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EFFECTS OF HYPERMEDIA INSTRUCTIONAL PACKAGE ON ACQUISITION OF PROBLEM SOLVING SKILLS OF CHEMISTRY STUDENTS IN OSUN STATE, NIGERIA

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Abstract
Poor performance in Chemistry final examination has been variously attributed to lack of instructional materials to teach. Researches have also outlined the merits of using hypermedia to solve instructional problems in different teaching subjects. The current study developed a Hypermedia Instructional Package for teaching Chemistry in secondary schools, and examined its effects on students' problem solving skills in Chemistry. Sample for the study consisted of sixty (60) students, drawn from two secondary schools using purposive sampling technique. Two intact classes that met the selection criterion were used. There were two groups in this study, one experimental group and one control group. Each school represented a group. Data collected were analyzed using statistics of t-test and ANOVA. The pre and post test results showed that the hypermedia package did not produce significant difference in problem solving skill of students in the two groups (t= -1.19, -2.51, P>0.05). The results however showed that there was a significant difference in the problem solving skill of male and female (F=1.74, 3.48, P<0.05). The results further showed that there was a significant difference in terms of the time of task completion (t= -20.10, P<0.05). The study concluded that Hypermedia Instructional Package does not have a significant effect on students' problem solving. However, the variables of sex and completion time have effect on problem solving skills of students in a hypermedia instructional environment.
Keywords: Hypermedia, Problem solving, performance, Time, Procedural knowledge

Introduction

Science and Technology have become the hallmark for sustainable development in any national economy. The developed countries forged ahead by recognizing the relevance of Science to their national growth. Research evidences have proven that Chemistry's contribution to quality of life and nation building are worthwhile in all aspects (Ekpete, 2012). It was based on this that the Federal Government of Nigeria, through her National Policy on Education (NPE, 2004) made Chemistry a compulsory Science subject at the secondary school level. Researchers such as Eke (2008) have accepted that any nation aspiring to be scientifically and technologically developed must have adequate level of Chemistry education. Chemists recognized the importance of Chemistry, in the prosperity of the less developed economies like Nigeria at the International Chartered Chemists of Nigeria (ICCON) conference in 2008 by declaring the theme "What on earth is not Chemistry". In the conference, it was concluded that no developed economy got to its peak without the knowledge, skills and applications of Chemistry principles in large industrial production of cosmetics, detergents, cloths/textiles, fertilizers, and petroleum products. Ogunbanjo (1998) opined that all over the world, Science, on which Chemistry is pivoted has been accepted as a vehicle of technology, social, and economic development, despite such laudable event to establish the importance of Chemistry in the world and other events, there have not been remarkable effects of such events on students' interest towards Chemistry.

Wilson (1983) and Soyibo (1985), in a study reported that students' positive attitudes to science correlate highly with their science achievement. Students exposed to programmed instruction recorded higher and more favorable attitude toward Chemistry. Similar reports were recorded by Udousoro (2000) and Popoola (2002), that students show more positive attitudes after exposure to self learning strategy, such as computer and text assisted programmed instruction, self learning device and self instructed problem based. "This favourable attitude towards Chemistry" as reported in the studies quoted above was attained with the use of Computer Assisted Instruction. It is an indication that traditional approach in teaching has failed in coping with the demands and needs of today's students.

Researchers such as Adesoji (2008), Umanah and Wonu, (2010) have shown that different factors contribute to students' lack of interest, unattractive attitude and poor performance in Chemistry. While the former advocates non-use of 'problem solving technique' as a major cause, the latter maintains that students' background is a predictor of academic performance in schools. Halladyna and Shanghnessy (1982) affirmed that factors such as teacher's attitude and teaching methods, parental influence, gender, cognitive styles, career interest and societal view of science are some contributing factors to students' want of interest and poor performance in Chemistry. These factors contribute in no small measure to the eventual lack of science process skill among students. Proctor and Dutta (1995) defined skill as goal-directed, well-organized behavior that is acquired through practice and performed with economy of effort. Each element of the definition is important: first, skill develops over time, with practice; second, it is goal-directed in response to some demand in the external environment; third, it is acquired when components of behaviour are structured into coherent patterns; and finally, cognitive demands are reduced as skill develops. Skill acquisition has continued to occupy the attention of researchers, increasing understanding of the role of perception, feedback and other factors (Newell, 1991; Schmidt, 1975; 1988).

Problem solving has been observed to be one of the principal causes of scholastic failure in areas of science such as Mathematics, Chemistry and Physics (Perez & Terragosa, 1983). This is so because students do not learn how to solve problems but merely memorize solutions explained by teachers in line with the traditional method of teaching. Problem solving transcends all scientific disciplines and it constitutes an integral part of calculation courses at all level of studies, almost everything that an individual does involves problem solving which is directed toward achieving a goal. A problem is said to exist whenever there is gap between a present state and an anticipated goal state without any immediate clear picture of how to bridge the gap (Hayes, 1981).

Philips and Philips (1991) categorized problems into two namely;

- Generic Problems – These are problems with standard procedure by which they may be solved and the procedure consists of series of steps that are performed in order to accomplish the goal of the problem.

- Harder problems – These are made of complex problems combining several generic problems or by using more complex language to extrapolate the problem into an unfamiliar solution.

Different authorities have offered different definitions of problem solving as a concept. Ausubel (1968) defines problem solving as a form of discovery learning which bridges the gap between a learner's existing knowledge and solution to problem. Here problem solving will draw heavily on previous or existing knowledge of the learner which must be brought to bear on the situation at hand. However, the task of assessing or keying into previous knowledge is not always easy as this depends on a number of variables existing at the time when the experiences were formed and or when they were being recalled by the learner. Duffield (1989) on his part defined problem solving as a goal directed cognitive learning process that makes use of previously learned knowledge and cognitive strategies. This view of problem solving not only sees it as relying on previous knowledge but also as a learning process involving cognitive controls such as cognitive style and metacognition. However, it tends to ignore the affective and cognitive elements necessary for problem solving (Jonassen & Tessmer, 1996). The affective elements here include beliefs, attitudes and problem domain while cognitive ones include the motivational factors, persisting on task, exerting efforts, and making choices.

Padgette (1991) also noted that problem solving is an art, which consists of understanding all the rules and that means all of them, not just the point–by-number type and then understanding which ones to break in any given problem. Thus, any problem situation contains three important characteristics, the givens, a goal and obstacles. The givens are the elements, their relations and the conditions that compose the initial state of the problem, the goal is a desirable scientific end and the obstacles are the characteristics of the problem solver and the situation that makes it difficult for the solver to know how to transform the initial stage of the problem into the final stage. In order to solve problem successfully the problem solvers need to understand the content and knowledge of the subject matter.

Farayola and Salaudeen (2009) also opined that problem solving is a complex mental process that involves visualizing, imagining, manipulating, analyzing, abstracting and associating ideas. They further stated that problem solving is a process which begins with the initial contact with the problem and ends when the solution is reviewed in the light of the given information. From all the definitions given above, problem solving can be defined as a goal directed sequence of cognitive, affective and cognitive operations geared towards finding an unknown entity for bridging a gap between a present and a goal state.

Procedural knowledge (problem solving rules) is more sophisticated than declarative and conditional knowledge in terms of cognitive level; it involves both declarative and conditional knowledge. According to Schunk (1996), procedural knowledge consists of concepts, rules, and algorithms. It is the knowledge of how to perform cognitive activities and is often implicit. Procedural knowledge originates in problems solving activity in which a goal is decomposed into subgoals for which the problem solver possesses operators (Anderson, 1995).

Smith and Ragan (1993) stated that procedural rules are a generalizable series of steps initiated in response to a particular class of circumstances to reach a specified goal and tell learners what certain actions should be taken. Examples of those processes include solving mathematical problems and proving geometric theorems. When learning procedural knowledge, one should highlight the related conditional knowledge. Retrieval of procedural knowledge is similar to that of declarative knowledge.

Gagné (cited in Smith & Ragan, 1993) distinguished procedural knowledge from declarative knowledge by stating that procedural knowledge reflects "knowing how," where as declarative knowledge involves "knowing that." In Bloom's level of cognitive objectives, procedural knowledge includes application, analysis, and evaluation levels. To solve problems, learners may simultaneously select and apply conditional and procedural knowledge and apply related rules. In that process, learners should also recall declarative knowledge related to those rules. When learners employ both conditional and procedural knowledge to solve a problem or to reach a conclusion, the learning process in which they are involved is called problem solving (Smith and Ragan).

According to Wheatley (1984) problem solving is defined broadly as what one does, when one does not know what to do. Problem solving requires the logical and creative thinking (Bybee and Sund, 1990). Gagne (1977) defined the problem solving as a thinking process by which the learner discovers a combination of previously learned rules that he can apply to solve a novel problem. Pizzini (1989) defined the problem solving as a method of learning as well as an outcome of learning. Many researchers indicate that the use of problem solving instructional models and techniques to teach science influences the problem solving skill of students. Problem solving skills are promoted by providing a rich environment in potential for exploration and by encouraging students to reflect on their actions (Hass and Parkay, 1993).

Several problem solving strategies with different phases or steps have been advanced for use in teaching Mathematics and Science. Some applicable for both numerical and non-numerical problems while some are useful to numerical problems only. Polya (1945) proposed a four step general framework for problem solving as follows:

- Understanding the problem
- Devising a plan to solve the problem
- Carrying out the plan and
- Looking back.

Perez and Terragosa (1983) suggested that scientific methodology and problem solving should have some similar conceptions as both are involved in investigative processes. They insisted that problem solving should follow the path of scientific methodology rather than relying on the usual algorithms which merely require mechanical application of clearly defined procedures for each type of problem. According to them, the methodological components of problem solving have the following four characteristics which led to the four stages involved in their strategy:

- A qualitative study of the situation in hand is to be carried out and hypotheses put forward i.e. developing a theoretical paradigm.
- Possible strategies for solving the problem have to be devised in the light of the qualitative study carried out and the theoretical knowledge available.
- The problem itself has to be solved with high degree of verbalization being encouraged i.e. execution of problem solving.
- The results are analyzed and evaluated.

Another strategy developed by Ross (1988) for problem-solving involves what he called four clusters of skills namely: Problem representation, Information retrieval, Information processing, and Information reporting. Ross (1988) added that out of the four skills outlined, problem representation is the most difficult skill for students. In order to systematically address this problem, there is need to purposefully mount instructional intervention programme that will foster this skill in students. The emphasis here should be on the two main procedures involved in problem representation namely:

- Focusing the problem (identifying) a particular problem to be solved

- Developing a frame work (a representation) of the essential elements of the problem in a mental structure conducive to finding a solution.

Perhaps what is missing in the strategy is a fifth step which is very important if one must assist the learner discover and learn from his mistakes during problem solving process – the evaluation and feedback stage. The missing gap in Ross (1988) strategy was filled by Alan (1995) who suggested the following steps in problem solving:

- Defining the problem
- Planning a solution
- Solving the individual part which involves sketches, diagram and grouping
- Putting it all together
- Evaluation.

Research studies on problem solving revealed that problem differed in structure, context, complexity and representation. Gick (1986) and Jonassen and Henning (1999) opined that problem solving depend on conceptual knowledge and procedural knowledge available to the learner. Students without conceptual knowledge of the subject matter will find it difficult to solve problem. Greeno (1978) emphasized the relationship between the conceptual possessed by the problem solver and their knowledge of the procedures that all problem solving is based upon two types of knowledge which are knowledge of the problem solving and conceptual knowledge. In order to solve a problem therefore, a problem solver must develop a framework or representation (model) of the essential elements of the problem in a mental structure conducive to finding a solution after proper focusing of the problem. This implies that every problem solver constructs a mental representation (or mental model) also known as problem space based on prior knowledge (Newell & Simon, 1972).

Jonassen (2003) defines problem solving as an individual thought process because the previously learned law can be applied in solving problems in any situations. It is also deemed to be a new type of learning and is the result of application of knowledge and procedures of the problems (Mc Gregor, 2007). Generally, each individual requires knowledge and skills to solve problems (Taconis et al., 2000).

Halakova and Proksa (2007) stated that the solution of problems in any subject area is a highly complex human behaviour. This matter is documented in a large number of studies and articles which have appeared in journals of research and teaching. It has reflected a new interest regarding how students solve problems. Problem solving has always been a stumbling block for students who are studying chemistry, and most of the teachers in the field of chemistry are aware of this.

According to Jawhara (1995), problem solving activities can open opportunities for students to learn freely. In their own ways, students will be encouraged to investigate, seek for the truth, develop ideas, and explore the problem. Students are also trained not to be afraid to try various ways to solve problems, as well as having the courage to make decisions, act on the decisions and be responsible for the products of the action. The experiences gained through problem solving will help our students to become progressive, creative and ambitious. These features are necessary in order to face the challenges of becoming a developed country based on science and technology (Lim et al., 1999).

Problem solving is also deemed to be what is done by an individual when faced with a question or situation where the solution is not available. In seeking a way out from any obstacle, students should think, make decisions and use specific strategies. Therefore, to achieve this, the activity of thinking and skills to rationalize a solution plays an important role. It will require students to generate and induce a systematic and logical thinking. This ability requires students to follow certain steps and logic because it requires a revision to determine the reasonableness of a settlement. Thus, any successful attempt will encourage a students' positive attitude towards problem-solving activities (Curriculum Development Centre, 2006).

Stewart (1982) concluded that no matter how simple a problem may be, a beginner in problem solving required significant procedural and conceptual knowledge. Conceptual and mathematical knowledge are not enough to determine the success of students in problem solving. Attitude of students towards the subject is a good predictor in solving problems.

Su (2008) conducted an informative study of integrating Hypermedia technology into problem-solving for promoting student's abilities in general chemistry. The experimental group was taught with Hypermedia supplementary materials, which include descriptions of conceptual animations for solution process, activity series, and diluted solution. The control group was taught as usual, using a regular chemistry textbook. The groups were similar in terms of chemistry achievement as assessed by the report of the pretest for the experimental group and control group, and there was no significant difference in the t-test. The study revealed that the experimental group received significantly higher conceptual understanding scores on the posttest than the control group did. Students received traditional instruction to use static visuals that were not successful at solving the misconceptions in chemistry.

Serin (2011) investigated the effects of the hypermedia-based instruction on the achievements and problem solving skills of the science and technology students based on the pre-test/post-test control group design. The participants of the study consist of 52 students; 26 in the experimental group, 26 in the control group. The experimental group received the computer-based science and technology instruction three hours a week during three weeks. The result of the study revealed a statistically significant increase in the achievements and problem solving skills of the students in the experimental group that received the computer based science and technology instruction.

Kumar and Helgeson (1996) investigated the effect of Hypermedia Pen-Point and Powerbook computers on solving a multiple step chemistry (molarity) problem among White, Afro-American and Hispanic students (N = 60) at the high school level. The study explored the effect of two different types of computers on cognitive and non-cognitive (affective) factors in chemistry problem solving. The results showed that more of the White and Afro-American Pen-Point computer users solved the problem correctly than did students using the Power book computer. Attitude survey results of all ethnic groups showed that more Hypermedia Pen-Point computer users felt comfortable working with computers. The study concluded that the Hypermedia Pen-Point computer with induction pen input device has a more positive effect on the problem solving performance and attitude of students towards computers than does the Power book computer with key- board input device. The study highlighted the importance of the learners being comfortable with the technology tools used in computer aided learning process.

The study by Adesoji and Raimi (2004) examined the effect of supplementing laboratory instruction with problem solving strategy and/or practical skills teaching on student's attitude toward chemistry. A total of 286 senior secondary class II students (145 males and 141 females) drawn from four local government areas in Oyo township in Oyo state, Nigeria, took part in the study. A pretest-posttest non randomized quasi-experimental design was used in the study. The analysis of covariance and Scheffe post hoc analysis results revealed that the use of enhanced laboratory instructional strategy significantly improved the attitudes of students toward chemistry. The results underscore the need for secondary school chemistry teachers to adopt the use of enhanced laboratory instructional strategy in order to promote good attitude on the part of the students toward learning of chemistry. Hollingworth (2001) conducted a study on the role of computers in teaching chemistry problem solving. In this study the ways in which computers and ICT used in chemistry problem solving were reviewed and details were presented of an on-line tutorial developed for enhancing the problem solving skills of science students. The research emphasized the strategic use, rather than the mere possession of knowledge that improves learning and reflective thinking required the student to organize monitor and evaluate their thinking and learning to come to a deeper understanding of their own processes of learning.

Hollingworth and McLoughlin (2001) conducted a study in developing Chemistry student's metacognitive problem solving skills online. The study concluded that metacognition can be developed in contexts that engage students in self-monitoring their own problem solving approaches, in scenarios where they can ultimately use that knowledge. This requires creating real life anchors for the development of problem solving skills and enabling students to explore, test and review their own strategies. The study also anticipated that the research will result in significant changes to the way teaching in the sciences is currently conceptualized, while maximizing the potential of online technologies.

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Rickey and Stacy (2000) in their paper "The role of metacogntion in learning chemistry" discussed metacognition and its role in conceptual change and problem solving in chemistry. They argued that promoting metacognition in the science classroom prompts students to refine their ideas about scientific concepts and improves their problem solving success.

Experts in instructional designs and Mathematics educators have argued that since different learning experience are provided for achieving different outcomes (Gagne & Briggs, 1978) therefore; instruction to support problem–solving learning outcomes should differ from that used to support concept learning or rote learning for instance. They recommend instructional strategies such as authentic cases, simulations, modeling, coaching and scaffolding (Jonassen, 2000). Different problem solving models have emerged in the last thirty years in a bid to explain the processes involved in problem–solving. The most popular of these models is the information processing and solution construction model e.g. IDEAL which focuses on identifying potential problems, defining and representing the problem, exploring possible strategies, acting on these strategies and looking back and evaluating the effects of these activities (Bransford & Stein, 1984). The information processing theory believes that humans take in information (like any other information processor e.g. computer), translates the problem into an internal representation on which it can operate, operates on it appropriately and output the results. The information processing model further assumes a uniform theory of problems (Smith, 1991). Studies based on this theory tend to find out what knowledge learners already bring to task, what information they key on and how they use these items of information.

Others have argued that problem solving is not a uniform activity and as such cannot be regulated by a uniform theory. This is because problems are different in content, form or process (Jonassen, 2000). This has led to other emerging models vis–a–vis theoretic conceptions of problems solving such as the Schema–Model. This model assumes that different schemas are required in solving different or particular problems. If the learner possesses a complete schema for any problem type, then constructing the problem representation will be a question of mapping an existing schema onto a problem, and using the procedure that is part of the problem schema to solve it. Existing problem schemas are said to be the result of previous experiences in solving particular types of problems, enabling learners to proceed directly to the implementation stage of problem solving and try out the activated solutions (Gick, 1986).

The implications of these views are three fold. First, is that problem solving is a byproduct of our knowledge (previous experiences) of the concepts or ideas involved in a problem situation (conceptual knowledge) and also our ability to take the right steps and decisions (procedural knowledge). Second, experts and novices have different problem schemas. Novices do not possess well developed problem schemas and they are not able to recognize problem types and so rely on weak problem strategies such as information processing approaches (Mayer, 1992). On the other hand, experts are good problem solvers as they recognize different problem states thereby reducing the searching through problem space (Sweller, 1988). Third, is the type of problem? Problems vary in their nature or structure, complexity and manner of presentation or representation.

Ilemona (2001) asserted that the kind of attitude a child brings to the classroom is very important and that attitudes are fundamental to the dynamics of behaviour and they determine what the student learns. Other factors affecting the learning of chemistry problem solving have been traced to students' intellectual abilities. Lester (1980) reported that reading skills contribute to verbal problem solving abilities and single element among others such as verbal, numerical, memory and computation abilities are associated with and related to success in problem solving (Falokun, 1981).

Lynn (1995) found that the use of computer had greater impact on the elementary school student's understanding of concepts and process skills related to physical science (light) and life science (body systems and functions) , expository writing skill in science related topics and epistemological views of the nature of science.

Statement of the Problem

Students of senior secondary schools have been challenged majorly with difficulty in solving Chemistry problems that require mathematical skills. This challenge usually discourages students from offering any Chemistry course and consequently impacted negatively on the performance of the students. The challenge is further impacted upon with lack or inadequate use of instructional materials that could help learners learn mathematical concepts in Chemistry. Learners are left at the mercy of the Chemistry textbooks and monotonous teaching techniques. These led to students' poor performance in Chemistry at the senior secondary school examinations. The capability of hypermedia to present instructional contents using a combination of nodes has been articulated in the literature. It is not known whether this medium could have effect on Chemistry students.

Objectives of the Study

The objectives of this study are to:

(i) examine the effect of Hypermedia Instructional Package on student's problem solving skills in Chemistry.

(ii) investigate the effects of the Hypermedia Instructional Package on problem solving skills of male and female students in Chemistry.

(iii) examine the effect of the Hypermedia Instructional Package on learners' completion time of Chemistry tasks.

Research Hypotheses

The following null hypotheses are set for the study:

(i) There will be no significant difference in problem solving skills of Chemistry students exposed to Hypermedia Instructional Package and those taught with teacher expository method.

(ii) There will be no significant difference in problem solving skills of male and female students' exposed to hypermedia instructional package and those taught with teacher expository method.

(iii) There will be no significant difference in the completion time of Chemistry tasks of students exposed to hypermedia instructional package and those that were taught with teacher expository method.

Methodology

This study adopted pre-test post-test experimental design. The design of the study was in two parts. The first part of the design was the development and designing of a Hypermedia Instructional Package for teaching Chemistry. The second part was the utilization of the instructional package to test its effectiveness on students' performance. This design was hinged on the theory of cognitive flexibility theory as applicable to the field of Educational Technology. The population consisted of all Senior Secondary School one (SSS 1) students offering Chemistry in Ife East Local Government Area of Osun State. Sample for this study consisted of sixty (60) students, drawn from two secondary schools in Ife East Local Government Area of Osun State. The two (2) schools were selected using purposive sampling technique based on the availability of Chemistry teachers, Chemistry laboratory and functioning computers. Two Intact Senior Secondary School one classes that met the selection criterion were used. There were two groups in this study, one experimental group and one control group. Each school represented a group. Students in each of the two schools constituted the experimental and control group. The experimental group was exposed to Hypermedia Instructional Package, while the control group was taught using the teacher expository method of teaching.

Research Instruments

The research instrument used was Chemistry Achievement Test (CAT). The achievement test was a researcher designed titled Chemistry Achievement Test (CAT). This instrument contained 20 multiple choice question. It was designed to determine the students' performance at both pre and post-test. The face and content validity of the achievement test was carried out by experts in the field of Educational Technology and Chemistry teachers. The reliability of the instrument was determined using the Pearson Product Correlation Coefficient. Eleven (11) students were selected by simple randomization procedure. The instrument was administered on the students on two different occasions, with an interval of two weeks. On the first contact, the students were given Multiple Choice Questions on Chemistry to respond to within time duration of 40minutes. The same procedure was followed during the second contact. From the result of the test r = 0.85, with r value less than 1 and greater than 0.01 level of significance, it was concluded that there was a positive relationship between the two sets of test. Also, the instrument was about 85% error free, hence, the instrument was adjudged reliable for the study.

Results

Effect of Hypermedia Instructional Package on student's problem solving skills in Chemistry.

Table 1: Mean, Standard Deviation and t-test of students' problem solving skill at Pre and Post Test

Test	Group	N	$\bar{x}$	S.D	t	df	P
Pre - Problem solving skill	Experimental	30	3.73	1.20	-1.19	58	0.23
	Control	30	4.13	1.38			
Post - Problem solving skill	Experimental	30	9.33	1.49	-2.51	58	0.15
	Control	30	8.43	1.27			

Table 1 shows the performance of both experimental and control groups in problem solving in Chemistry. The experimental and control groups had 3.73 and 4.13 as mean scores respectively at the pre-test (problem solving). However, the t-value (-1.19) yielded a significant value that is above 0.05 alpha. This implies that there was no significant difference in the problem solving skills of the students in both groups at the pre-test. At the post-test, the experimental and control groups had 9.33 and 8.43 as mean scores respectively at the post-test (problem solving). However, the t-value (-2.51) yielded a significant level that is above 0.05 alpha. This implies that there was also no significant difference in the problem solving skills of the students in both groups at the post test. This implies that the Hypermedia Instructional Package does not have any significant effect on students' problem solving skill. Therefore, the hypothesis is accepted.

Effects of the Hypermedia Instructional Package on male and female problem solving skills in Chemistry.

Table 2: One-way ANOVA summary of the difference in the mean of the sex of the students Problem solving skill in the Pre and Post Test

Test		Sum of Squares	df	Mean Squares	F	P
Pre test	Between Groups	2.533	3	0.84	0.49	0.25
	Within Groups	97.200	56	1.74		
	Total	99.733	59			
Post test	Between Groups	19.517	3	6.51	3.48	0.002
	Within Groups	104.667	56	1.87		
	Total	124.183	59			

Table 2 shows that the performance of male and female learners in problem solving skill in Chemistry was not statistically different at the pre test (SS=2.533, 99.733; df= 3, 56; MS=0.84, 1.74; F=0.49, P>0.05). At the post test, there was a significant difference in the problem solving skill of learners (SS=19.517, 104.667; df= 3, 56; MS= 6.51, 1.87; F=3.48; P<0.05). This implies that the Hypermedia Instructional Package had effect on the performance of male and female learners after exposure to Chemistry. Therefore, the hypothesis is rejected.

Examine the effect of Hypermedia Instructional Package will on learners' completion time of Chemistry tasks.

Table 3: Mean, Standard Deviation and t-test of the Time of Completion in Pre and Post – Test

Test	Group		$\bar{x}$	Standard Deviation	t	df	P
Pre-Test Time of completion in	Experimental	30	6.56	3.60	0.6361	58	0.20
	Control	30	5.18	2.47			
Post-Test Time of completion in	Experimental	30	17.73	2.35	-17.57	58	0.00
	Control	30	29.40	2.14			

Table 3 shows the performance of both experimental and control groups with respect to time of completion of the problem solving skills in Chemistry. The experimental and control groups had 6.56 and 5.18 mean scores respectively at the pre-test (time of completion). However, the comparison of the two means scores yielded at t-value (0.6361) that is greater than 0.05 alpha. This implies that there was no significant difference in the time of completion of the students in both groups at the pre-test. At the post-test, the experimental and control groups had 17.73 and 29.40 mean scores respectively at the post-test (time of completion). However, the comparison of the two means scores yielded at t-value (-17.57), this t-value yielded a significance less than 0.05 alpha. This implies that there was a significant difference in the time of completion of the students in both groups at the post test. This implies that the Hypermedia Instructional Package has a significant effect on the time of completion in Chemistry tasks of the students. Therefore, the hypothesis is rejected.

Discussion and Conclusion

The result obtained in this study did not show a significant difference in the problem solving skills of the students in the two groups. It indicates that the Hypermedia Instructional Package does not have any significant effect in the students' problem solving skills. This might have occurred due to insufficient exposure of students to instructional intervention such as Hypermedia. This result agrees with Peach (1996) who conducted a study on "The effects of knowledge and type of instructional objectives on intentional learning with hypermedia instruction. This study explored the use of different types of knowledge with learning from linear and non-linear instruction presented in the Hypermedia. There were no significant differences found in this study as a result of the instructional objectives. He further reported that prior computer experience had greater overall learning in both treatments and students who had prior hypermedia experience had greater influence in acquisition of knowledge. Nevertheless, the findings of this study found that there was a significant difference in the problem solving skills performance of male and female after exposure to Hypermedia Instructional package. However the result points to the fact that male performed better in problem solving than their female counterparts. Ojaleye (1996) reported a significant relationship between the performance of students in intellectual abilities test and mathematical problem solving test among Senior Secondary School students. Angrist (1999) investigated in his study and found that there was a significant difference due to interest of boys in designs, web, and solving problems. He also found that there was a significant difference in the performance of male to female. Ogunleye and Babajide (2011) observed that science subjects such as Chemistry are given masculine outlook by many educationists. That means that women and girls grapple with a lot of discriminations and difficulties (Okeke, 2008). Applying feminist theory in Science Education which stated that by changing the science curriculum and how science is taught will make a significant change on women participation in science.

The result of this study also found that there was a significant difference in the time of completion of the learners' completion time in Chemistry tasks. The Hypermedia Instructional Package had effect on the time of completion of the learners. The students were able to complete problem solving within a short time. Evans and Gibbons (2007) determined whether the addition of interactivity to a computer-based learning package enhances the problem solving of 33 (22 male and 11 female) undergraduates on a Physics degree by using a hypermedia system to learn about the operation of a machine. Students using the hypermedia system outperformed those exposed to conventional teaching method in the problem-solving test, and needed less time to complete both memory and problem-solving tests. The study concluded that Hypermedia systems facilitate deep learning by actively engaging the learner in the learning process.

Future Research Directions

This study was able to identify the strength of hypermedia in improving the performace of Chemistry students with respect to academic performance, time of completion of tasks and problem solving skills. The researchers would wish to in future extend the research to examining the effcets hypermedia would have on students sex, attitude and motivation of Chemistry students. It would also be important to investigate the effects or influence of hypermedia in other subject areas.

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