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TEACHER-DIRECTED, STUDENT-DIRECTED INSTRUCTIONAL STRATEGIES AND GENDER AS PREDICTORS OF STUDENTS' ENTREPRENEURSHIP KNOWLEDGE IN BIOLOGY IN OYO STATE, NIGERIA

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ABSTRACT: *This study, investigated teacher-directed, student-directed biology instructional strategies and gender as predictors of students' entrepreneurship knowledge in Oyo state, Nigeria. The study adopted pretest-posttest, control group – quasi experimental design using 3x2x2 factorial matrix. 360 students were randomly selected from six senior secondary schools in four local government areas in Ibadan. Five instruments used were: Students' Entrepreneurship Knowledge Test (r = 0.82). Operational Guides for; Teacher-directed Biology Instruction, Student-directed Biology Instruction and the Conventional Biology Instruction. Three null hypotheses were tested at 0.05 level of significance. Data were subjected to Analysis of Covariance and Scheffe post hoc test. Treatment had significant main effect on students' entrepreneurship knowledge ($F_{(2,347)}$ = 658.08, p<0.05). Students in the teacher-directed group had the highest mean score ($\bar{x}$= 38.04) followed by student-directed ($\bar{x}$ = 37.93) and conventional method ($\bar{x}$= 17.33). Gender had a significant main effect on students' entrepreneurship knowledge ($F_{(1,347)}$ = 8.09, p<0.05). Teacher-directed and student-directed biology instructional strategies had positive effects and therefore encouraged entrepreneurship among senior secondary school students taking into cognizance their gender.*

Keywords: Entrepreneurship, Teacher-directed, Student-directed, Science and Technology.

Introduction

Science and technology are making progress at a fast rate. This accelerated advancement has its impact on the economic, social and cultural aspects of our lives. The lessons and skills that education in science provides help in producing responsible citizens, a strong economy, a healthier environment, support for scientific research and advancement and a bright future for all.

Federal Republic of Nigeria (2004) in the National Policy on Education espouses an educational philosophy that lays emphasis on the quality of instruction oriented towards inculcating the acquisition of competencies necessary for self-reliance among other values. Hence, the teaching of subjects including biology in secondary schools should produce learners who are able to use their knowledge for self-reliance. Notably, the teaching of biology in the secondary school does not include entrepreneurship which can

help in achieving this goal. Nwangwu (2007) believe that our youths are not trained to be self-reliant. Arogundade (2007) opine that this has resulted in overdependence of our school leavers and graduates on the government for the provision of jobs and that the inability of the government to do this has led to the high rate of unemployment. Arogundade (2007) further stress that; entrepreneurship education will equip students with skills for self- reliance.

Biology is chosen for this study because the West African Senior School Certificate Examination (WASSCE) Regulations and Syllabuses (2009 to 2011) lists it as one of the core subjects for which certificates shall be awarded to students. The same is also true of the National Examination Council (NECO). As expressed by Yusuf and Afolabi (2010), it is central to many science-related courses such as medicine, pharmacy, agriculture, nursing and biochemistry. As a science subject, biology is very important for national and personal development.

According to UNESCO (2010), learning is influenced by the teacher-learner relationship. The roles of the teacher and the learner vary in this relationship. On the one hand, the teacher can be a mere transmitter of knowledge; the learner is entirely dependent on what the instructor teaches or does. The students in this context are mere "recipient" rather than learners. On the other hand, the teacher can play the role of a guide or a facilitator in which a learner is assisted in becoming autonomous, being able to plan his or her learning.

Teacher-directed instruction is any instruction initiated and guided primarily by the teacher. Wales (2009) believes that the conventional approach to teaching is defective and makes students passive but the teacher-directed instructional strategies that call for more active responses from students are good for the delivery of instruction in classrooms. Rosenshine and Mesister (1995), Good and Brophy (2004) believe that teacher-directed instructional strategies implemented as intended is useful for a variety of educational contexts. Demant and Yates (2003) found out that teachers themselves support the approach. Wales (2009) further express the opinion that some aspects of most subjects taught in schools are better taught using teacher-directed method. Wales (2009) then listed teacher-directed instruction as "lectures and readings, advance organisers, recalling and relating prior knowledge, elaborating and extending information, mastery learning, direct instruction and Modeline Hunter's effective teaching model". The basic thing is that the teacher gives the instruction. In a teacher-directed classroom, the teacher plans, shapes and guides the learning process allowing the students to participate actively. He or she analyses course standards and prepares a sequence of instructional strategies to help students acquire the knowledge and skills to meet set standards. The teacher-directed approach provides students with a step-by-step process for tackling complex tasks. (Tanner, Bottoms, Ferragin and Bearman 2007). In this study, a combination of lectures and reading, recalling and relating prior knowledge, with

elaborating and extending information involving high participation by students are used to investigate the effectiveness or otherwise of the teacher-directed instructional strategy.

Student-directed learning on the other hand, is based on the belief that active students' involvement in the learning process increases learning and motivation. According to Tanner, Bottoms, Ferragin and Bearman (2007), good student-centred learning values the students' role in acquiring knowledge and understanding. This approach empowers students to ask questions, seek answers and attempt to understand the world's complexities. The teacher and students share the responsibility of instruction and assessment but the students are more actively involved. The levels of students' involvement may vary. The low end may consist of the teacher's incorporation of students' needs, interests, learning styles and abilities. High levels of their involvement may consist of students playing a role in planning instruction. Regardless of the level of involvement, the basic expectation is that the teacher and students are partners in instruction and learning. Happold and Christensen (2010) listed the methods of students' participation as "think-pair-share, paired team learning, the learning center, peer tutoring, problem solving, inquiry and discovery, inquiry learning, cooperative learning and project-centred learning". According to Wales (2009), two of the relatively well known and most widely used are inquiry and cooperative learning. In this study, the cooperative and project centred learning are used. The students in this case are assigned a high level of involvement in the teaching and learning while the teacher is passive. The cooperative learning enables the learners to work with each other while they focus on the entrepreneurial opportunities which they used as projects.

Wood and Gentile (2003), Blair, Schwartz, Biswas and Lewlawong (2007); express the opinion that the conventional method of teaching science is inadequate for effective learning in science. Olatoye and Adekoya (2010), James and Olajide (2011) and Oludipe and Oludipe (2010) in previous studies relating to methods of teaching science in Nigerian secondary schools also express the opinion that the conventional method of teaching science is ineffective.

The National Policy on Education by the Federal Republic of Nigeria (2004) established a policy of equal access to education for all Nigerian citizens at all levels. This means all Nigerian citizens are to be exposed to education irrespective of gender.However, women are disadvantaged in entrepreneurship. Omoifo (2008) opines that in Nigeria and most countries of the world, there is a disadvantaged position of women in entrepreneurship. This has led to what is referred to as gender gap, disparity or inequality. According to Oguntimehin (2008), there is no controversy about the rampant vices that are daily increasing in Nigeria as a result of unemployment. This embarrassing phenomenon is on daily basis calling for concerted actions to embrace entrepreneurship education for women, because when you educate a woman, you educate a nation. It is becoming increasingly clear that investment in women pay off many folds, when women are given opportunities for training and development generally and entrepreneurship education in

particular. Empowering women underscores the ability to make genuine choices which are functions of income and incomes are functions of knowledge gained through education.

Parental involvement in business towards entrepreneurship may affect students' entrepreneurship. Many parents ignorantly believe that the higher the academic qualification, the richer the graduate will be in future (Jimngang, 2004).

Ramon (2008) while answering a question "why is the rate of entrepreneurship among African Americans so low?" asserts that it is because many black Americans still have a slave mentality. This mentality is one of dependence on the government, and one that does not allow one to rise above difficulty. He went further to argue that the other reason is the way and manner parents raise their children. He opines that if more of our children are going to be entrepreneurs we must train them early about business, economy, working hard, saving money, making wise choice and learning from failure. He then concludes that entrepreneurship is not for everyone – when we have well educated children who are trained to be responsible, respectful, resourceful and hard-working then we will have more black entrepreneurs.

Statement of Problem

The predominant conventional teaching strategy adopted in teaching biology, a science subject and indeed all subjects in the secondary school is devoid of bringing out the salient entrepreneurial opportunities and skills inherent in them. Premised on this observed defect, our school leavers generally lack the basic knowledge needed to be self-reliant which inevitably compound the unemployment problem. This explains the reason why our graduates look unto the government for provision of non-existing job opportunities in the public sector. Further, the different attempts embarked upon in the past such as NDE and NIDB to stem the unemployment problem and stimulate entrepreneurial initiatives have only recorded marginal success; a reason why unemployment is still a serious problem in the country. Although NERDC launched a new SSS curriculum which included entrepreneurship subjects there is still the need to incorporate it into specific subjects and find out the appropriate teaching strategies to implement the curriculum.

This study therefore investigated teacher-directed, student-directed biology instructional strategies and gender as predictors on students' entrepreneurship knowledge.

Hypotheses

The study tested the following null hypotheses:

Ho_1: There is no significant main effect of treatments on students' entrepreneurship knowledge.

Ho_2: There is no significant main effect of gender on student's entrepreneurship knowledge.

Ho_3: There is no significant interaction effect of treatment and gender on students' entrepreneurship knowledge.

Methodology

The study employed a pretest, posttest, control group, quasi-experimental design, using a 3x2x2 factorial matrix. It includes biology instructional strategy at three levels, parents' business involvement at two levels and gender also at two levels.
Biology instructional strategy at three levels:

The target population was made up of SS 1 biology students in all co-educational secondary schools in Ibadan, Oyo State. Six Schools were randomly selected and put into experimental and control groups. Intact classes were used in each of the schools. SSS1 is chosen because there are many topics that naturally provide entrepreneurial opportunities in SSS1 biology. All the topics used for the study were SSS1 topics.

Research Instruments

Five instruments were constructed and used for this study.

1. Students' Entrepreneurship Knowledge Test (SEKT)
2. Operational Guide for Teacher-directed Biology Instruction (OGTBI)
3. Operational Guide for Student-directed Biology (OGSBI)
4. Operational Guide for Conventional Biology Module (OGCBI)
5. Researcher's Assessment Sheet for Teacher-directed Biology Instruction (RASTBI), Student-direct Biology Instruction (RASSBI),Conventional Biology Instruction (RASCBI)

Students' Entrepreneurship Knowledge Test (SEKT)

The instrument is divided into three sections A, B and C. Section A deals with the students' demographic data, such as school, gender, age, class and whether in science, social science or art. Section B deals with parents' level of education, occupation and business involvement. Section C has 40 multiple choice items each with five options: A to E. The SEKT is made up of 40 multiple choice objective questions constructed by the researcher to measure students' cognitive achievement in biology and entrepreneurship. Each correct answer attracted one mark.

Validity and Reliability of SEKT

The SEKT was administered to a sample of 60 SS1 students (30 boys and 30 girls) in two schools, not part of the study but whose students are of similar age structure and class to the students covered in the study. From the students' responses, a reliability coefficient of 0.82 was obtained using Kuder Richardson 20 (KR20).

Operational Guide for Teacher-directed Biology Instruction (OGTBI)

This instrument consists of lesson plans on four selected topics in biology. The topics are Biology and Living Things, Animal Nutrition, Relevance of Biology to Agriculture and

Pollution. The steps followed were: Introduction; Presentation; Explanation; Visit to a snailry, fish pond and making of beans powder; Summary; Evaluation and Assignment

Operational Guide for Student-directed Biology Instruction (OGSBI)

The instrument consists of lesson plans on four selected topics in biology. The topics are Biology and Living Things, Animal Nutrition, Relevance of Biology to Agriculture and Pollution. The steps followed were; Introduction, Presentation by the students with the teacher as the facilitator only, Hand-on activities/visits/invitations of entrepreneurs suggested by the students. Summary by the students with the teacher as a facilitator, Evaluation by the students, Assignments suggested by the students

Operational Guide for Conventional Biology Instruction (OGCBI)

This instrument consists of lesson plans on the selected topics in biology. The steps to be followed are: introduction, presentation, explanation, summary, evaluation, assignment. The lessons are to be taught the conventional way without entrepreneurship being discussed.

Researcher's Assessment Sheet for Teacher-directed Biology Instruction (RASTBI)

This is used to assess teacher's performance during lessons using the teacher-directed instructional strategy, student-directed instructional strategy and assess teacher's performance during lessons using the conventional strategy.

Research Procedure

Table 1: Summary of Research Activities

Weeks	Topics	Teacher-directed	Student-directed	Conventional
1-2	Training	Training of research assistants and teachers by the researcher. Objectives of the lessons were given to students in the student-directed group.		
3	Pre-test	Pre-test conducted by the researcher, assistants, teachers and entrepreneurs		
4-5	(a) Biology and living things (b) Animal nutrition	Lesson directed by the teacher. Entrepreneurship defined with at least two entrepreneurs invited.	Lesson directed by the students. Entrepreneurship discussed and entrepreneurs invited.	Conventional classroom lesson without entrepreneurship.
6-7	Snailry and fishery	Visit to the snail farm and fish pond with the snail/fish farmer as instructor. Students learnt how to breed; feed and market snail and fish. The students actually feed snail/fish, cleaned snail house/fish pond and sold the snail/fish	The students suggested and directed a visit to the snail farm/fish pond where the snail/fish farmer is the instructor. Students learnt how to breed, feed and market snail/fish.	Animal nutrition continued. No mention of snailry or fishery.
8-10	Relevance of biology to agriculture	The teachers taught the topic with horticulture and beans powder production taught by the entrepreneurs. The students planted, trans planted, nursed and sold ornamental plants. They also made and sold beans powder.	Students suggested the entrepreneurs in horticulture and beans powder production. The entrepreneurs taught them. They planted transplanted, nursed and sold ornamental plants. They also made and sold beans powder.	The teacher taught the topic without entrepreneurship being discussed.
11	Pollution	The teacher taught pollution while the refuse manager/entrepreneur taught students refuse disposal. The students packed disposed and burnt refuse on the school compound	The students discussed pollution and visited an entrepreneur who taught refuse disposal. The students packed disposed and burnt refuse on the school compound.	Teacher taught pollution without entrepreneurship being discussed.
12		Post-test conducted by the researcher, assistants, teachers and entrepreneurs		

Data Analysis

The data obtained was analysed using Analysis of Covariance. The pre-test scores were the covariates. The Multiple Classification Analysis (MCA) was used to show the magnitude

of the performance of the various groups using posttest mean scores and the Scheffe post-hoc analysis was used to determine the direction or sources of the observed significant differences.

Results

Ho_1: There is no significant main effect of treatment on students' entrepreneurship knowledge.

Table 2: Summary of Analysis of Covariance (ANCOVA) of Students' Post-test Entrepreneurship Knowledge Scores by Treatment, Gender and Parents' Business Involvement

Source	Sum of Squares	DF	Mean Square	F	Sig.	Remark
Covariates	1739.152	1	1739.152	66.308	.000	*
Pre-test	1739.152	1	1739.152	66.308	.000	
Main effects	34809.027	4	8702.257	331.788	.000	
Treatment	34520.904	2	17260.452	658.083	.000	*
Gender	212.180	1	212.180	8.090	.005	*
Parents' Business Involvement	75.943	1	75.943	2.895	.090	
2-way Interaction:	144.880	5	28.976	1.105	.358	
Treatment x Gender	96.038	2	48.019	1.831	.162	
Treatment x Business Involvement	42.367	2	21.184	.808	.447	
Gender x Parents' Business Involvement	8.083	1	8..083	.308	.579	
3-way interactions:	80.895	2	40.447	1.542	.215	
Treatment x Gender x Parents' Business Involvement	80.895	2	40.447	1.542	.215	
Explained	36773.954	12	3064.496	116.839	.000	
Residual	9101.244	347	26.228			
Total	45875.197	359	127.786			

* Significant at $p < 0.05$

Table 2 reveals that there is a significant main effect of treatment on students' entrepreneurship knowledge. ($F_{(2,347)} = 658.083$, $p < .05$). This means that there is a difference between the entrepreneurship knowledge of students exposed to entrepreneurship and the students taught with the conventional biology method (control group). Hence the null hypothesis Ho_{1a} is rejected.

The Multiple Classification Analysis (MCA) was computed to show the magnitude of knowledge in the different groups. The results are shown in Table 3 below.

Table 3: Multiple Classification Analysis on Students' Entrepreneurship Knowledge by Treatment, Gender and Parents' Business Involvement

Grand mean = 31.10

Variable + Category	N	Unadjusted variation	Eta	Adjusted for independent + covariates deviation	Beta
Treatment Groups:					
1. Teacher-directed	120	7.17		6.94	
2. Student-directed	120	6.97		6.83	
3. Control	120	-14.14		-13.77	
			.89		.86
Gender:					
1. Male	164	-2.39		-.85	
2. Female	196	2.00		.71	
			.19		.07
Parents' Business involvement					
1. Involved in business	267	.53		.27	
2. not involved in business	93	-1.52		-.79	
			.08		.04
Multiple R-squared					.797
Multiple R					.893

In Table 3, the post-test mean scores of the treatment groups are teacher-directed 38.04, student-directed 37.93 and control 17.33. This means that the teacher-directed instructional strategy contributed most to the observed difference, followed by the student-directed and the least contribution is from the conventional strategy (control group).

The Scheffe Post Hoc Tests were run to reveal the sources of the difference. These are presented in Table 4

Table 4: Scheffe Post-Hoc Test on Students Entrepreneurship Knowledge

Treatment	Mean	Teacher-Directed Group	Student-Directed Group	Control Group
Teacher-directed group	38.04			*
Student-directed group	37.93			*
Control group	17.33	*	*	

* Pairs significantly different at $p < 0.05$

Table 4 shows that there is a significant difference between the teacher-directed group and control group and also between the student-directed group and control group. The teacher-directed and student-directed groups do not show significant difference. This means that both the teacher-directed and student-directed strategies produce more entrepreneurship knowledge in students than the conventional biology instructional strategy.

Ho_2: There is no significant main effect of gender on students' entrepreneurship knowledge.

Table 2 shows that there is a significant main effect of gender on students entrepreneurship knowledge ($F_{(1,347)} = 8.090$, $p < .05$). This means that there is a significant difference between the post-test entrepreneurship knowledge of male and female students. The null hypothesis is therefore rejected.

The MCA Table 3 reveals the source of the significant difference. The Table shows that the mean score for male is 30.25 while that of female is 31.81. This means that the female students contributed more to the significant difference than the male students.

Ho_3: There is no significant interaction effect of treatment and gender on students' entrepreneurship knowledge.

Table 2 shows that there is no significant interaction effect of treatment and gender on students entrepreneurship knowledge ($F_{(2,347)} = 1.831$, $p > 0.05$). The null hypothesis is accepted.

Discussion, Implications and Recommendations

The findings revealed that treatment significantly affected the students' post-test achievement mean scores in entrepreneurship knowledge.

The fact that the treatment had a significant effect on the students' entrepreneurship knowledge shows that the students have been looking for something outside the usual classroom studies in biology. These kids mean business (2007) believe that students are yearning for experimental learning and in this case, the treatment provided something different, interesting and applicable to the students' future financial standing. The finding also goes in line with the opinion of Oshomn (2009) that the lack of the knowledge of entrepreneurship prevents people from venturing into it. The treatment provided the knowledge and the students imbibed it.

The teacher-directed instructional strategy however produced better effect on entrepreneurship knowledge than the student-directed strategy. This is in line with the opinion of Tanner, Bottoms, Feragin and Bearman (2007) that the teacher-directed learning provides a clear effective presentation of key concepts and procedures

The students in the teacher-directed group had the opportunity of having clearly stated facts about entrepreneurship from the teacher and therefore performed better than the students in the students-directed group. This is in line with the opinion of Wales (2009) that the teacher-directed instructional strategy that involves students' participation can be effective in teaching. This shows that the teacher is still the better person to disseminate information on knowledge in some concepts and contents. It also corroborates the

opinion of Bbekele and Ndedi (2010) that the teachers should be to some extent entrepreneurs themselves so that the teaching of entrepreneurship can be effective.

These findings corroborate the submissions of Consortium for Entrepreneurship Education (2006), National Foundation for Teaching Entrepreneurship (2008) and Catalyst (2006) that entrepreneurship education produces entrepreneurship knowledge required to start or develop a new business. It is also in line with the submission of Mithaug and Mithaug (2003) that instruction in entrepreneurship improves academic performance.

Having found out the effectiveness of teacher-directed and student-directed instructional strategies in teaching biology, teachers should be encouraged to use either or a combination of both when teaching. To this end, seminars and workshops should be organised by the government to train teachers more on the use of these instructional strategies.

The government and other stakeholders in education can help in enhancing students' self-employment skills by encouraging teachers to use appropriate teaching strategy and providing teaching/learning centres and human resources for entrepreneurship. This will help in making our youths less dependent on the government for jobs.

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