Blended Learning and Performance in Basic Sciences in ODeL Programs in Nigeria:

Search for Quality Teaching Methodology

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Abstract

The use of appropriate Open and Distance method of teaching in the teaching of Basic Sciences in Nigeria Open and distance learning programs has been a challenge. This majorly is due to the low technological state of the country. Most Open Distance and E-Learning (ODeL) institutions in Nigeria are still adopting the hybrid "Blended" instruction method of teaching in Basic sciences especially in practical courses. This paper researched into effect of complete online instruction and blended instruction methods of teaching on students' performance in Basic sciences in an ODeL at undergraduate level. The study was carried out by comparing students' performance in Basic science courses taught completely in ODeL instruction mode and blended learning mode. The data was collected at source and chi square statistical method of analysis was be used for the research. Consequently, the study findings showed that blended learning mode yields better academic performance in basic sciences at ODeL in Nigeria .

Keywords: Blended learning, Basic sciences, Teaching methods, ODeL.

I. Introduction

Learning science is a cumulative process; each new piece of information is added to what students already know (or believe) about the topic at hand. If students have a solid foundation, the new pieces fit together more easily. However, if the students' preparation is spotty or incomplete, they may find it harder to grasp the new material. If the new material conflicts with earlier misconceptions or firmly held assumptions, the students unfortunately may ignore or

distort the new information so that it fits into their old framework of understanding (American Psychological Association, 1992; Pintrich, 1988.

National Open University of Nigeria is a distance and learning institution in Nigeria that keys into the "Information Age" approaches to learning. These approaches focus on learner-centered education and meeting individual learner needs (Watson and Reigeluth, 2008). The recommendation for active learning in the context of today's student context is focus on inquiry-based learning (Prince, 2004; McLaughlin et al, 2014). At global level, there are three teaching approaches in higher education: traditional, online and emerging, flipped format. In NOUN, the online content matter delivery is majorly adopted. This approach is learner-centered in which students assess subject matter content via online and print media. Online approach has been shown to improve student satisfaction, engagement, and course grades over traditional approaches (Critz and knight, 2013; McLaughlin et al., 2013; Mortehsen and Nicholson, 2015). Although others have reported negative impart related to in-person lecture time in flipped classes (Wilson, 2013; Missildine et al., 2013). This suggests that success of different formats may depend on course subject.

Previous research on basic science students in NOUN shows that there is poor performance in basic science courses (Odunmbaku, 2018), suggesting a need to enquire into better adoptable method for teaching basic science courses in NOUN. This paper therefore has the objectives of evaluating the effect of subject matter delivery mode of basic science course on student learning outcomes in terms of academic performance at NOUN. In this research, it is hypothesized that subject matter mode of delivery has no significant relationship with academic performance and that blended learning mode of subject matter delivery would not show improved academic performance compared with online-only mode of delivery.

Literature Review And Theoretical Framework

This section consists of the conceptual clarification, review of related literature, and the fundamental theoretical underpinning.

Conceptual Framework

Concept of Learning

By definition; Learning is a process that:

1. **is active** - process of engaging and manipulating objects, experiences, and conversations in order to build mental models of the world (Dewey, 1938; Piaget, 1964; Vygotsky, 1986).
2. **builds on prior knowledge** - and involves enriching, building on, and changing existing understanding, where "one's knowledge base is a scaffold that supports the construction of all future learning" (Alexander, 1996).
3. **occurs in a complex social environment** - and thus should not be limited to being examined or perceived as something that happens on an individual level. Instead, it is necessary to think of learning as a social activity involving people, the things they use, the words they speak, the cultural context they're in, and the actions they take (Bransford, et al., 2006; Rogoff, 1998), and that knowledge is built by members in the activity (Scardamalia & Bereiter, 2006).
4. **is situated in an authentic context** - provides learners with the opportunity to engage with specific ideas and concepts on a need-to-know or want-to-know basis (Greeno, 2006; Kolodner, 2006).
5. **requires learners' motivation and cognitive engagement** to be sustained when learning complex ideas, because considerable mental effort and persistence are necessary.

Blended Learning

This is a formal education program in which a student learns at least in part through delivery of content and instruction via digital and online media with some element of student control over time, place, path, or pace(Friesen, N. 2012). While still attending a "brick-and-mortar" school structure, face-to-face classroom methods are combined with computer-mediated activities (Strauss, V., 2012).

Concept of Teaching

Teaching is the process of imparting knowledge and skills from a teacher to a learner. It encompasses the activities of educating or instructing. It is an act or experience that has a formative effect on the mind, character or physical ability of an individual.

Theoretical Framework

The underpinning theory in this paper is constructivism theory.

Constructivism is a learning theory that attempts to explain how learners learn by constructing understanding for everyone.it is a synthesis of multiple theories diffused into one form and the assimilation of both behaviorialist and cognitive ideals. The "constructivist stance maintains that learning is a process of constructing meaning; it is how people make sense of their experience" . The constructivism theory emphasizes that learning should be an active process in which learners construct new ideas or concepts based upon their current or past knowledge (Brandon and All, 2010). According to these authors, the constructive theory model sees constructivism as a spiral with the students at the center of the spiral making students the center point of learning. A teacher is expected to encourage student critical thinking and inquiry by asking them thoughtful, open-ended questions, and encourage them to ask questions of each other.

This is a combination effect of using a person's cognitive abilities and insight to understand their environment. This coincides especially well with current adult learning theory. This concept is easily translated into a self-directed learning style, where the individual has the ability to take in all the information and the environment of a problem and learn. Constructivism reflects the organismic world view (Goldhaber, 2000).

Contrary to criticisms by some (conservative/traditional) educators, constructivism does not dismiss the active role of the teacher or the value of expert knowledge but modifies that role, so that teachers help students to construct knowledge, rather than to reproduce a series of facts.

The constructive controversy involves deliberative discussions aimed at creative problem solving (Johnson, Johnson, and Tjosvold, 2006). Students must be skilled collaborators, and follow the norms of cooperation and the rules of rational argumentation. Students are strongly motivated to produce solutions, and display high-level reasoning and greater mastery and retention of new knowledge gained. They generate high quality and creative solutions.. The essence of adopting the theory among many others is because it is the most relevant to the subject under discussion. Learning by memorization in science classes is common because students have not been actively involved in the classroom activities. It is not surprising to see in science education a student with a good grade but cannot link his or her classroom experience with the real-world problem Crouch, Watkins, Fagen and Mazur, 2007). The reason is that he or she has not learned through authentic learning instruction. Jonassen (1997) further observes that constructivism is a learning theory that gives teachers another perspective to rethink how students learn and to focus on process and provide ways of documenting change and transformation. It also reminds teachers to look for different ways to engage individual student, develop rich environments for exploration, and prepare coherent problem sets and challenges that focus on the model building effort, and elicit and communicate student perceptions and interpretations.

Review of Related Literature

There are different teaching methods employed in science education in Nigerian tertiary institutions. Research shows that students' retention in a lecture-based science courses is weak. According to Bok (2006), an average student only retains 42% of what he or she learned after the end of the lecture and 20% one week later. It was opined that teaching method like the lecture method commonly used does not help the students to acquire sufficient functional understanding (Bernhard et al., 2007). Berry (2008) argued that lecture method lacks the effectiveness of an active learning approach. In the opinion of Fagen and Mazur (2003), lecture method causes the bad reading habit among the students. Franklin, Sayre, and Clark (2014), students taught in lecture-based classes learn less than those taught with activity based reformed methods.

In a study on the effect of teaching method, choice of discipline and student-lecturer relationship on academic performance, it was found among others that while 46% of female students reported

rushed lectures, 29.69% of male reported lack of access to learning facilities such as internet as reasons for their low performance (Adeyele and Yusuff 2012). In another study, Ogwo and Oranu (2006) affirm that demonstration method is the most widely used instructional method for acquisition of practical skills as it involves verbal and practical illustration.

Methodology

Sample Population

The sample size for this study comprised of 40 basic science undergraduates of a public ODeL institution. The sample was equally divided into two groups of basic science undergraduates; those that attended facilitation and those that did not. The researcher was actively involved, therefore convenience sampling was used. According to Abram (2010), in the convenience sampling method, "respondents are selected by convenience due to their proximity, availability, accessibility or through any other way that the researcher decides"

Courses Structure

The basic science courses chosen for this study are first year first semester compulsory courses in the Faculty of sciences at an ODeL institution in Nigeria. The courses are General Biology I (BIO101), Introductory Physical Chemistry (CHM103), Elementary Mathematics I (MTH 101), and Elementary Mechanics, Heat and Properties of Matter (PHY101). Participants offering these courses were divided into two groups comprising each of 20 members. A group was exposed to blended learning mode of subject matter delivery, while the other group was exposed to only online mode.

To investigate the influence of course delivery format, the courses' subject matters were imparted on participants according to two different delivery formats: online, or blended. The investigation was carried out in a semester for different courses

Research Design

Quantitative and experimental research designs were adopted for this study to compare the effectiveness of two teaching methods used for teaching basic science courses in an ODeL

institution . Quantitative because it involved the use of numerical data and experimental because the participants were divided into blended and control groups. According to McLeod (2007), the most common way to design an experiment is to divide the participants into two groups: the first one is the experimental group and the second is the control group. The blended group was exposed to blended (online and traditional teaching) learning while the controlled group was exposed to only the online teaching methodology use in an ODeL institution. Twenty participants were used in each group. The data collected was the participants' semester examination scores. For the experimental group, the courses subject matter were imparted on them with online teaching materials which were written in compliance with open and distance methodology. Also the group was taught simultaneously using the traditional teaching method for eight weeks of the twelve weeks of semester duration for lectures. The traditional method heavily employed lecturing otherwise called facilitation. The controlled group on the other hand was imparted the knowledge of the courses subject matter using only online teaching materials. The performances of the participants in each group in the courses were compared. The result found was used to verify the hypothesis

Data Presentation and Analysis

To have a clear view of the relationship under study, participants' examination scores were used as data and were analyzed using measure of central tendency statistics

Table 1: Mean Scores for Online (Controlled) Group

	Sample Mean	N	Standard Deviation	Standard error of Mean
BIO101	56.6	20	8.2547	1.507
CHM103	52.8	20	8.8691	1.6193
MTH101	46.3	20	6.3333	1.1564
PHY101	55.5	20	9.1788	1.6759

Table 2: Mean Scores for Online Blended Group

Courses	Sample Mean	N	Standard Deviation	Standard error of Mean
BIO101	65.5	20	8.8775	1.6208
CHM103	48.25	20	9.6812	1.7676
MTH101	54.45	20	12.1469	2.2178
PHY101	57.4	20	14.1542	2.5843

The mean scores of the groups as shown in the tables above indicate that there is a significant difference between the results of each group in the courses but with a negative difference in CHM103. This validates that the blended group has a different identity in scores in comparison to the controlled group. On an average the mean scores of the controlled group are less than that of blended except in CHM103.

Table 3

T-Test Statistics

	Mean	Standard Deviation	Standard Error Mean	T	df
BIO101	-8.7	11.3097	2.5289	-3.44	19
CHM103	1.55	13.3622	2.9879	1.52	19
MTH101	-8.15	13.6638	3.0554	-2.67	19
PHY101	-1.9	18.9101	4.2284	-0.60	19

Decision rule

The decision rule taken is that the null hypothesis (Ho) should be accepted if t lies inside intervals $-t_{.05}$- $t_{.05}$ which for 20-1 =19 degree of freedom is interval -1.73 to 1.73.

Based on the decision rule above, the following decisions were reached

1. For BIO101, with t = -3.44, reject null hypothesis (Ho) and accept alternate hypothesis (H_1)
2. For CHM103, with t = 1.52, accept null hypothesis (Ho) and reject alternate hypothesis (H_1)
3. For PHY101, with t= -0.60, reject null hypothesis (Ho) and accept alternate hypothesis (H_1)
4. For MTH101, with t= -2.67, reject null hypothesis (Ho) and accept alternate hypothesis (H_1)

Discussion of Findings

The study aimed to find out if blended learning method or complete online method of delivery of subject matter is more effective for the teaching of basic sciences at undergraduate level in an open and distance institution.

The data analysis of the study showed that both groups were identical because their mean scores were of close range. However, the controlled group students, who were taught using only online method, scored less in their examination except in CHM103. The performance of the controlled group in BIO101, MTH101, and PHY101, indicates that these students learnt less and showed inconsistent performance than the blended group. For CHM103, the poor performance in blended method could possibly be attributed to the difficulty level of the course.

The hypothesis tested also showed that the null hypothesis should be accepted for only CHM103, while it should be rejected for BIO101, PHY101, and MTH101. Since three out of the four courses under test indicate that the null hypothesis should be rejected, it implies that this should be used in generalization of the result. Therefore the results showed the difference of impact of the two teaching methodologies adopted for teaching basic sciences in an ODeL institution that students who were taught using blended learning method demonstrated better knowledge and understanding of the theoretical framework as indicated by the results of three out of the four courses used in the study.

CONCLUSION

In an attempt to compare between blended and online-only mode of subject matter delivery in Basic sciences in an ODeL institution, from the above findings the following conclusions were drawn:

- Students' academic performances in basic sciences are better when taught using blended rather than online-only mode of subject matter delivery.
- Students' performance using any of the delivery modes is better in non-calculation courses as compared with calculation courses.

RECOMMENDATIONS

From the above conclusions, the following recommendations are made

- Further research should be conducted on reasons for poor academic performance in calculation courses using both mode of delivery as compared to non-calculation course.
- Other mode of educational delivery in line with open and distance education should be investigated and explored.
- Better teaching methodology should be adopted to enhance retention of knowledge required for basic science courses.
- Research should be made on reason for deviation in trend in CHM103 as compared to other courses being taught with blended method.

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