

## EFFECT OF YOUTUBE TUTORIALS ON THE IMPROVISATION OF MODELS OF BIOLOGICAL STRUCTURES BY PRESERVICE BIOLOGY TEACHERS

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### Abstract

The study focused on the effectiveness of YouTube-based instruction on preservice biology teacher improvisation of models of biological structure. It adopted one group pre-test post-test quasi-experimental design, which involving administration of pre-test, implementation of the treatment and post testing the participants. The population covered all the 285 preservice biology teachers of the Department of science education, Sokoto State University, Sokoto in the 2024/2025 session. A sample size of 196 students were selected for the study through purposive sampling techniques. Biological Model Development Assessment Inventory was used as an instrument for data collection. reliability index of 0.69 was obtained using Cronbach alpha after pilot study. The paired sampled and independent sampled t-test statistics was used to test hypotheses one and two respectively at 0.05 alpha level. The result showed that YouTube video tutorials improve Undergraduate preservice biology teachers' improvisation of models of plants and animal cells and human digestive system, while level of study does not affect improvisation of models of plants and animal cells and human digestive system when YouTube tutorials were used for the instruction. It was recommended that Instructors of teacher training institutions, Faculties and Departments, should provide the preservice biology teachers with the YouTube Video tutorials and guide them to acquire the basic skills necessary for creating models of biological structures for effective biology instruction.

**Keywords:** YouTube, Biological Models, Preservice Teachers, Level of Study

### Introduction

Teacher Education is central to producing individuals capable of enhancing knowledge, skills and attitude of the learner for efficient and productive society. Consequently, the goal of teacher education in Nigeria captured in the National Policy on Education aimed at producing teachers with the intellectual and professional skills suitable for effective classroom instruction and changing situations (Federal Republic of Nigeria, 2013). The vision of every biology teacher was to guide the learner acquire knowledge of biological concepts, to enable him develop interest in the area. To achieve this, adequate and suitable instructional materials must be provided to aid the learning processes. In biology instruction, most of the instructional materials used are visual in nature, they include real objects (specimen), Models objects, charts and photographs. Visual materials like specimen are often preferred in any biology classrooms, they give the learner the opportunity to observe them in their real form, shape and study their major features. However, some biological specimens are dangerous and inappropriate to be used by the learners, hence, the rationale for developing and using their model structures to facilitate learning. In Nigerian schools today, most of the models structures available in biology laboratories are industrial made which are too expensive and difficult to obtain by classroom teacher. Therefore, it is imperative to equipped the preservice biology teachers with the skills and know-how about

the production or improvisation of instructional materials such as models for effective biology instruction (Sayen&Mertoglu, 2020).

Improvisation refers to the process of using local materials to make alternative or substitute when the real material is not available (Tukur, 2012). Teachers' skills in improvisation can bridge the gap between limited materials and the need for quality education (Kuereye&Eganbor, 2025). Literature reported some of the challenges of improvisation among Nigeria's teachers to include; lack of skills and strategies (Besson, Ndem&Etorti 2023); lack of experience (Birabil& Abe, 2023); access to experts' assistant and technical support (Olibie, Nwabunwanne&Dorothy, 2015). Some of the strategies recommended for improving improvisation among teachers in Nigeria includes; the use of mentoring (Olu-Ajayi, 2017); Professional development, training, and Internet literacy (Olibie, Nwabunwanne&Dorothy, 2015). Consequent to the aforementioned problems and suggested strategies of improving improvisation among teachers, it is imperative that teachers of today must be prepared and developed to be relevant in the new classroom, by improving their knowledge, skills and competency in the use of emerging technologies for effective teaching and learning processes (Mormah&Bassey, 2021).

YouTube is one of the 21<sup>st</sup> century technologies which provides free online and offline video sharing platform that allow the learner to watch, download and re-watch videos educational purposes. It was launched in 2005 (YouTube, 2005). Videos capture the attention and stimulate curiosity and develop creative mind-set of the learner (Moeed, 2016). Furthermore, Roodt et al. (2014) opined that video-based instruction, helps and strengthens learner's ability to learn independently. YouTube provide a lot of educational channels for learning practical courses (Deepak, 2018), and also serve as a platform where students can acquire further explanations of concepts and procedures (Romadhon&Qurohman, 2017). Furthermore, Duncan et al, (2013) reported that, students who watch videos for learning some practical application of concepts or procedure, often download and watch such videos repeatedly. This may give them the opportunity to practice the procedures severally and comfortably. Thus, Deepak (2018) suggested that YouTube can be used as instructional material or alternative to classroom learning especially in higher institutions of learning.

Literature shows that YouTube provides the learner with the opportunity to revise content severally, learn in any language, learn a single topic from different sources or instructors. and avoid scheduled time tables of the classroom (Deepak (2018). Koto (2020) found that YouTube videos simplify the acquisition of conceptual and procedural knowledge, thereby enhancing students' knowledge, skills and creativity. Fynn et al, (2021) explore the use and implications of using YouTube in teaching and learning in Ghanaian universities. The study involved Higher National Diploma (HND), Bachelor Degree (B. Sc.) and Master Degree (M. Sc.) students from five Faculties. Findings of the study revealed that 66.2% of the participants indicated that learning through YouTube improved their understanding, and motivation level. The study also concludes that learning with YouTube enable university students to demonstrate practical application of concepts in their course of study and supports independent learning. Furthermore, Mohammed, and Ogar, (2023), investigate the prospects of YouTube videos in enhancing the academic achievement and retention of undergraduate students in environmental education. The study used one group pre-/post-test quasi-experimental involving 126 students of environmental education offering a course titled

Natural ecosystem. The study used the YouTube videos to teach students the content of the course as a special treatment. The findings of the study revealed that YouTube videos improved academic performance and retention ability of undergraduate students. The study noted that YouTube videos provide students with the opportunity to pause and rewind contents at their convenience thus forming a lasting cognitive experience in them. The present study has some similarities with the work of Mohammed, and Ogar, (2023) especially the research design. However, the present study focuses on assessing the effect of YouTube-based instruction on preservice biology teachers 'improvisation of models of biological structures

### **Statement of the Problem**

Learning biological concepts and processes requires hands-on approach involving instructional materials such as real objects, models of body organs, pictures, charts and others. The principles of using these materials emphasizes the use of real objects or specimens, but suggests the use of model structures in the absence of the real objects. Despite this, most of these materials (models of real objects) available in Nigeria's schools are industrial instead of teacher made. Therefore, it is imperative to equip the preservice biology teachers with the skills and know-how about the production or improvisation of models for effective biology (Sayen&Mertoglu, 2020). The models used for biology instruction are either physical or computer models. Physical models such as a model of a skeleton are among the most commonly used in secondary school biology education (Jansen et al, 2019).

Biology teachers (preservice and in-service) in Nigeria are trained on the importance of using these instructional aids during their training programme, albeit, they are also trained in the general concept of improvisation and improvisation techniques instead of techniques for improvisation of specific materials. This has resulted in having teachers with the knowledge and idea of improvisation but lacking the skills and knowhow of creating models of biological structures for effective instruction. It is evidently clear to everyone who went through a biology education programme in Nigeria that the common method of teaching is lecture method irrespective of the content of the subject matter. Moreover, the lecturers taking instructional methodology courses are not specialist or trained with the skills of improvising or creating models of biological structures, so even if they have the desire to equipped their students with the procedures for improvising or creating specific models of biological structures it will prove impossible because no one give what he doesn't have.

The emergence of YouTube educational/tutorial channels has presented an opportunity for individuals to watch videos online or download to watch offline at their comfort and speed, and learn the skills and procedures for creating the materials of interest. These video tutorial channels show individuals how to create electrical, mechanical, food processing and instructional materials such as a variety of models of biological structures using simple items that are easily accessible. Based on this development, this study aimed at investigating the effectiveness of these video tutorials on preservice biology teachers' improvisation of models of biological structure in Sokoto State Nigeria.

### **Objectives of the Study**

1. To find out the effectiveness of YouTube tutorials models on preservice biology teachers' ability to create plant and animal cells and human digestive system
2. To find out the effect of level of study on preservice biology teachers' ability to create plant and animal cells and human digestive system after using YouTube video tutorial

### **Research Hypotheses**

1. There is no Significant difference between the preservice biology teachers' improvisation of models of plants and animal cells and human digestive system before and after using YouTube tutorials
2. There is no Significant difference between ability of 300 and 400 level preservice biology teachers to create models of plants and animal cells and human digestive system after using YouTube tutorials

### **Methodology**

This study adopted one group pre-test post-test quasi-experimental design. It involves administration of pre-test, implementation of the treatment and post testing subjects in the experimental group. The effect of the treatment is usually measured by comparing the pretest and posttest scores of the participants. The population for this study comprises 285 preservice biology teachers of the Department of science education, Sokoto State University, Sokoto. The students were targeted because of their background in the subject matter and pedagogy. The sample size 196 was determined using a research advisor table (2006) for estimating sample size of given population. The sampling procedure used was purposive sampling techniques. Considering that students are exposed to methodological courses and teaching practice at specific level of their studies and the technological requirement for assessing the YOUTUBE channels. The participants selected are from 300 and 400 levels undergraduate preservice biology teachers who satisfied criteria 1 and 2 by virtue of their levels of study and meet 3 and 4 through physical screenings which required each participant to present his or her android phone and fill the research consent form.

This study used Biological Model Development Assessment Inventory (BMDAI) as an instrument for data collection. The BMDAI is a form of psychomotor assessment instrument; it was developed to assess the ability of the participants to create a model of biological structure. It was divided into two sections. Section A provides the demographic information of the participant being assessed. Section B comprises 12 items measuring the ability to design, use of appropriate materials, fixing the relevant structure and appropriateness of the model structure. Each item is assessed based 5 five-point Likert Scale ranging from 5 (Excellent) to 1 (Poor). The overall score of the instrument was 60 marks and the score of each participant determines his/her ability to create the model.

The content Validity of the BMDAI was ascertained through face validation. An Instrument Validation Form was administered to the validators alongside the instrument, to report their assessment and comments about the instrument. The use of simple language, reducing the number and modification of some items as well as provision of sufficient instructions are among the observations raised during the validation, all correction and observations were effected before pilot study to ascertain the reliability of the instrument. The

reliability index of BMDAI was ascertained after a pilot study involving 20 students who were voluntarily selected at Sokoto State University. The scores of each instrument were organized to calculate its reliability index using Cronbach alpha with the help of SPSS statistical software. A coefficient 0.69 was obtained.

The main activities during the data collection are: watching and downloading YOUTUBE tutorials, development of the models of biological structures and assessments. The first activity carried out involved the display of models of plant cell, animal cell, human skeleton, excretory system and digestive system. Participants were required to carefully observe each model, subsequently, they were divided into groups, each group was requested to create an improvised structure of one model organ of their choice. Furthermore, each group was provided with the required materials such as papers, wood, saw, gum, nail, scissors, leather, smooth paper, colours etc. After a specific period, all groups' tasks were assessed using Biological Model Development Assessment Inventory and recorded as pretest scores.

The second activity lasted for three weeks. Each week the participants were guided by members of the research team and additional research assistants to watch online YOUTUBE video tutorials on how to create one selected model of biological structure. After a specific period of watching and learning from the videos, each group was requested to use the materials provided and develop the type of model structure they learned through the video tutorials. Each model developed by the participants was assessed using Biological Model Development Assessment Inventory as a lesson evaluation. Scores of each group were recorded for each member of the group as a posttest score. These processes were repeated every week until the participants were exposed to the video tutorials on how to develop models of plant cell, animal cell and Human digestive system, by learning and creating one model every week. Finally, all the scores of pretest, and posttest of all the participants were organized for data Analysis.

The statistical tools used for data analyses are paired sampled and independent sampled t-test for testing the null-hypotheses 1 and 2 respectively at 0.05 level of significance. All the data analyses were carried out using Statistical Package for Social Science (SPSS) software.

## **Results**

Following a series of activities for effective data collections, organization and analyses, the result was presented to test the hypotheses set for this research.

**H<sub>01</sub>:** There is no Significant difference between the preservice biology teachers' improvisation of models of plants and animal cells and human digestive system before and after using YouTube tutorials

Table 1: Paired Sample t-test result of Pretest and Posttest Score

| Group     | N   | Mean  | Standard<br>Deviation | Mean<br>Difference | t-value | P-Value |
|-----------|-----|-------|-----------------------|--------------------|---------|---------|
| Pre-test  | 196 | 8.75  | 3.66                  |                    |         |         |
|           |     |       |                       | 14.07              | 38.09   | 0.00    |
| Post-test | 196 | 22.82 | 3.66                  |                    |         |         |

 $\alpha =$ 

0.05

Data presented in Table 1 above showed the descriptive statistics and t t-test result of Pretest and Posttest Score of BMDAI of Preservice Biology Teachers which measure their ability to create physical biological models before and after learning through YouTube video tutorials. The results showed that preservice biology teachers have a mean score and standard deviation 8.75 and 3.66 respectively, prior to learning how to develop physical biological models through YouTube tutorials. Subsequently, their mean score and standard deviation increases to 22.82 and 3.66 respectively when exposed to YouTube video tutorials.

The mean difference 14.07 indicated improvement on preservice biology teachers' ability to develop physical biological models after learning through YouTube tutorials. Furthermore, the analysis on the table showed that the p-value (0.00) is less than alpha value (0.05), and the t-value (38.09) is greater than the critical value (1.97) at 0.05 alpha value. This means both the t-test and alpha value on Table 2 indicated that the mean difference (14.07) between the pre-test and post-test was statistically significant. Consequently, hypothesis one which state "there is no significant difference between the preservice biology teachers' improvisation of models of plants and animal cells and human digestive system before and after using YouTube tutorials" was rejected

**Ho2:** There is no Significant difference between ability of 300 and 400 level preservice biology teachers to create models of plants and animal cells and human digestive system after using YOUTUBE tutorials

Table 2: independent sample t-test result of UG III and UG IV BDAI Scores

| Group  | N   | Mean  | Standard<br>Deviation | Mean<br>Difference | t-value | P-Value |
|--------|-----|-------|-----------------------|--------------------|---------|---------|
| UG III | 102 | 22.71 | 3.03                  |                    |         |         |
|        |     |       |                       | 0.22               | 0.42    | 0.67    |
| UG IV  | 94  | 22.93 | 4.25                  |                    |         |         |

 $\alpha = 0.05$



The summary of descriptive statistics and t-test results presented in Table 2 showed that UG III preservice biology teachers have a mean score 22.71 and standard deviation 3.03, while UG IV preservice biology teachers have a mean score 22.93 and standard deviation 4.25. The mean difference between the two groups (0.22) suggested that the two groups have slightly similar mean scores of ability to create physical models of biological structure, after receiving training through YOUTUBE video tutorials. Furthermore, the table showed that the p-value (0.67) is greater than alpha value (0.05), and the t-value (0.42) is also less than the critical value (1.97) at 0.05 alpha value. This means both the t-test and alpha value on the table indicated that the mean difference (0.22) between the two groups is not statistically significant. Consequently, hypothesis two which states “there is no significant difference between the ability of 300 and 400 level preservice biology teachers to create models of plants and animal cells and human digestive system after using YouTube tutorials was accepted.

## Discussion

Following the analyses of data obtained from the instrument used for data collection in this study, two major findings of the study were discussed as follows:

The first finding was discovered from the data in Table 1 which revealed that YouTube video tutorials improve Undergraduate preservice biology teachers’ improvisation of models of plants and animal cells and human digestive system. This followed the analysis of the preservice biology teachers’ ability to create physical biological models before and after they were exposed to video tutorials, illustrating the step-step procedures of creating models of plants cell, animal cells and human digestive system during the intervention period of the study. This finding was corroborated by Deepak (2018) which shows that YouTube videos fosters creativity and understanding. Both understanding and creativity are required in creating the physical models of biological structures. This finding was also supported by Koto (2020) who reported that YouTube videos simplify the acquisition of conceptual and procedural knowledge, thereby enhancing students’ knowledge, skills and creativity. Conceptual and procedural knowledge facilitated by YouTube, are also necessary for creating physical models of biological structures. Furthermore, the finding of this study was supported by the study of Clifton and Mann (2011) which found that using YouTube in teaching improved deep learning, and academic performance of the University students. The finding was also supported by the study of Fynn,et al (2021) which concludes that use of YouTube allows university students to demonstrate practical application of concepts.

The second finding of the study was discovered when post-test scores of the 300 and 400 level undergraduate preservice biology teachers were compared. The independent t-test result summary in Table 2 showed that there is no significant difference between the ability of 300 and 400 level preservice biology teachers to create models of plants and animal cells and human digestive system after using YouTube tutorials. This therefore, revealed that the Preservice biology teachers’ level of Undergraduate study does not affect their improvisation of models of plants and animal cells and human digestive system when YouTube tutorials were used for the instruction. This implies that YouTube videos can be used as an instructional media for both 300 and 400 level University students, because they make students motivated and engaged. This concur with Zayraey (2025) who reported that

watching videos enhanced students' motivation to improve their skills. The finding also hinted that YouTube videos can be used at the university levels of study associated with high academic stress. The Study of Jafaru, et al (2022) reported that 300 and 400 level university students have significantly higher academic stress due to difficulty of their curriculum content, high pressure of examination and research project writing. In another study, Aam, et al (2017) revealed a significant relationship between level of study and academic stress. The implication of this finding to the aforementioned studies is that YouTube video tutorials could serve as an intervention for treating levels of study associated with high academic stress.

### **Conclusion**

YouTube video tutorials were found by this study to improve undergraduate preservice biology teachers' improvisation of models of plants and animal cells and human digestive system. By watching the video tutorials repeatedly, they developed the ability to select and use suitable materials design the correct shape of the biological structure, clearly identify the key components of the structure and precisely cut and fixed the components. This study also concluded that preservice biology teachers' level of study does not affect their improvisation of models of plants and animal cells and human digestive system when YouTube tutorials were used for the instruction. Therefore, both 300-400 level university students can be exposed to YouTube video tutorials to acquire knowledge and skill of producing materials for biology instruction.

### **Recommendations**

1. Instructors of teacher training institutions, Faculties and Departments, should provide the preservice biology teachers with the YouTube Video tutorials and guides them to acquire the basic skills necessary for creating models of biological structures for effective biology instruction
2. The 300 and 400 level preservice biology teachers should be considered appropriate for using YouTube video tutorials to acquire basic skills associated with the creation of models of models of biological structures.



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