
Barriers to Incorporating Student-Centered Learning Approaches into the Teaching and Learning of Undergraduate Biology in Nigeria

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ABSTRACT

Promoting Biology Education that will enable all students to develop inquiry minds to be imaginative but rigorous in their thinking and to understanding the processes of scientific investigation and the principles of scientific knowledge is the focus of this paper. Too many of the nation's undergraduate Biology education courses still rely on lectures and textbooks to cover the necessary content as listed on the syllabus instead of using Student-Centered learning (SCL) approaches. Despite the documented value of SCL strategies, there remain formidable barriers to its incorporation in the classroom making the traditional lectures remain the norm for most science classes in Nigeria. A survey research was carried out to determine if the identified formidable barriers affect the incorporation of SCL into undergraduate Biology education classrooms. All the undergraduate Biology education lecturers (28) in Ahmadu Bello University (Federal College of Education, Zaria study campus) were taken as sample for the study. Results from the study indicate that all the identified barriers affect the incorporation of SCL in undergraduate Biology education classrooms. Results also showed the readiness of majority of the lecturers (89%) to incorporate SCL in their classrooms. Recommendations include the need for a changed attitude and increased cooperation among students, teachers' unions and other relevant stakeholders of higher education institutions to advocate for proper national policies, as well as increased funding to support a transition to Student Centered Learning.

Keywords: Student-Centered Learning, Incorporation, Barriers, Undergraduate Biology

INTRODUCTION

Science is the collection and interpretation of evidence through investigation and building on existing knowledge to improve our understanding of the world in which we live. It is not a collection of facts, but is about asking questions, experimenting and being curious. Individual scientific disciplines alongside mathematics are vital ingredients for

developing a conceptual understanding of our world and in tackling the global challenges facing us. For Biology Education to be effective, context (that is conveying the science to students in a way that is relevant and inspiring) is as important as content (that is helping them to acquire breadth and depth of knowledge). Therefore promoting Biology education that enables all students to develop inquiry minds, to be imaginative

but rigorous in their thinking and to understand the processes of scientific investigation and the principles of scientific knowledge is essential. The benefits are lifelong, deepening knowledge, stimulating curiosity and enabling them to engage with contemporary and future issues that have science at their core. A holistic approach to Biology Education through a rich curriculum that exploits the potential of teaching and learning both inside and outside school should find new ways to stretch and challenge all students and encourage them in pursuit of excellence in all aspects of Education (Brewer & Smith, 2010).

The concept of Student-Centered Learning was first introduced in a Communique of the ministerial meeting of the Bologna process at Leuven in 2009, where ministers agreed that student-centered learning and mobility will help students develop the competences they need in a changing labour market and will empower them to become active and responsible citizens (Nordal, Gehrke and European Students' Union, 2014). Student-centered learning is a concept inspired as a critical pedagogy. Years of research on the learning process have shown that the transmission of knowledge from teachers to learners is less effective than an approach to teaching and learning that involves students directly in the production of knowledge and transforms students' perceptions and understandings by empowering them to apply knowledge in their own contexts (Nordal, et al., 2014). It is essential to develop excellence in teaching through innovative methods. This requires learners to be exposed to varied learning opportunities and assessment modes. Student-centered teaching and learning

strategies is part of these learning opportunities which if well implemented will result in transferrable skills such as problem solving, critical thinking and reflective thinking (Weimer, 2011) in the learners.

Student-Centered Learning (SCL) is an instructional approach in which students influence the content, activities, materials and pace of learning (Froyd & Simpson, 2010). This learning model places the student (learner) in the center of the learning process. The instructor provides students with opportunities to learn independently from one another and coaches those in the skills they need to do so effectively. The SCL approach includes such techniques as active learning experiences for lectures, assigning open-ended problems and problems requiring critical or creative thinking that cannot be solved by following text examples. It also encompasses involving students in simulations and role plays and using self-paced and/or cooperative (team-based) learning. Properly implemented, SCL can lead to increased motivation to learn, greater retention of knowledge, deeper understanding and more positive attitudes towards the subject being taught (Collins & O'Brien, 2003). Barr and Tagg (1995) expressed Student Centered Learning as the change or move from an "Instruction Paradigm" (in which instruction focuses on transferring knowledge to students) to a "Learning Paradigm" (which emphasizes produce learning through student discovery and construction of knowledge by students). Huba and Freed (2000) used the phrase learning-centered assessment to emphasize transition in the focus of instruction and assessment from teaching to learning. Many different researchers have developed and used approaches to teaching that fit the

criteria for student-centered learning. And these approaches have been assigned names giving a broad spectrum of names designating this approach (Council on Science and Technology, 2012).

Results from a growing number of studies (Weimer, 2011; Cerbin, 2012; Lom, 2012; Marcey & Brint, 2012) indicate that Student-Centered Learning approaches leads to improvement in students' performance. In favour of the effectiveness of these, it is opined that they supplement or replace the traditional lecture method. Succinctly captured by Handelsman Ebert-May, Beichner, Bruns, Chang, Dehaan et al., (2004) in an article in *Science*, "There is mounting evidence that supplementing or replacing lectures with active learning strategies and engaging students in discovery and scientific process improves learning and knowledge retention". Other examples of researches that showed the benefits of Student Centered Learning strategies in undergraduate Biology education includes: Haak, et al., (2011); Derting and Ebert-May, (2010) and Knight and Wood, (2005). Research of Burrowes (2003) also showed evidence that teaching Biology in a student-centered environment is more effective than traditional instruction in promoting academic achievement, increasing conceptual understanding, developing higher level thinking skills and enhancing students' interest in Biology.

Changes are needed in undergraduate Biology courses and curricula to ensure that what is being taught reflects the demands of today's world. Today's Biologists need new skills including the ability to think and contribute outside their disciplinary boundaries. Recent advances throughout the life sciences require new approaches to preparing Biology students.

These advances in the discipline also call out for new ways to prepare all undergraduates in the 21st century (NRC, 2009). Numerous clarion calls for reform of standard lecture delivery by incorporating Student-Centered Learning strategies in the classroom have also been forwarded by august science education advisory bodies (The Carnegie Foundation for the Advancement of Teaching (Cerbin, 2012); Lorn, 2012; NRC, 2000, 2003a, 2003b, 2004) and specifically for undergraduate Biology education, a call to action has been published by American Association for the Advancement in Science (AAAS, 2009). A number of reports over the last two decades (Labov et al., 2010; NRC 2008, 2009) have also called for renewed attention to undergraduate science education in general and to the life sciences in particular. Our undergraduates now are more diverse than ever. They come from a variety of social, economic and ethnic backgrounds. They enter institutions of higher education from a variety of entry points (directly from high school, as transfer students from community colleges or as late career students starting their college career after military service or other post-secondary life experiences). Because of its unique focus on living systems and the exciting techniques available today for asking and answering complex questions, Biology has the potential to contribute significantly to understanding and addressing many of the challenges the nation faces, from climate change and declining biological diversity to improving human health and widening access to safe food and clean water.

While most life scientists work at the cutting edge of research and innovation, too many of the nation's undergraduate Biology courses still rely on lectures and textbooks to

cover the necessary content as listed on the syllabus. And yet, many of the exciting new areas of science and the skills needed to be engaged effectively in them, typically do not appear in science classrooms and textbooks until many years after their inception (Jurkowski, Reid & Labov, 2007) leaving undergraduate Biology education lagging behind scientific advances. Thus, in addition to understanding concepts, undergraduates must have opportunities to develop core competencies to better prepare them to practice Biology as well as address other complex questions they may encounter in their day-to-day lives (NRC, 2009). Formidable barriers to incorporation of SCL into the classroom and traditional lectures remain the norm for most science classes. Some of these barriers include academic cultures that sometimes undervalue teaching innovations, habits revolving around lecturer-centered education, the necessity of delivering copious amounts of content in a single semester, the perceived efficiency of lecture method to students in notoriously large classes and student's skepticism regarding the value of and participation in active learning. This research intends to determine if these identified barriers affect the incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms in Ahmadu Bello University (FCEZ study campus) and also suggest ways in which conducive environment for implementation of these strategies can be created to improve teaching and learning of Biology (science) in Nigerian classrooms.

Statement of the Problem

Limitations of traditional lectures as a primary pedagogical tool in teaching science have been widely recognized over

the years. Biology education courses should help students integrate basic concepts into conceptual frameworks, link prior learning to new knowledge and develop reasoning and problem solving skills that allow the application of concepts to situations that are not explicitly memorized. However, these goals are rarely realized for the majority of undergraduate biology students in the traditional lecture model. For most students lecturing promotes memorization of facts rather than fostering deep understanding and even high academic achievers sometimes gain little understanding of basic science concepts through traditional didactic lectures. Despite the documented value of Student-Centered Learning strategies, there remain formidable barriers to its incorporation into the classroom and traditional lectures remain the norm for most science classes. In light of the ongoing, the time has never been better to focus on students learning and to integrate research into education to attract more students to explore the life sciences, both for career options and to better understand the complex world in which they live.

Objectives of the study

The objectives of this research are to:

- i. Identify the barriers that affect the incorporation of Student-Centered Learning strategies into undergraduate Biology classrooms
- ii. Determine how these barriers influence the incorporation of Student-Centered Learning strategies into undergraduate Biology classrooms
- iii. Ascertain the readiness of undergraduate Biology lecturers to incorporate student-centered

learning strategies in their classrooms.

Research Questions

The following research questions were formulated to guide the conduct of this study:

- RQ₁:** what are the barriers affecting the incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms?
- RQ₂:** Do the identified barriers influence incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms?
- RQ₃:** To what extent are undergraduate Biology lecturers ready to incorporate Student-Centered Learning strategies into their classrooms?

Null Hypothesis:

The null hypothesis postulated to guide the study is:

H₀₁: Identified barriers have no significant influence to incorporating SCL strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus)

METHODOLOGY

The descriptive survey research design was adopted for this study. The population for the study includes all Biology lecturers in

Table 1: Barriers to incorporating SCL strategies in undergraduate Biology classrooms

S/N	Questions	A	U	D	\bar{X}	SD	Decision
1	Academic cultures that sometimes undervalue teaching innovations is a barrier to incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms	20	1	7	2.46	0.88	Agreed
2	Habits revolving around lecturer centered education is a barrier to incorporation of Student-Centered Learning strategies in	18	4	6	2.43	0.84	Agreed

undergraduate studies of Ahmadu Bello University, Federal College of Education, Zaria study campus with a total number of 28. All the lecturers were taken as sample since the number is not large (in line with Sambo, 2005).The Barriers to Incorporating Student-Centered Learning Strategies in undergraduate Biology classrooms Questionnaire (BISLSQ) was developed in the light of the objectives of the study. The BISLSQ was developed by the researcher and it contains three sections: (A) General information (B) Identification of barriers (C) Effect of barriers and (D) Readiness of Biology lecturers towards incorporating SCL strategies in their classrooms. The content of the BISLSQ was validated by two science education experts from Ahmadu Bello University, Zaria. A total of 28 questionnaires were administered by the researcher in the study area. Percentage and mean, standard deviation and Pearson Product Moment Correlation statistics using SPSS version 2.0 were used to analyze the data obtained from the study.

PRESENTATION OF RESULTS

RQ₁: what are the barriers to incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus)?

S/N	Questions	A	U	D	\bar{X}	SD	Decision
3	undergraduate Biology classrooms The necessity of delivering copious amounts of content in a single semester (i.e. Bulky Curriculum) affects incorporation of Student-Centered Learning strategies in your undergraduate Biology classrooms	26	1	1	2.89	0.42	Agreed
4	The perceived efficiency of lecturing students in large classes is a barrier to incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms	20	1	7	2.46	0.88	Agreed
5	The skepticism of students towards students-centered and active learning strategies prevent one from incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms	5	1	22	1.39	0.79	Disagreed
6	Inadequate infrastructure is a barrier to your incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms	20	1	7	2.46	0.88	Agreed
7	The time allocated for teaching is a barrier to incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms	26	1	1	2.89	0.42	Agreed
8	Lack of adequate funding for students welfare is a barrier to incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms?	16	4	8	2.29	0.90	Agreed
Cumulative					2.41	0.751	

Decision Rule: Mean <2.00 disagree otherwise agreed

Table 1 shows respondents' opinions on barriers to incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus). The cumulative mean responses of all the items is 2.41 which is greater than the decision mean of 2.00 with the standard deviation value of 0.751 implying that their responses were

significant. Specifically, majority were of the opinion that the necessity of delivering copious amounts of content in a single semester (i.e. Bulky Curriculum) affects incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms and the time allocated for teaching a barrier to incorporation of Student-Centered Learning strategies in

undergraduate Biology classrooms. These items attracted the highest mean responses of 2.89 and standard deviation of 0.42 respectively with details showing that 26 respondents agreed while only 1 respondent disagreed to this view. This implies that several barriers hinder incorporation of

Student-Centered Learning strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus).

RQ₂: Do the identified barriers influence the incorporation of SCL strategies in undergraduate Biology classrooms?

Table 2: Influence of identified barriers to incorporating SCL strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus)

S/N	Items	A	U	D	Mean	Std. Dev.	Decision
1	Academic cultures influence the incorporation of Student-Centered Learning strategies in classrooms	24	2	2	2.79	0.57	Agreed
2	Habits revolving around lecturer centered education affects the incorporation of Student-Centered Learning strategies in classrooms	21	3	4	2.61	0.74	Agreed
3	Bulky Curriculum influence incorporation of Student-Centered Learning strategies in classrooms	23	2	3	2.71	0.66	Agreed
4	Large classes affects the incorporation of Student-Centered Learning strategies in classrooms	25	1	2	2.82	0.55	Agreed
5	The skepticism of students towards Students-Centered Learning influence incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms	6	3	19	1.54	0.84	Disagreed
6	Lack of adequate infrastructure influence incorporation of Student-Centered Learning strategies in classrooms	21	2	5	2.57	0.79	Agreed
7	Time allocated for teaching influence incorporation of Student-Centered Learning strategies in classrooms	27	1	0	2.96	0.19	Agreed
8	Lack of adequate funding for students welfare influence the incorporation of Student-Centered Learning strategies in classrooms	14	5	9	2.18	0.91	Agreed
Cumulative					2.52	0.58	

Table 2 shows respondents' opinions on whether or not the identified barriers influence the incorporation of SCL strategies in undergraduate Biology classrooms. The cumulative mean responses of all the items were 2.52 which is greater than the decision mean of 2.00 with the standard deviation value of 0.58 implying that their responses were noteworthy. Precisely, majority were of the opinion that time allocated for teaching influence incorporation of Student-Centered Learning strategies in classrooms as this

item attracted the highest mean responses of 2.96 and standard deviation of 0.19 with details showing that 27 respondents agreed while only 1 respondent was undecided. This implies that the identified barriers hinder incorporation of Student-Centered Learning strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus).

RQ₃: Are undergraduate Biology education lecturers ready to incorporate SCL strategies into their classrooms?

Table 3: Readiness of Biology lecturers towards incorporating SCL strategies

S/N	QUESTIONS	A	%	D	%
1	Would you like to adopt a Student-Centered Learning approach in teaching your course?	25	89	3	11
2	Can you cover the content in the syllabus using Student-Centered Learning approaches?	15	54	13	46
3	Will you incorporate Student-Centered Learning approaches when teaching large class	19	68	9	32
4	Is it possible for you to move from Teacher-Centered to Student-Centered in stages gradually?	28	100	0	0
5	Will you respond positively, constructively and motivate students towards Student-Centered Learning approaches.	24	86	4	14
6	Are you ready to adjust your schedule and make sacrifice for adequate preparation to shift from Teacher-Centered to Student-Centered Learning approaches?	24	86	4	14

Hypothesis Testing

HO: Identified barriers have no significant influence to incorporating SCL

strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus)

Table 4: PPMC for Influence of Identified Barriers on Incorporating SCL Strategies in Undergraduat Classrooms at A.B.U. (FCEZ Study Campus)

Variables	N	\bar{X}	S.D	df	r-cal	r-crit	P	Remark
Identified Barriers	28	19.29	5.03	26	0.582	0.388	0.001	S
Incorporating SCL Strategies	28	20.18	3.59					

r-crit = (.139) P<0.05

Table 4 revealed a mean score of 19.29 with a standard deviation of 5.03 for the identified barriers as against a mean of 20.18 with standard deviation of 3.59 for incorporating SCL Strategies. The calculated r value was greater than the critical r value ($0.582 > 0.388$) at 0.05 alpha level of significance. In other words, the calculated p value (0.001) is less than 0.05 alpha level of significance. The result revealed that the identified barriers have significant influence on the incorporation of SCL strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus). Based on the result, the null hypothesis which states that Identified barriers have no significant influence to incorporating SCL strategies in undergraduate Biology classrooms at A.B.U. (FCEZ study campus), is therefore rejected.

DISCUSSION

Data obtained from Table 1 indicate that majority of the lecturers (71%) agree that academic cultures that sometimes undervalue teaching innovations is a barrier to incorporation of student-centered learning strategies in undergraduate Biology classrooms. 64% are of the opinion that habits revolving around lecturer-centered education is a barrier to incorporation of student-centered learning strategies in undergraduate Biology classrooms. Almost all the lecturers (93%) agree that the necessity of delivering copious amounts of content in a single semester (that is Bulky Curriculum) affect their incorporation of student-centered learning strategies in their undergraduate Biology classrooms. 71% of the lecturers perceive efficiency of lecturing students in large classes a barrier to incorporation of SCL strategies in their undergraduate Biology classrooms. On the

contrary, 71% of the lecturers believe that the skepticism of students towards students-centered and active learning strategies does not prevent them from incorporating of SCL strategies in their undergraduate Biology classrooms. 93% of the lecturers indicate that the length of time allocated for teaching is a barrier while 57% the lecturers accepted that lack of adequate infrastructure is a barrier to incorporation of SCL strategies in undergraduate Biology classrooms. 80% of the lecturers believe that adequate funding for students welfare will greatly enhance and motivate students to accept incorporation of Student-Centered Learning strategies in their classrooms. Most of all the identified formidable barriers influence the incorporation of Student-Centered Learning strategies as observed by Allen and Tanner, (2005); Wood and Gentile, (2003); Hanford, (2012) and Marcey and Brint, (2012).

Results obtained from Table 3 indicate the readiness of most of the lecturers to incorporation of SCL strategies into their classrooms. 86% indicate they are ready to adopt a SCL approach in teaching their course, 54% accepted that they can cover the content in the syllabus using SCL approaches, 68% accepted to incorporate SCL approaches when teaching large classes, all the lecturers (100%) were of the view that they can move from teacher-centered to student-centered approaches in stages gradually, 86% will respond positively, constructively and motivate students towards SCL approaches and finally, majority (86%) indicate their readiness to adjust their schedule and make sacrifice for adequate preparation to shift from teacher-centered to student-centered learning approaches. It was observed the lecturers are

willing to incorporate SCL strategies if formidable barriers can be overcome. PPMC analysis for Influence of Identified Barriers on Incorporating SCL Strategies in Undergraduate Classrooms was significant at $P < 0.05$. This result reveals that all identified barriers influence the incorporation of SCL strategies in undergraduate Biology classrooms at A.B.U. (FCEZ Study Campus). In line with Labov et al., (2010) and NRC (2008, 2009), the time has never been better for us to focus on students learning and to integrate research and education to attract more students to explore the life sciences, both for career options and to better understand the complex world in which they live.

CONCLUSION

Biology education lecturers should shift their perspective and allow students take on more active roles as learners. They must decide to think and act as facilitators who empower their students. Students should be allowed to have the flexibility to learn "anytime and anywhere," meaning that student learning can take place even outside of traditional classroom and school-based settings. Students should be given opportunities to make choices about their own learning and contribute to the design of learning experiences. Lecturers should endeavor to overcome these barriers with the help of adequate authorities.

RECOMMENDATIONS

1. The implementation process of Student-Centered Learning requires first and foremost support and ample government funding to provide student welfare services.
2. Continuous professional development for academic staff should be provided by relevant authorities

3. Adequate infrastructure and funding should be provided for teachers to motivate them to adopt SCL strategies
4. Favorable and conducive working conditions that allow academic staff to schedule their time with their students should be provided by relevant authorities.
5. There is a need for attitudinal change at all levels and increased cooperation among students, higher education institutions, teacher unions and other relevant stakeholders to advocate for proper national policies, as well as increased funding to

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