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Impact of Real-World Problem-Solving Strategy on Biology Students' Comprehension in Makurdi Metropolis

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Abstract

The study determined the impact of Real-World Problem-Solving Strategy (RWPSS) on biology students' comprehension in Makurdi metropolis of Benue State, Nigeria. The study used quasi-experimental design. Three research questions and three hypotheses guided the study. The population of the study consisted of all students in the secondary schools in Makurdi metropolis with 90 as sample using Stratified random sampling technique from two schools. Biology Students Comprehension Test (BSCT) with 20 items constructed by the researcher which yielded a reliability coefficient of 0.80 and validated by one expert in Science Education and one in measurement and evaluation was used to collect data for the study. The data collected was analyzed using descriptive statistics of mean to answer the research questions while the t-test of independent sample was used to test the research hypotheses at 0.05 level of significance. The findings revealed among others that RWPSS is more effective in enhancing comprehension of biology students than CTM, recorded t-test value of 0.055 with a p-value of 0.040. This is less than 0.05 level of significance ($p=0.040<0.05$). RWPSS is more effective in enhancing the comprehension of male and female biology students than CTM, recorded t-test value of 0.055 with a p-value of 0.020. This is less than 0.05 level of significance ($p=0.020<0.05$). The study recommended among others that the Ministry of Education and School administrators should ensure that Real-world problem-solving strategy is used by teachers in enhancing comprehension of biology students irrespective of gender, boarding or day.

Keywords: real-world problem solving, biology students' comprehension

1. Introduction

The world all over has experienced unprecedented development in the past three decades, as a result of advancement in science and technology. This development has come with associates' challenges that need to be solved logically. This calls for grooming young minds with highly innovative and creative abilities for a better tomorrow (Abakpa, Emmanuel, & Odith, 2016). According to Arslan and Emre (2021) the teaching and learning of science in the 21st century should be focused on

education for the betterment of tomorrow by producing graduates that can find lasting solution to the interconnected global environmental challenges like climate change, biodiversity loss, pollution, as well as social challenges such as poverty, inequality, migration and insecurity among others. The author maintained that the teaching and learning of science at the primary and secondary school levels should consist of the influence involved in shaping the development of an individual in a way that he or she would be exposed to real-world problem-solving strategies that could trigger high level comprehension abilities to arrive at permanent solutions. Michael (2022) asserts that Biology is one of the core subjects that if well taught could raise young minds and brains that can provide permanent solutions to the environmental problems through real-world problem-solving modalities.

Anyanwu, Obochi and Isah (2015) opine that teaching and learning biology through real-world problem-solving strategy offers numerous benefits, including increased student engagement, deeper understanding, improved critical thinking, and the development of essential life skills. This approach helps students connect theoretical knowledge to practical applications, making learning more meaningful and relevant. By tackling real-world challenges, students develop problem-solving skills that are transferable to various fields and future endeavors. Amedu (2015) states that real world problem-solving strategy encourages active participation and collaboration, moving away from passive rote learning that is the whole mark of conventional teaching methods. The author stressed that the challenge of solving real-world problems fosters intrinsic motivation, as students are driven by the desire to find solutions and make a difference. By applying concepts to real-world scenarios, students develop a deeper understanding (comprehension) of the issues involved and how it connects to their lives.

Several biology topics lend themselves well to real-world teaching strategies, allowing students to connect abstract concepts to their daily lives. Topics like ecology, genetics, and human biology are particularly effective when taught using real-world examples, hands-on activities, and project-based learning (Yakubu, 2016). According to Usman and Tsedo (2018) topics like ecology can be done through field trips to local parks, forests, or even the student's own backyard can provide real-world observations of ecosystems, food chains, and biodiversity. Students can collect data, analyze it, and discuss the impact of human activities on the environment. Genetics; relating genetic concepts to everyday phenomena like inherited traits (eye color, hair texture), genetic disorders (cystic fibrosis, sickle cell anemia), or the impact of genetic engineering on agriculture can make the topic more relatable and engaging. Activities like extracting DNA from fruit or examining fingerprints can make learning more hands-on. In human biology, Students can connect anatomical concepts to sports, dance, or other physical activities. Exploring topics like the digestive system, the cardiovascular system, or the nervous system through real-world examples like how food is processed, how the body responds to exercise, or how we perceive the world through our senses can make learning more relevant and meaningful (Owoyemi, 2018). Many scholars are of the view that real-world problem-solving strategy can be used in all the topics in biology to promote more proactive science teaching and learning in the 21st century that by far surpasses the conventional teaching methods that have provided little or no result over the years.

Musa (2017) pointed out that conventional teaching methods, while sometimes effective, can hinder deeper understanding and engagement in subjects like biology by focusing on rote memorization and passive learning. This can lead to reduced student interest, difficulty applying knowledge, and a weaker grasp of complex concepts. The author stressed that traditional lectures and textbook-based learning can be monotonous and less engaging, especially for subjects like biology that can be highly visual and hands-on. When concepts are not connected to real-life applications or the students' experiences, it can be harder for them to see the value of the subject and become disengaged (Michael, 2017). Focusing solely on memorizing facts and definitions without understanding the underlying principles can lead to difficulty applying the knowledge in different contexts. Conventional methods often prioritize recall over critical thinking and problem-solving, hindering students' ability to analyze information and make connections that could lead to solving real world problems (Daniel & Gonzales, 2016). There are several

attempts by researchers to prove the efficacy of real-world problem-solving strategy over conventional teaching methods.

Nataša and Radovan (2023) opined that problem-solving activities could be grouped into analyzing and planning problem-solving, discovering solution(s) to the problem, problem-solving evaluation activities and additional activities involving the discussion of the problem and also the degree of student independence in the process of discovering a solution to a problem. Obochi (2021) concluded that problem-solving had significant effects on the academic performance of the students of low ability. Low ability students that were taught physic using problem-solving strategy improved in academic performance and retained the learnt concepts better than those taught using the lecture method. In the vein, Kala, Isah, and Yusuf (2023) concluded that problem-solving instructional strategy used in teaching basic science content has significant main effect on academic achievement and retention when compared with lecture method. Thus, scarcity on studies on impact of real-world problem-solving strategy on students' comprehension in biology has necessitated the present study.

Godpower and Ihenko (2017) affirmed that poor teaching method or poor instructional delivery has overwhelmed our Nigerian educational system and resulted in poor performance of students especially in the core science subjects which is the foundation for many future science-oriented careers. Innovative and creative instructional strategies are the delivery mechanism of classroom instruction in the 21st century therefore become necessary. Teaching and learning of science cannot be complete without effective innovative strategies that has practical elements that allows learners the opportunity to physically interact with the real-world problem-solving strategies to broaden their comprehension abilities. It is so sadden that majority of the teachers in Nigeria still restrict learners only to the confines of the normal classroom teaching and learning with exposing them to real-world problem-solving strategies. The aim of science education globally now is to expose learners to the real-world solving strategies to build understanding around so many societal challenges with a view of finding lasting solutions. But most teachers today pay lip service to this issue and rather spend more time on mere presentation of information to their students in the classroom rather than figuring out how best to expose them to real world problem solving. It is in order to address this problem that this study investigated the impact of real-world problem-solving strategy on senior secondary school biology students' comprehension in Makurdi metropolis Benue State, Nigeria.

1.1 Purpose of the Study

The purpose of this study is to find out the impact of Real-world problem solving on Biology students' comprehension in Makurdi metropolis. This study therefore attempts to:

1) Determine the extent of comprehension of Biology students exposed to Real-world Problem-Solving Strategy (RWPSS) and those exposed to Conventional Teaching Methods (CTM).
2) Ascertain the extent of comprehension among male and female Biology students exposed to RWPSS and those exposed to CTM.
3) Examine the extent of comprehension of Boarding and Day Biology students exposed to RWPSS and those exposed CTM.

1.2 Research Questions

The following research questions were answered in this study.

1) What is the extent of comprehension of Biology students exposed to RWPSS and those exposed to CTM?
2) What is the extent of comprehension among male and female Biology students exposed to RWPSS and those exposed to CTM?
3) What is the extent of comprehension of Boarding and Day Biology students exposed to RWPSS and those exposed CTM?

1.3 Research Hypotheses

The following hypotheses were tested.

1) There is no significance difference on the extent of comprehension of Biology students exposed to RWPSS and those exposed to CTM.
2) There is no significance difference on the extent of comprehension among male and female Biology students exposed to RWPSS and those exposed to CTM.

3) There is no significance difference on the extent of comprehension of Boarding and Day Biology students exposed to RWPSS and those exposed to CTM.

2. Methodology

The study determined the impact of Real-world problem-solving strategy on Biology students' comprehension in Makurdi metropolis Benue State, Nigeria. The study used quasi-experimental design. Three research questions and three hypotheses guided the study. The population of the study consisted of all students in the secondary schools in Makurdi metropolis approved by Benue State Ministry of Education Board with 90 as sample using Stratified random sampling technique from two schools. The experimental group was taught Biology using Real-World Problem Strategy (RWPSS) in line with lessons procedure prepared by the researcher while the control group were taught the same Biology topics using the Conventional Teaching Methods (CTM) lesson plans. Biology Students Comprehension Test (BSCT) with 60 items constructed by the researcher which yielded a reliability coefficient of 0.80 and validated by one expert in Science Education and one in measurement and evaluation was used to collect data for the study. The data collected was analyzed using descriptive statistics of mean to answer the research questions while the Analysis t-test of independent sample was used to test the research hypotheses at 0.05 level of significance.

3. Results

3.1 Research Question 1

What is the extent of comprehension of Biology students exposed to RWPSS and those exposed to CTM?

Table 1. Pretest and Posttest mean Comprehension Scores of Biology Students taught with RWPSS and those taught with CTM

Group	N	Pretest Mean	Posttest Mean	Grand Mean	Remark
RWPSS	45	69.89	79.47	74.68	More Effective
CTM	45	50.88	60.69	55.76	

Mean Scores of Students Comprehension in Biology.

Source: Field Report SPSS April, 2025.

Table 1 shows that pretest mean score of 69.89 and posttest mean score of 79.47 with grand mean of 74.68 for the students taught biology using RWPSS, which is higher than that of those taught using CTM. Therefore, RWPSS is more effective in enhancing students' comprehension in Biology.

3.2 Research Question 2

What is the extent of comprehension among male and female Biology students exposed to RWPSS and those exposed to CTM?

Table 2. Mean Comprehension Scores of Male and Female Students Taught Biology using RWPSS and those Taught using CTM

Gender	Method	N	Post-Test Mean Remark
Male	RWPSS	22	40.10 More Effective
	CTM	23	28.20
Female	RWPSS	23	52.30 More Effective
	CTM	22	30.40

Mean Scores of Students Comprehension in Biology.

Source: Field Report SPSS April, 2025.

Table 2 indicates that with posttest mean comprehension score of 40.10 and posttest mean score of 28.20 for the male students taught biology using RWPSS and those taught using CTM. Also, the female students taught biology using RWPSS recorded posttest mean comprehension score of 52.30 as against those taught using CTM which 30.40. Therefore, Real-World Problem Solving Strategy is more effective and enhances greatly the comprehension of students in biology irrespective of gender.

3.3 Research Question 3

What is the extent of comprehension of

Boarding and Day Biology students exposed to RWPSS and those exposed CTM?

Table 3. Mean Comprehension Scores of Boarding and Day Students Taught Biology using RWPSS and those Taught using CTM

School Status	Method	N	Post-Test Mean	Remark
Boarding	RWPSS	23	35.00	More Effective
	CTM	22	23.31	
Day	RWPSS	22	40.05	More Effective
	CTM	23	25.15	

Mean Scores of Students Comprehension in Biology.

Source: Field Report SPSS April, 2025.

Table 3 reveals that the boarding students taught biology using RWPSS recorded posttest mean comprehension score of 35.00 against those same boarding students taught using CTM which recorded 23.31. Also, day students taught biology using RWPSS recorded posttest mean comprehension score of 40.05 against those taught using CTM that recorded 25.15, Thus, RWPSS is effective in enhancing students comprehension to a great extent irrespective of school status.

Hypothesis 1

There is no significance difference on the extent of comprehension of Biology students exposed to RWPSS and those exposed to CTM.

Table 4. t-test of independent sample on the mean performance scores of students taught Biology using RWPSS and those taught using CTM

Variables	**N**	**Mean**	**SD**	**T**	**Df**	**P**	**Dec**
RWPSS	45	74.6800	0.5221	0.055	88	0.04	N
CTM	45	55.7851	0.5002				

The t-test of independent sample on the mean comprehension scores of students taught Biology using RWPSS and those taught using CTM recorded t-test value of 0.055 with a p-value of 0.04. This is less than 0.05 level of significance ($p=0.04<0.05$). Thus, the null hypothesis is rejected. This means there is significant difference on comprehension scores of students taught Biology using RWPSS and those taught using CTM.

Hypothesis 2

There is no significance difference on the extent of comprehension of male and female Biology students exposed to RWPSS and those exposed to CTM.

Table 5. t-test of independent sample on the mean comprehension scores of male and female students taught Biology using RWPSS and those taught using CTM

Gender Method	N	Mean	SD	T	Df	P	DEC
Male RWPSS	22	20.0500	0.5200	0.055	88	0.02	R
CTM	23	14.0100	0.5101				
Female RWPSS	23	26.1500	0.5230				
CTM	22	15.0200	0.5200				

The t-test of independent sample on the mean performance scores of male and female students taught Biology using RWPSS and those taught using CTM recorded t-test value of 0.055 with a p-value of 0.020. This is less than 0.05 level of significance ($p=0.020<0.05$). Thus, the null hypothesis is rejected. This means irrespective of sex the students perform higher in RWPSS.

Hypothesis 3

There is no significance difference on the extent of comprehension of Boarding and Day Biology students exposed to RWPSS and those exposed to CTM.

Table 6. t-test of independent sample on the mean comprehension scores of male and female students taught Biology using RWPSS and those taught using CTM

Gender Method	N	Mean	SD	T	Df	P	DEC
Boarding RWPSS	23	17.0100	0.5220	0.055	88	0.04	R
CTM	22	11.6550	0.5111				
Day RWPSS	22	20.0250	0.5324				
CTM	23	12.5750	0.5235				

The t-test of independent sample on the mean comprehension scores of boarding and day students taught Biology using RWPSS and those taught using CTM recorded t-test value of 0.055 with a p-value of 0.040. This is less than 0.05 level of significance ($p=0.040<0.05$). Thus, the null hypothesis is rejected. This means irrespective of school status the students perform higher in RWPSS.

4. Discussion of Findings

Result from Table 1 showed that the gained mean comprehension scores of students in the RWPSS group were higher than those of the gained mean comprehension scores of students in the CTM group. This was further confirmed by the t-test of independent sample results in Table 4 which confirmed that students taught biology with RWPSS performed better than those taught with CTM. This implies that RWPSS was more effective in enhancing and facilitating students' comprehension in Biology concepts than the conventional teaching methods. The findings of the study are in agreement with Kala, Isah and Yusuf (2023) whose findings upholds higher achievement of students in Biology through the use of Real-world Problem-Solving Strategy. The result in Table 2 indicated that the overall gained mean comprehension scores of male and female biology students taught with RWPSS is greater than the scores of those students taught with CTM. This is further confirmed by the t-test of independent sample result in Table 5 which showed significant difference in the mean comprehension scores of students taught with RWPSS and those taught with CTM. This implies that RWPSS gender friendly and has positive influences on students' comprehension towards biology. This finding is in consonant with Obochi (2021) who confirmed that real-world problem-solving strategy is gender friendly.

Results in Table 3 showed that the means comprehension scores of biology boarding and day students taught with RWPSS is higher than those taught with CTM. The high lost mean scores obtained by the conventional teaching method group showed that they had comprehend less compare to those of the RWPSS which had higher mean scores. This was further confirmed by the t-test of independent sample result in table 6 which revealed that the students taught with RWPSS comprehend more than those taught with CTM both in the boarding and day schools. This implies that RWPSS is more effective in enhancing and facilitating students' comprehension of biology concepts than CTM. The findings support that of Fernand et al. (2023), Godpower and Ihenko (2017) whose findings reported high students' comprehension through real-world problem-solving strategy.

5. Conclusion

The study concluded that Real-world problem-solving strategy is more effective in enhancing comprehension of biology students than conventional teaching method. Real-world problem-solving strategy is more effective in enhancing comprehension Biology students than conventional teaching method irrespective of gender. Real-world problem-solving strategy is more effective in comprehension of biology concepts by students in both boarding and day schools.

6. Recommendations

Based on the findings of this study, the following recommendations were made;

1) The government through the Ministry of Education and Ministry of Science and

Technology should ensure that real-world problem-solving strategy is used by teachers in enhancing comprehension of biology students irrespective of gender, boarding or day.

2) Ministries of Education and professional bodies such as STAN should organize workshops, seminars and symposia from time to time to popularize and sensitize Biology teachers on the integration of Real-world problem-solving strategy in biology instruction.

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