognitive structure that take place during learning, and on the consequent demonstration of learning that the learner can display.

Bruner (1980) noted a clear distinction between learning that must take place by a student as a natural part of interacting with the environment, and the specific learning which is intended by the teacher. He points out that what motivate student to learn a concept stems from a biologically based drive of curiosity. Such drive involves an interest in the learning task itself and also satisfaction been gained from the task. White (1979) has argued that individuals have a basic drive towards competence in which exploration, attention and perception are used to promote and effective and competence interaction with the environment. From the above it can be deduced that the background knowledge in Integrated Science of first year teacher trainees has an influence on the extent to which they are motivated to learn Integrated Science effectively. It is therefore imperative to conduct a study to ascertain the relationship between the background knowledge in Integrated Science of first year teacher trainees and their success in the end of first semester examinations.

RESEARCH METHOD

Formulation of Hypotheses

On the basis of the literature study, the following theoretical hypothesis was formulated;

The following null hypothesis (Ho) was formulated. There is a relationship between teacher trainees' background in Integrated Science and their success in the end of first year first semester Integrated Science examination.

Alternative Hypothesis (H_1)

There is a significant difference between teacher trainees' background in Integrated Science and their success in the end of first year first semester Integrated Science examination.

Research design

A research design is the plan which specifies how the research participate (samples) are going to be obtained and what is going to be done with them with the view to reaching conclusion about the research problem (Huysamen 1994).

The research design therefore, shall specify

a) The number of groups that shall be used.

b) Whether the group shall be drawn randomly from the populations involved or whether they shall be assigned randomly.

c) Exactly what shall be done to the sample chosen.

In view of the hypothesis empirical research was conducted at St. Louis College of Education from April 20th 2012 to May 15th 2012 on 250 level 100 teacher trainees to investigate the possible relationship between their background in Integrated Science and their success in the end of first semester examination in Integrated Science. The Pearson's correlation was used to test the hypothesis about the difference of the means of the performance of the teacher trainees in their WASSCE and DBE examinations in Integrated Science. The Pearson's correlation was used to find out whether there was a significant relationship between the marks of the students in their WASSCE and their DBE Integrated Science examination. The Pearson's correlation was used to establish the relationship between the two means (Bluman, 2004).

Population

The research was aimed at obtaining information about the relationship between the background knowledge in Integrated Science and success in the end of first semester first year examinations in Integrated Science. The 280 level 100 teacher trainees of St. Louis College of Education constituted the accessible population. All the teacher trainees of St. Louis College of Education constituted the target population.

Sampling procedure

Two hundred and fifty level 100 teacher trainees of St. Louis College of Education were purposively selected for the study. Two hundred and fifty level 100 teacher trainees grades obtained in WASSCE and the first year end of first semester examination in Integrated Science were collected from the examination office.

Ethical Issues

The ethical measures that were undertaken included con-

Table 1. Statistics on |Level 100 teacher trainees WASSCE Grades and DBE Grades in integrated science

		WASSCE/SSCE	DBE
N	Valid	250	250
	Missing	0	0
Mean		60.5600	57.6200
Median		59.0000	57.0000
Mode		59.00	50.00
Std. Deviation		7.06868	7.46260
Variance		49.966	55.690

Table 2. Frequencies and percentages of WASSCE/SSCE integrated science scores for the 2011/2012 admissions

Mark	Frequency	Percent	Valid Percent	Cumulative Percent
49	13	5.2	5.2	5.2
54	68	27.2	27.2	32.4
59	82	32.8	32.8	65.2
64	30	12.0	12.0	77.2
69	31	12.4	12.4	89.6
74	24	9.6	9.6	99.2
79	2	.8	.8	100.0
Total	250	100.0	100.0	

Table 3. Frequencies and percentages of DBE end of first semester January 2012 integrated science scores for the 2011/2012 level 100 students

Mark	Frequency	Percent	Valid Percent	Cumulative Percent
41	1	.4	.4	.4
43	3	1.2	1.2	1.6
44	3	1.2	1.2	2.8
45	1	.4	.4	3.2
46	10	4.0	4.0	7.2
47	6	2.4	2.4	9.6
50	21	8.4	8.4	18.0
51	11	4.4	4.4	22.4
52	14	5.6	5.6	28.0
53	12	4.8	4.8	32.8
54	11	4.4	4.4	37.2
55	18	7.2	7.2	44.4
56	10	4.0	4.0	48.4
57	9	3.6	3.6	52.0
58	4	1.6	1.6	53.6
59	17	6.8	6.8	60.4

Table 3. Continue

60	14	5.6	5.6	66.0
61	8	3.2	3.2	69.2
62	9	3.6	3.6	72.8
63	12	4.8	4.8	77.6
64	9	3.6	3.6	81.2
65	10	4.0	4.0	85.2
66	3	1.2	1.2	86.4
67	13	5.2	5.2	91.6
68	2	.8	.8	92.4
69	2	.8	.8	93.2
70	5	2.0	2.0	95.2
71	2	.8	.8	96.0
72	1	.4	.4	96.4
73	2	.8	.8	97.2
74	3	1.2	1.2	98.4
75	2	.8	.8	99.2
77	1	.4	.4	99.6
79	1	.4	.4	100.0
Total	250	100.0	100.0	

Table 4. Correlations between WASSCE and DBE Level 100 Results

		WASSCE/SSCE	DBE
WASSCE SSCE	Pearson Correlation	1	.118
	Sig. (2-tailed)		.063
	N	250	250
DBE	Pearson Correlation	.118	1
	Sig. (2-tailed)	.063	
	N	250	250

sent from the teacher trainees. They were assured of anonymity and confidentiality.

Statistical reliability and validity

The reliability of a test refers to the consistency with which a test measures and it expressed as a coefficient, which can assume any value between 0 and 1. The higher the reliability of a test, the smaller will be the difference between the testees' scores in repeated applications of the test and the more useful such test will be. The study was undertaken to establish the relationship that exists between the grades of the level 100 teacher trainees in the end of first semester examination in Integrated Science and their respective grades in WASSCE Integrated Science. The mean of the grades in the two respective examinations were compared. The Pearson's correlation was employed for testing the relationship between the two means.

Data collection procedure

The grades of two hundred and fifty teacher trainees in Integrated Science at the end of first semester examinations were compiled from the examinations office of the College. The grades of these two hundred and fifty trainees in the WASSCE Integrated Science were comp-

iled from their files.

Data analysis

The responses that were obtained from the results of the students were put on tables and the Pearson's correlation analysis was applied to the data.

Generally, one rejects the null hypothesis if the p-value is smaller than or equal to the significance level. If the level is 0.05, then the results are only 5% likely to be as extraordinary as just seen, given that the null hypothesis is true.

From the above correlation, the calculated p-value of 0.063 exceeded 0.05, and thus the null hypothesis that - there is a relationship between teacher trainees' background in Integrated Science and their success in the end of first year first semester Integrated Science examination cannot be rejected.

Therefore, there is enough evidence to support the claim that there is a significant relationship between the teacher trainees' background in Integrated Science and their success at the end of first semester examination in Integrated Science.

DISCUSSION OF RESULTS

From table 4, the calculated Pearson's correlation value was 0.063 but the accepted value is 0.05. The calculated Pearson's correlation value of 0.063 is however higher than 0.05, therefore the null hypothesis could not be rejected. Therefore, there was not enough evidence to support the claim that there is a significant difference between the teacher trainees' background in Integrated Science and their success at the end of first semester examination in Integrated Science.

This shows that, most of the grades obtained at WASSCE in Integrated Science correlated highly with the grades obtained at the end of first semester examination in Integrated Science. It can therefore be deduced that the ability of the teacher trainees to form science concepts depends upon the teacher trainee's background in Integrated Science. It therefore stands to reason that the science concepts that have been formed early by the teacher trainees are used to develop new concept later. In this state of affairs, the ability of teacher trainees to solve problems in Integrated Science will to a large extent depend on their ability to form concepts which is based on their background in Integrated Science.

Levine (1999) has stated that obstacles to solving problems include being fixated and not being adequately initiated. Being fixated means focusing on prior strategies and failing to look at a problem from fresh, new perspective. Functional tiredness is a type of fixation in which an individual tries to solve a problem in a particular way that has worked in the past. It therefore stands to reason that the teacher trainees' inability to solve problems from a fresh new perspective but focusing on prior strategies is a function of their background in Integrated Science. It can therefore be concluded that if teacher trainees who gain admission to Colleges of Education with poor grades in Integrated Science their performance in Integrated Science in the Diploma in Basic Education examinations is likely to be poor. It is therefore important to ensure that the profile of teacher trainees who apply to enter the Diploma in Basic Education program be rigidly examined in order to ensure that teacher trainees with sound knowledge base are admitted. This is because if a student enters a College of Education with a poor background in Integrated Science, the student might not be able to acquire sufficient knowledge in Integrated Science that will be needed to teach in the basic schools.

According to Zirbel (2001) a person has a set of intellectual abilities and has developed specific ways of thinking and of surviving in general, and has learned a variety of skills during his lifetime, including how to speak and how to read. The person has a certain database of knowledge that he has acquired over the years. How much of this material is really accessible or there on recall is another issue.

Zirbel further contends that, human beings will have developed specific personality traits and skills, and will have learned specific ways of thinking, developed special talents and ways of thinking which they are more at ease than with others. In other words, our experiences have determined how our brain got hardwired, what types of specific skills and intelligences we possess and how we think in general. If new information is fed into the student's brain and a thinking network already exists, the student will feel more at ease and will more readily be able to follow certain arguments. This then requires changing the original hardwiring. But with a lot of training, and a lot of effort from the students' side this can be done but the point is the student has to do all the thinking, or in other words, construct knowledge. So, if we teach new materials in a yet foreign fashion we have to consider having to reconfigure or even create some of the thinking networks and thus the hardwiring.

It should be noted that the Integrated Science is a foundation course in the Diploma in Basic Education program which is designed to consolidate what the teacher trainees already possess from the Senior High School level. It therefore stands to reason that the teacher trainees who enter the Colleges of Education with better grades in Integrated Science are readily able to follow certain arguments, possess specific skills and intelligence and can construct knowledge and therefore perform better in the end of first semester examinations in Integrated Science.

Therefore it can be concluded that teacher trainees

who enter College of Education with good grades in Integrated Science in WASSCE examinations are more likely to perform better in Integrated Science in the Diploma in Basic Education examinations.

CONCLUSION

It can therefore be concluded that the students who apply to enter the Diploma in Basic Education program must be rigidly examined to ensure that they possess sound knowledge in Integrated Science. This is due to the fact that the study has revealed that there is significant relationship between the background knowledge in Integrated Science and performance in Diploma in Basic Education examinations in Integrated Science. It is recommended that science tutors identify teacher trainees with poor background in Integrated Science and offer remedial tuition for them.

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