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Development and Utilization Webquest as an Instructional Strategy in Teaching Thermodynamics in Colleges of Education in Kwara State

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ABSTRACT

The worldwide education system has been significantly impacted by the growth of technology. The purpose of the study was to develop and utilize the Webquest instructional package for the teaching of thermodynamics in chemistry. This is intended to see if its usage will bring significance to pre-service chemistry teacher's performance. Thermodynamics is one of the chemistry topics students find difficult to understand. The study was carried out in colleges of education in Kwara State. All third-year chemistry students at the colleges of education made up the study's population. A thermodynamics performance test in Chemistry and the Webquest software program served as the study's two research tools. Data for the pre-test and post-test were collected at the start and conclusion of the study, respectively. The study revealed that students had a different impression of studying thermodynamics, in accordance with the research aims and findings. The students in the webQuest group claimed that using the webQuest package gave them a fresh perspective on how to comprehend the notion of thermodynamics, it is essential for the organizations in charge of teacher training colleges across the nation to promote the use of webQuest in instruction and training for teachers-in-training.

1. Introduction

Science has been defined as a method of learning about the existence of the natural world; it is also defined as the pursuit and application of knowledge to have a better understanding of the natural and social worlds based on systematic methodology. The advancement and development of the human race has been significantly influenced by science and technology. In order to improve student performance in Nigerian institutions, the use of technology-based instructional aids is crucial in the teaching and learning of sciences in classrooms (Ogunleye

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1999). One of the key goals of teaching science education is to increase student understanding of scientific topics while also improving science education in Nigeria (Sesen and Tarhan2010).

One of the branches of the physical sciences, chemistry is crucial to the development of technology. Because it connects fields of study like physics, geology, and biology, chemistry is referred to as the "central science." Chemistry knowledge has been crucial to the civilization and advancement of the human race; its advantages as a scientific tool have enabled man to make the most of all available natural resources in order to further the survival of the human race. According to studies, chemistry has a significant role in improving people's quality of life, establishing nations, and advancing humankind overall (Olorundare, 2014; Olorukooba, 2007) and (Adesoji, & Fisuyi, 2001).

Technology-based education has made it easier for the education sector to grow. Information technology has grown the education sector by enhancing and extending the knowledge provided in textbooks, according to Okeh & Opone, (2007), by supplementing and extending content that is provided in different formats other than print, delivering all or part of the learning experiences to learners, and providing a dual-way channel of communication for exchange between the teacher and the students, with their peers for feedback or for learning debate and reports, the use of information technology has contributed to the growth of the education sector (Oladosu, 2001).

One important teaching resource for chemistry is the Internet. Because it enables them to discover fresh methods and tactics for instruction, teachers also benefit from using the Internet in the classroom. Teachers can connect their pupils to the chemical happenings around them by using their preferred medium, which is technology, because E-learning supports student-centered learning and broadens their knowledge base, students are the main benefactors of Internet use (Okeh, & Opone, 2007),. Teachers must keep up with the pace of technology in the era of Android, iPhone, iPad, and laptops. WebQuest and other technology-based teaching methods have made this possible. E-learning's key goals include expanding educational opportunities, cutting costs and time, and improving student academic achievement. Due to its various forms, e-learning is increasingly being used in the educational field. E-learning gives pupils the chance to learn more effectively (Stockley, 2014) and (Siko. 2008).

WebQuest was introduced by Bernie Dodge and Tom March in 1995 in an effort to introduce the World Wide Web into the classrooms and also as a means of helping teachers integrate computer technology into curriculum learning areas. It is defined by (Dodge,1995) as an inquiry-oriented activity that helps students to learn by gathering some or all of the information they need to solve a particular question from resources on the internet (Aoki, 2004).

WebQuest is a lesson that is taught in a classroom setting where most or all of the data that the students investigate and analyze is found online (Dodge, 2004). The activity is inquiry-based, gives students a difficult assignment to complete, gives

them access to online resources, and scaffolds the learning process to encourage higher order thinking (Yoder, 1999).and Selami (2016). Introduction, task, resources, process, evaluation, and conclusion are the six parts of a webQuest. The main objective of the research is the development and utilization of webQuest as an instructional strategy in teaching Thermodynamics in colleges of education in Kwara state. With the development of the World Wide Web (WWW), new learning paradigms, such as e-learning or online learning, have emerged. Numerous research studies have been conducted as a result of the use of the online learning system in higher education, helping to identify its strengths and drawbacks (Wang, 2010 and Wang, 2008). According to studies by (Unoroh, 2004), (Olanrewaju, 2009), (Adebayo, 2008), (Oviawe, & Oshio (2021) and (Agogo & Onda, 2014), several initiatives have been undertaken by academics to address the issues of students' low performance in chemistry.

These studies' findings indicated that among the elements contributing to the poor performance of chemistry students are the teacher's qualifications, years of teaching experience, and bad teaching strategies. Findings from many research indicated that students struggle with the notion of thermochemistry; they perceive the subject as challenging, which has forced studying to be for the only aim of passing their exams, leading to the majority of times where meaningful learning does not occur. In their studies on challenging chemistry topics, (Unoroh, 2004) and (Olanrewaju, 2009), it was found that one of the concepts that students struggle to master is thermodynamics. There are numerous ways to teach this idea, but teachers frequently lack the time to do so in an efficient manner. Nevertheless, it is crucial to employ a variety of instructional strategies to ensure that students grasp the material in question. The instructional technique for WebQuest has the potential to be successful, thus it is necessary to find out how it affects students' performance in chemistry.

Research Questions

The following research questions were answered in the study:

1. What is the difference in the performance of chemistry students when exposed to WebQuest and blended learning instructional strategies?
2. What is the difference in the performance of male and female students when taught using WebQuest instructional strategy?
3. What is the difference in the performance of male and female students exposed to blended learning instructional strategy?
4. What is the difference in the performance of chemistry students on the basis of their score levels when taught using WebQuest instructional strategy?

Research Hypotheses

The following null hypotheses were tested in the study at 0.05 level of significance.

Ho1: There is no significant difference in the performance of chemistry students exposed to WebQuest and blended learning instructional strategies.

Ho2: There is no significant difference in the performance of male and female chemistry students exposed to WebQuest instructional strategy.

Ho3: There is no significant difference in the performance of male and female chemistry students exposed to blended learning instructional strategy.

Ho4: There is no significant difference in the performance of chemistry Students exposed to WebQuest based on score level.

Literature Review

The constructivism, cooperative learning, and problem-based learning tenets are the foundation of the WebQuest paradigm (Dodge, 2002b). WebQuest is not new, but it does offer a way to combine excellent learning techniques with efficient internet use. WebQuest is a method of teaching and learning that uses computers and involves students in an activity that uses the internet as a resource (Vidoni, and Maddux, 2002). It allows students to access online resources to learn more about a certain subject According to studies (Dodge, 2001 and Umar, and Maswan, 2010), WebQuest is driven by four fundamental constructs: critical thinking, knowledge application, social skills, and scaffold learning. Cooperative learning, authentic assessment, critical thinking, and technological integration are some of the well-touted approaches to teaching and learning that can be brought together, according to Crocco, Smith, and Cramer (2001) and (Oye, Salleh, & Iahad. 2010).

The following six elements often make up a web quest: an introduction, a task, a process/ procedure, resources, an evaluation, and a conclusion. They serve a particular purpose and are universal to all WebQuest (Young, and Wilson, 2002)

Introduction: The introductory section of the WebQuest provides background information on the subject and seeks to engage and motivate students. In this section, students are given an explanation of why they should finish the WebQuest (Chatel & Nordell, 2002 and Okebukola, 2005).

Task: It is a formal explanation of what the teacher expects the students to do. This portion also includes information about the anticipated product (Brooks & Byles, 2000). **Process:** The learner is given instructions to follow in this section of a WebQuest, along with thorough instructions on how to carry out the task at hand.

Resources: This section includes a selection of well-chosen web resources. Without wasting time on improper online searches, it enables students to make the most of their class time (Vanguri, Sunal, Willson. & Wright, 2004).

Evaluation: This section explains how the created WebQuest will be judged; it frequently takes the form of scoring guidelines. Students can observe how their work will be judged in this area (Wagman, 2005).

Conclusion: A succinct summary is provided in this part, and it should include a few phrases describing what the students learned from the WebQuest (Chatel, Nodell, 2002) and (Ikepeze, & Boyd, 2007)

2. Methodology

The study was carried out in colleges of education in Kwara State. These colleges of education are teacher training institutions where students receive three years of teacher preparation before receiving a National Certificate in Education. Graduates of these colleges who wish to become All third-year chemistry students at the state's government-owned colleges of education made up the study's population. Out of the chosen colleges, one was given the task of using the webQuest instructional strategy, serving as the experimental group, and the other was given the task of using the lecture style of instruction, serving as the control group. This is an intact class that was purposefully chosen.

A thermodynamics performance test in Chemistry and the webQuest software program served as the study's two research tools. The software program utilized in the study is WebQuest on thermodynamics. It is a piece of software that can be used both online and off, and it was created by the researcher in association with IT professionals. The overall platform for the program is Macromedia Dreamweaver 8, and it is in HTML format. The development procedure involved the usage of computer programs and software like Banner Maker, Macromedia Flash 8, and Microsoft Word. Macromedia Flash was used for simulation effects, whereas Banner Maker was used for specialized visuals, buttons, and texts. The webQuest software consists of a webpage that includes the introduction, task, process, resources, and evaluation elements of a webQuest design. For students to easily navigate the software, the instructions to finish the webQuest package were supplied. While the students in the control group were instructed using the lecture approach, the students in the experimental group were taught using the webQuest method. The instrument also includes a chemistry performance test (CPT), which consists of 10 thermodynamics-related questions drawn from a variety of textbooks and other learning resources.

Data Collection and Analysis

Data for the pre-test and post-test were collected at the start and conclusion of the study, respectively. The investigation took place over the course of six (6) weeks.. All of the students who took part in the study had an Android phone, an iPhone, an iPad, or a laptop.

3. Results and Discussion

A total of 102 individuals are shown in the table, with 65 participating in the webQuest group and 37 in the lecture method group. The webQuest group's average score was 2.62, with a.654 standard deviation. From the data in Table 1, it can be inferred that webQuest performed better than the lecture style of instruction in thermodynamics. Students performed better than using the lecture approach of instruction with the webQuest teaching strategy. Chemistry students who were taught using the webQuest instructional technique performed significantly better than those who were taught using the lecture method ($t(64) =$

32.24, $p < 0.05$). This study's findings indicated that using webQuest to teach thermochemistry improved students' performance.

This was made possible since the pupils' interest levels increased as a result of their exposure to the internet and digital materials. Their success was also ascribed to the program's capacity to help students recall their lessons with ease. These results support research by Halat & Perker (2011), Abbit & Ophus (2008). When asked, students at all levels said they preferred webQuest to conventional teaching techniques because it improved their performance in chemistry, reading comprehension, and vocabulary knowledge. This was noted by the authors. These results concur with those of Hassanien (2006), who investigated the use of webQuest for communication in the English language; the results showed that when taught through webQuest, students performed better and remembered their lessons better (Lim, & Hernandez, 2007).

Research Question 1: What is the difference in the performance of chemistry students when exposed to webQuest and blended learning instructional strategy?

Table 1 summarizes the performance of chemistry students when exposed to webQuest and blended learning instructional strategies. The table revealed that there were differences in the mean score based on the type of instructional strategy used. The mean score of the performance of chemistry students when taught using blended learning instructional strategy is 2.62 which are higher than the mean score of chemistry students exposed to webQuest instructional strategy of 2.59.

The table shows a total of 102 participants with 37 participants in the webQuest group and 65 participants in the blended learning group. The blended learning group had a mean score of 2.62 and a standard deviation of .654, while the webQuest group has a mean score of 2.59 and a standard deviation of .644. It could be deduced from the values in table 2 that blended learning instructional strategy gave a higher performance in thermochemistry than webQuest instructional strategy.

Table 1. The t-test Analysis of the Performance of Chemistry Students' when Exposed to WebQuest and Blended Learning Instructional Strategy

Teaching Strategy	N	Mean(x) SD	df	t	sig
Web Quest	37	2.59	0.64	64	32.24 0.00
Blended Learning	65	2.62	0.65		

Hypothesis 1: There is no significant difference in the performance of chemistry students exposed to webQuest and blended learning instructional strategies.

Table 1 shows there was a significant difference in the performance of chemistry students exposed to webQuest and blended learning instructional strategies ($t_{(64)} = 32.24$, $p < 0.05$). The p -value is lower than 0.05, level of significance when exposed to webQuest and blended learning instructional strategy, the hypothesis formulated is rejected.

This means that students exposed to blended learning instructional strategy performed better than those exposed to webQuest. The reason for the better performance could be attributed to the fact that they were taught using two different methods of teaching which will have given them a better understanding of the area they were not clear with in either of the methods.

Research Question 2: What is the difference in the performance of male and female chemistry students when taught using webQuest?

Table 2 gives a summary of the performance of male and female chemistry students when exposed to webQuest. The Table revealed that differences existed in the performance of male and female chemistry students taught thermochemistry using webQuest. The 21 female chemistry students had a mean score of 2.81, while the 16 male students' mean score was 2.31. The difference in the mean score was in favour of the female students.

Hypothesis 2: There is no significant difference in the performance of male and female chemistry students exposed to WebQuest instructional strategy.

Table 2 reveals that there was a significant difference in the performance of male and female chemistry students exposed to the use of WebQuest ($t_{(35)}=14.60; p>0.05$) since the P- value is less than the 0.05 level of significance the null hypothesis is therefore rejected. Also, the female had better performance as it is reflected in their higher mean score (2.81) as against that of male students (2.31).

Table 2. The t-test Analysis of the Performance of Male and female Chemistry Students Exposed to WebQuest Instructional Strategy

Student Gender	N	Mean(x)	SD	df	t
Sig Male	16	2.31	0.79	35	14.7 0.02
Female	21	2.81	0.40		

Research Question 3: What is the difference in the performance of male and female chemistry students when taught using blended learning instructional strategy?

Table 3 shows the result of the performance of male and female chemistry students when exposed to the use of blended learning. The mean score of male chemistry students (2.69) is higher than the mean score of female chemistry students (2.59). Also in table 3, there were 65 participants comprising 32 males and 33 females. The table reveals that male students performed better than the female students when exposed to the use of blended learning instructional strategy.

Hypothesis 3: there is no significant difference in the performance of male and female chemistry students exposed to blended learning instructional strategy.

Table 3 reveals that there is a significant difference in the performance of male and female chemistry students exposed to the use of blended learning instructional strategy ($t_{(2.63)} = 0.22$), $P > 0.05$, since the P – value is higher than the 0.05 level of significance, the null hypothesis therefore not rejected.

Table 4. The t – test Analysis of the Performance Of Male And Female Chemistry Students Exposed To Blended Learning Instructional Strategy

Students gender	N	Mean (x)	SD	Df	t	Sig
Male	32	2.69	0.69	63	0.22	0.64
Female	33	2.59	0.62			

Research Question 4: what are the differences in the performance of chemistry students on the basis of their score levels when taught using webQuest instructional strategy?

Table 4 illustrates the differences in the performance of low, medium and high scoring students when taught using webQuest instructional strategy. Table 4 shows the mean score for the low scoring students (4.6) while the medium and high scoring students have mean scores of 13.8 and 38.5 respectively.

Table 4. Description of the Difference in the Performance of Low, Medium and High Scores

Score Level	N	Mean (x)	SD
Low scores	3	4.60	8.10
Medium scores	9	13.80	24.30
High scores	25	38.50	67.60

Hypothesis 4: There is no significant difference in the performance of chemistry students exposed to webQuest instructional strategy based on score level.

The result of the significant difference in the performance of chemistry students on the basis of score level when exposed to the use of webQuest instructional strategy ($t_{(2.33)} = 2.73$, $p > 0.05$) is greater than the 0.05 level of significance. The null hypothesis is not rejected.

Table 5. Analysis of Covariance of Mean Score on the Performance of Chemistry Students Exposed to WebQuest Instructional Strategy Based on Score Level

Source	Type III Sum of Square	df	Mean Square	F	Sig
Corrected model	1.427 ^a	3	.476	2.050	.126
Intercept pretest score level	5.486	1	5.486	23.653	.000
Pre test score level	.008	1	.008	.034	.854
Score level	1.267	2	.633	2.731	.080
Error	7.654	33	.232		
Total	100.000	37			
Corrected total	9.8081	36			



Figure 1. Cross Section of Students During the Web Quest Instructional Activities

A. Findings on the performance of chemistry students' taught using webQuest instructional strategy

The result of this study showed that students' performance in thermochemistry was better when taught using webQuest instructional strategy. This was possible because the students interest was aroused due to the fact that they were exposed to internet and digital materials. This is in agreement with findings of studies by Halat and Peker (2011); Abbit and Ophus (2008) and Salami (2016). These authors observed that, students at all levels when questioned indicate they preferred webQuest to traditional teaching methods, because it showed a positive effect on their performance in chemistry, reading skills and vocabulary

knowledge. The present findings also agree with those of Hassanien (2006) who studied the use of webQuest for oral communication in English language. The result showed students performed better and they remembered lessons better when taught using webQuest.

B. Findings on performance of chemistry students' when taught using blended learning instructional strategy.

Blended learning had an improved effect on the performance of chemistry students. The result of hypothesis one showed that students taught using blended learning performed better than those taught using the traditional method of teaching because it involves their active participation through the process of grouping which gave the opportunity to share knowledge and interact with each other. Vernadakis et. al (2014), Abidoeye (2015), Gambari et al(2017), Yapici & Akbayin (2012), Cobanoglu & Yurdakul (2014), Tuncay & Uzunboylu (2011) agreed that students in the blended learning study group had higher performance score. On the other hand, this study is not in agreement with the study of Smyth, Houghton, Cooney and Casey, (2012), they are of the view that challenges students face with internet connection could frustrate their efforts and thereby dampen their morale.

4. Conclusion

This study provided an offline version of the package so that, in the absence of internet service, students could use it on their laptop, iPhone, iPad, or Android phone. This was done in order to foster a love of learning and lessen the challenges chemistry students in colleges of education faced while learning thermodynamics. This study revealed that students had a different impression of studying thermodynamics, in accordance with the research aims and findings. The students in the webQuest group claimed that using the webQuest package gave them a fresh perspective on how to comprehend the notion of thermodynamics and stoked their curiosity about the subject. Additionally, this research assisted in eradicating a misperception about thermodynamics. Despite the fact that it was a challenging subject, they were given the chance to speak up and organize their ideas and responses as best they could.

Recommendation

According to the findings of this study, it is essential for the organizations in charge of teacher training colleges across the nation to promote the use of webQuest in instruction and training for teachers-in-training (who were the study's participants) in order to make sure they are career-ready for technology, improve learning outcomes, and boost performance when they begin teaching.

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