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IMPACT OF IDEAL PROBLEM SOLVING ON SELF-EFFICACY AND PERFORMANCE IN CHEMISTRY AMONG SECONDARY SCHOOL STUDENTS, KATSINA METROPOLIS, NIGERIA.

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Abstract

The study investigated the impact of IDEAL Problem Solving on self-efficacy and Performance in Chemistry Concept as a tool for enhancing critical thinking for Quality Education among Secondary School Students, Katsina Metropolis, Nigeria. Two Objectives, research question and null hypotheses were generated to guide the study. The design of the study was a quasi-experimental pretest-posttest-control-group design, involving one experimental group and one control group. The experimental group was exposed to IDEAL Problem Solving Model while the control group was taught using Lecture Method. A sample size of 83 SS 1 Chemistry students selected from two secondary schools in Katsina Metropolis were used as the study sample drawn from population of 753 students out of 10 schools. The instruments used for the study was a twenty five-item multiple choice Chemistry Performance Test (CPT) and Chemistry Self-efficacy scale (CSS) which was validated by experts and used for data collection. Mean, standard deviation, t-test and ANCOVA was used for data analysis. The result showed that; Students exposed to IDEAL Problem Solving Model performed significantly better in the Chemistry Performance Test (CPT) than those taught with lecture method. Also the IDEAL Problem Solving Model significantly enhanced Chemistry students' self-efficacy. Based on these findings, conclusion was drawn and the educational and economic implications were extensively discussed. Among the recommendations made was that IDEAL Problem Solving Model if effectively utilized and applied by teachers in the instructional delivery in chemistry and other science subjects could significantly improve the self-efficacy and performance of students which in turn enhances inclusive and quality education. Since the strategy encourages critical thinking, problem solving skills, motivation and performance, as chemistry plays an important role in the economic.

Keywords: Quality Education, Critical Thinking, IDEAL Problem Solving, Self-efficacy and Academic Performance.

Introduction

Quality education is one that provides all learners with capabilities they require to become economically productive, develop sustainable livelihoods, contribute to peaceful and democratic societies and enhance individual well-being. The learning outcomes that are required vary according to context but at the end of the basic education cycle must include threshold levels of literacy and numeracy, basic scientific knowledge and life skills including awareness. Quality Education requires children's active participation. Capacity development to improve the quality of teachers and other education stakeholders should be crucial throughout this process. Quality of education is determined by the development of total personality of the students. Education should aim at supporting the development of independent thinkers who are discerning problem solvers. Any discussion of quality education usually concentrates on some issues such as student level of achievement, relevance for life after school, and conditions of learning (teachers, facilities and instructional material). In inclusive viewpoint, quality education today has been defined from several perspectives: access, equity, equality, full participation, inclusion,

integration and empowerment. Satisfaction replaced excellence to denote quality since the beginning of 21st century. Similarly, diversity management has found a way into the arena of quality education today. Being responsive to diversities and sensitive to the principles of inclusion, quality education has become an overriding concern of stakeholders (Kafle, 2010). In order to maintain quality in education, it is necessary that there is quality in content and methods of teaching, management of educational process, what the students learn, and how to adapt education to changing needs through innovation (Ranjit, 2004). Based on observation, Pedagogy has been seen as a major issue. Teachers need to place greater emphasis on important knowledge and affective skills. The current reform provides space for teaching to emphasize on the application of knowledge, analysis, synthesis and evaluation besides recall and simple understanding. It also opens to opportunities for activities and learning experiences where learners develop personal and social skills and attitudes as they interact by sharing, discussing, acting responsibly, using different forms of communication and accepting diversity that promotes critical thinking. School-based learning, by contrast, often is slow and linear in its approach. Yet educators can positively impact this scenario by infusing their work with the learners with the skills and strategies that constitute real world problem-solving. Such skills are in the realm of critical thinking and creative problem solving. Critical thinking is an important area in the process of problem solving. Taken together, they comprise the most powerful approaches we can employ to educate the learners for the future lives they will live as citizens in a global society. These two skills has a tremendous impact on what students learn about subject matter, how they learn it, and how they feel about what they have learned.

Critical thinking is a recent educational paradigm for quality education. The development of a society and education depends on the creativity and critical thinking of the people and students. The rationale of specifically teaching critical thinking in any discipline is to improve the thinking skills of students and thus better prepare them to succeed in the world. Critical thinking involves the intentional application of rational, higher order thinking skills, such as analysis, synthesis, problem recognition and problem solving, inference, and evaluation" (Angelo, 2005). Critical thinking is needed to define the problem, to evaluate assumptions, opinions, and facts. Also make decisions and to choose the best ideas to solve a problem. Problem solving needs creative thinking to generate options and possibilities that can be transformed combined and explored in order to expand the number of possible solutions. The skill of problem solving is acquiring the knowledge that will lead one to a solution, and one's ability to combine that knowledge in a ready-to-use format and utilize it to find a solution (Altun. (2003). Problem solving is the highest level of learning in the hierarchy anticipated by Gagne (1970) which depends on the master of next lower type of learning. Problem situation occurs when they can adopt some useful strategies for effective problem solving. Bransford and Stein (1984) advocated five steps that are basically associated with the task of problem solving. These are (i) identifying the problem, (ii) defining and representing the problem, (iii) exploring possible strategies, (iv) acting on the strategies, and (v) looking back and evaluating the effect of one's activities referred to as IDEAL learning strategy. It is used to assist students in metacognitive processes especially in improving thinking ability and problem solving.

According to Nickerson in Phillipson and Lam (2011), states that "IDEAL refers to the steps that lead to problem solving and creativity, including identifying the problem, defining and representing the problem, exploring possible strategies, acting on the strategies and looking back and evaluating, "whereas according to Chidsey and Bickford (2016), states that" IDEAL define a problem as the difference between what is expected and what happened. The problem is not inherent to single person, but that a problem exists and needs to be addressed "From the above concepts it can be concluded that the IDEAL strategy is a step that leads to problem

solving and creativity, including identifying problems, defining and representing problems, exploring possible strategies, working on strategy and looking back and evaluating. IDEAL is designed to help identify and understand the different parts of a problem solving, each letter representing an important component in the process of completion: (a) identify problems; (b) define the problem; (c) explore alternate intervention; (d) apply the selected intervention; and (e) look at the effects. As with other learning strategies, IDEAL problem solving model also have advantages, according to Elias and Colleagues in Wehmeyer (2007): a) to increase awareness of problem and to introduce the idea of problem solving, b) to encourage positive expectations for problem solving and divert attention from negative or preoccupying thoughts, c) to encourage persistence against emotional stress and difficult situation, d) to facilitate a positive emotional state. This study employed the IDEAL problem solving model to enhance students' self-efficacy and performance which in turn will promote quality education.

Self-efficacy is an individual's characteristic (a self-construct) which enables a person to have a positive or realistic view of themselves or situations that they are in (Sieler, 1998). Self-efficacy is a belief that one is competent to handle the task at hand. It refers to a person's expectation of his or her ability to achieve a goal in a given situation and is a very influential factor in ensuring a person's potential is realized (Stevens, 2005). In other words, a person with a high self-efficacy has a realistic view of themselves and their capability which makes them persistence in their endeavors. Students who have higher levels of self-efficacy (more confidence in their ability to achieve their goals) are more likely to engage in metacognition and in turn, are more likely to perform at higher levels. Learning in a science classroom requires students to be self-regulated and this trait goes hand in hand with self-efficacy, metacognition and good achievement.

The importance of Chemistry is in line with the goals of secondary education in Nigeria which emphasized useful living within the society (FRN, 2013). Due to its abstract nature, there have been persistence decline in the achievement of students. Some of the reasons for this under-achievement according to Jegade and Fatoke (2014) include; poor capital investment in terms of provision of science resources, teachers' persistent use of traditional teaching methods which are ineffective in science pedagogy, Perceived difficult nature of topics in Chemistry by students, Poor computational skills, inability to apply learned concept, principles, formulae, units and lack of procedural guide or problem-solving skills (Bellow, 2005). In view of this, it is thereby important for science educators (Chemistry educator) to employ teaching strategy that will enhance critical thinking in learner by boasting their self-confidence and making them problem solvers for quality education. Based for this, this study investigated the impact of IDEAL problem-solving model as a tool for enhancing critical thinking for quality education on students' academic performance and self-efficacy in Concept of Chemistry.

Statement of the Problem

In spite of the important position of chemistry, there has been consistent decline in the performance of students in public examinations conducted by the West African Examination Council (WAEC) and National Examination Council (NECO) in Sciences across the country over the years (Samba & Eriba, 2012). But the most recurring factor for the low performance of students in is the inefficient teaching strategy employed by secondary school teachers, which is the conventional teaching strategy; lecture method (Jegede, 2009). According to Abah (2006), for effective teaching to occur, the teacher should get the learners involved as much as possible in activities that will enable them to develop the needed process skills and attitudes relevant to scientific life. Chemistry educators should understand the importance and advantage of problem solving ability as the prediction of achievement in the school environment. Students, having

problem solving ability, have the ability to acquire knowledge of wide applicability, and the development of the same ability to transfer that skill, acquired through problem solving in schools, to find solutions for their personal and community problems. Gupta, Pooja&Kavita (2015) concluded that problem solving ability of the students help them in building strong cognitive ability, which should be in a better position to reap the benefits of high academic achievement, enrolled in reliable future career choice, job availability and quality education. Once the Problem solving ability is acquired by the student, the elimination of error and putting correct discrimination for the practical work is achieved. Problem solving ability brings out the individual differences among the students for inclusion education. Increasing the ability of problem solving is a key factor of the learning content. Students find abstract nature of Chemistry difficult to learn, this is believed to be associated with their cognitive development such as reasoning and problem solving ability. Problem-solving Chemistry learning might improve the performance of students. In spite of efforts by educational researchers to improve school achievement especially in Chemistry, less attention has been paid to the affective component of the learning using problem solving such as students' perceived self- assessment which is the extent students possess the self-assessment skills relevant for Chemistry problem solving. Under the light of aforementioned information, the objective of the present study aimed at investigating the effects of problem-solving on self-Efficacy and performance as it enhances critical thinking for quality education among Secondary School Chemistry Students in Katsina Metropolis.

Research Questions

Two Research Questions were raised to achieve these objectives;

- (i) What is the difference in the mean Academic Performance scores of Chemistry Students when exposed to IDEAL problem-solving method and those taught with Lecture Method.
- (ii) What is the difference in the mean self-efficacy scores of Chemistry Students when exposed to IDEAL problem-solving method and those taught with Lecture Method.

Hypotheses

The following null hypothesis was formulated to be tested at $p \leq 0.05$.

HO₁: There is no significant difference in the mean performance scores of Chemistry students exposed to IDEAL Learning model and those taught with Lecture method.

HO₂: There is no significant difference between the mean scores of Chemistry Students' self-efficacy towards Chemistry when exposed to IDEAL Learning model and those taught with lecture method.

Methodology

The design of this study was a quasi-experimental design involving pre-test, post-test, with one experimental group and one control group. The population of this study comprised all the Public Senior Secondary one Chemistry students (SS 1) in Katsina Metropolis of Katsina state, Nigeria (Single sex and co-educational schools); the age range of the students is between 12-14 years old and intact classes were used. The use of SS 1 chemistry students was because it is a foundational stage for science and need to be treated with uppermost interest as it forms the base for their problem solving skill in SS 2 and SS 3. According to Katsina Zonal Educational Board (2017), there are total of 753 students offering chemistry in the zone. In choosing the sample schools, simple random sampling technique was employed to select four science schools from the population. Pre-test was conducted to determine homogeneity of the sample based on their ability level. It also ensures that the groups are equivalent on all important dimensions and that there are no systematic differences between the two groups. Two schools with close academic performance equivalence of 8.62 and 8.72 respectively were selected as the sample

of this study. The selected schools were grouped into experimental schools and control respectively using random sampling technique by balloting. Experimental group was treated using IDEAL learning Model while the control group was taught using the lecture method. A sample size of 83 students was used for the study; 41 for the experimental group and 42 for the control group. The instrument for data collection was the Chemistry Self-Efficacy Scale (CSS) and Chemistry Performance Test (CPT). The instrument was validated by experts and pilot tested. The reliability coefficient of the CPT was determined using test-retest method within an interval of two weeks. And that of the CSS was done using Cronbach alpha procedure. Pearson Product Moment Correlation (PPMc) was used to determine the reliability respectively and was found to be 0.74 and 0.77. The treatment lasted for four weeks after which the study subjects were post-tested. The Pre-test and Post-test data obtained were collated and analyzed, the hypotheses were tested using t-test statistic and Analysis of Covariance (ANCOVA).

Results

HO₁: There is no significant difference between the mean performance scores of Chemistry students when exposed to IDEAL Learning Model and those taught with lecture method. The result of t-test analysis is as shown in Table 1.

Table 1: T-test Analysis of Mean Academic Performance Scores of Experimental and Control Groups.

Variable	N	Mean	SD	SE	Df	t-value	p-value	R
Experimental	41	16.11	3.14	0.36	81	5.04	0.001	S
Control	42	12.87	2.61	0.29				

*Significant at $P \leq 0.05$

From Table 1, it is evident that the calculated p-value of 0.001 is less than 0.05 level of significant. This implies that exposure to IDEAL Learning model significantly enhanced the academic performance of the students in the experimental group compared to their counter-part in the control group. Therefore, the null hypothesis of no significant difference is thereby rejected.

HO₂: There is no significant difference between the mean scores of Chemistry Students' self-efficacy in Chemistry when exposed to IDEAL Learning Model and those taught with lecture method. The result of ANCOVA is shown in Table 2.

Table 2: Analysis Covariance (ANCOVA) on Posttest Chemistry Students' Self-Efficacy

Source	Type III sum of squares	Df	Mean square	F	Sig.
Correct Model	48605.201	4	12151.328	235.229	0.001
Intercept	51705.326	1	51705.326	1002.528	0.001
Pretest	7932.371	1	7932.371	153.731	0.001
Experimental	46553.557	1	46553.557	903.436	0.001*
Gender	27.206	1	27.206	0.533	0.469**
Experiment x Gender	73.232	1	73.232	1.419	0.235**
Error	9848.788	76	51.598		
Total	710250.320	81			
Corrected Total	58253.101	80			

*Significant at $P \leq 0.05$

Results on Table 2 reveal that treatment produced a significant effect on the students' Chemistry self-efficacy. This is indicated by the calculated f-value of 902.436 which is significant

at 0.001 and also significant at 0.05 levels. This implies that instruction in IDEAL learning Model significantly enhanced the Chemistry students' self-efficacy. Consequently, the null hypothesis of no significant difference in Chemistry students' self-efficacy of those in the treatment and control group is rejected.

Discussion

The findings of this study from Table 1 and Table 2, revealed that the IDEAL Learning problem solving Model has significant effects on performance and Self-efficacy of students in chemistry which in turn enhances their problem solving ability for inclusive and quality education. The findings of this study are in line with Adesoji, (2008) who investigated the impact of problem-solving instructional strategy on the performances of students of different ability levels in Chemistry. He concluded that the need for good instructional strategy like problem-solving technique was advocated for teachers of science, especially Chemistry due to its abstract nature. This would go a long way in improving problem-solving skills of students no matter their ability level. The findings are also supported by Sunday (2010) who found out that students who shy away from problem solving will likely be less productive because they may have the ability but since it has not been developed (to think and reason) they lack to know how to operate in that field. Uchenna and Sunday (2011) concluded that problem solving abilities and students' learning styles have significant effects on the student's achievement. Since Chemistry involves a lot of problem solving and these strategies will help students to possess the problem solving skills. Srimadevi and Saraladevi (2016) also identified that decision making and self-efficacy has an impact on problem solving ability thereby enhancing critical thinking and problem solving skills. Singaravelu (2017) affirmed that Teacher should give practice on problems of a huge variety to develop creative thinking in his students to increase the problem solving ability.

Conclusion and Recommendation

Students involved in this study had a higher self-efficacy and performance after being taught using the IDEAL problem solving learning model compared to those taught using conventional approach (lecture method). This is because the IDEAL problem solving learning model involves step that leads to problem solving and creativity which are; Identifying the problem, Defining and representing the problem, Exploring possible strategies, Acting on the strategies and Looking back and evaluating. Which in turn empower the learner to take charge of his/her own learning in a highly meaningful fashion which is a good tool for inclusive and quality education in Nigeria and beyond.

Based on the findings and conclusion, it is recommended that IDEAL Problem solving model; it is imperative that chemistry teachers should adopt these strategies to enhance students performance in Chemistry. If effectively utilized and applied by teachers in the instructional delivery in Chemistry could significantly improve the performance and self-Efficacy of students. Students should be exposed to IDEAL Problem solving model to enable them work independently of the teacher among their various learning groups or individually to minimize the situation of poor performance and lack of self efficacy in Chemistry due to its application in our everyday life. As stated earlier, for trans- modern society, towards which we are heading, a society based mostly on cooperation, not on competition, requires a new approach of investments in human capital and a re- spiriting of the said item from an integrating perspective. This goal can be achieved only through education using learning strategy which promotes critical thinking which bring about correlation between the education quality, the economic performances (economic growth) and the institutional environment. This strategy can also be employed in an inclusive classroom due to its features. Critical thinking is beneficial,

as it can help students to better in schools and colleges by improving their understanding. It helps people succeed in their career by improving their ability to solve the problems, think creatively and communicate their ideas clearly and effectively.

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AVAILABILITY AND UTILISATION OF ELECTRONIC RESOURCES AND SERVICES BY LIBRARIANS IN UNIVERSITY LIBRARIES IN NASARAWA STATE, NIGERIA

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Abstract

This study surveyed the availability and utilisation of electronic resources and services by librarians in university libraries in Nasarawa State, Nigeria. The study reported that electronic resources and services constitute a major source of information for librarians in their job/research productivity. Availability of electronic resources and services denotes the assurance that electronic resources and services are acquired, processed and managed by libraries in order to facilitate their accessibility and utilisation, while utilisation entails the practical and deliberate effort to maximize the use of library electronic resources and services. The research design adopted for the study is descriptive survey and the population is 36 librarians from Bingham University, AutaBalifi, Federal University, Lafia and Nasarawa State University, Keffi. A structured questionnaire, observation checklist and interview schedule were used to collect relevant data regarding the study. The study revealed that various electronic resources and services are available across the three universities in Nasarawa State, Nigeria, except Online Public Access Catalogue (OPAC), multimedia services, electronic reference services, electronic Selective Dissemination of Information (SDI) and electronic document delivery services that behaved differently. Furthermore, there were variances in the utilisation and satisfaction rate with the use of electronic resources and services by librarians in the three university libraries under study. Where the utilisation/satisfaction is low, it was attributed to epileptic power supply, low bandwidth/ network fluctuation, lack of renewal /updates to subscription of online databases among others. The literature review showed that the job/research productivity of librarians depends on the level of availability and utilisation of electronic resources at their disposal, it was recommended that deliberate efforts by the university management should be made to ensure adequate funding of the university libraries in order to acquire and make electronic resources and services abundantly available in university libraries in Nasarawa State.

Keywords: Availability and Utilisation; Electronic Resources and Services; Librarians, University Libraries; Nasarawa State, Nigeria.

Introduction

The primary objectives of establishing a university is to promote scholarship, research and development in various fields of learning and community services, as stated in the national policy on education. One of the goals of university education is to acquire both physical and intellectual skills which will enable individuals to become self-reliant and useful members of the society (Eze and Uzoigwe, 2013). Behind the mission and vision of the university education is

the university library, which is the academic library serving the university community. A university library is generally regarded as the heart of the university. It is the hub of all academic activities in a university. The main functions of universities include: conservation of knowledge, pursuit, promotion and dissemination of knowledge through teaching, research and development of human resources for meeting the manpower needs of the nation. In order to carry out these responsibilities efficiently and effectively, universities worldwide establish libraries to complement and supplement their functions, aims and objectives. The primary purpose of the university libraries is to support teaching, learning, and research in ways consistent with, and supportive of, the institution's mission and goals (Emenike, Obiora and Chibuzor, 2014).

University libraries play a prominent role in supporting the mission and vision of the university by providing information resources and services in various forms to librarians, faculty members, students and researchers. Moreover, the librarians discharging these services to the library clientele need to be trained and equipped with relevant skills to deliver effective and efficient services. A librarian is an information professional who has undergone a degree course in library science (librarianship). He or she is saddled with the responsibility of managing the library and its collections, selection and acquisition of book and non-book or electronic materials, and other services such as Current Awareness Services (CAS), Selective Dissemination of Information (SDI), loan or Document Delivery Services (DDS), to meet the information needs of the library clientele. Nowadays, the quantity of electronic information resources are overwhelming, therefore, librarians must possess media literacy skills commensurate with the format of new information generated. Librarians are information professionals and they engage in the selection, acquisition, organisation, storage, preservation, retrieval and dissemination of information to users. They apply special skills and knowledge to undertake this task (Udensi, 2017).

Availability and utilisation of electronic resources and services refers to the effective use of electronic facilities available within and outside the library environment. It is the practical and deliberate effort to maximise the use of library electronic resources and services (Ntui & Udah, 2015). Lee & Lee (2010) in Amanyi, Akor & Madu (2018) maintained that academic library in 21st century is a place where various innovative electronic resources such as e-books, e-periodicals, Compact Discs (CDs), Digital Video Displays (DVDs) and other electronic reading materials are acquired, organised and managed. Electronic resources (or e-resources) denotes library resources in digital or electronic formats which include the information content and/or electronic devices accessible electronically. An electronic information resource is any digital medium where information is derived or extracted from (Kenchakkanavar, 2014). Electronic information resources are carrier of digital information and it also denotes means of electronic information supply. Similarly, Chima and Nwokocha (2013) maintained that an electronic information resources include all form of electronic information carriers that can be used to provide and encouraged effective research activities and development projects. According to Ani, Ngulube & Onyancha (2014), electronic information resources may be blogs, e-books, e-journals, online magazines, online newspapers, web pages, CD-ROM, DVD and electronic databases. Furthermore, the electronic databases that are commonly available in Nigerian university libraries include: ArXiv, Science Direct, EBSCO HOST, AGORA, HINARI, MEDLINE, JSTOR and OARE. The availability and use of electronic information resources by librarians and information professional is an important factors in their research work and service delivery. All university libraries regardless of size are expected to have adequate electronic information resources available for the librarians and their clientele.